自作関数 (R)

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#### & ####
"&"=function(x,y){if(is.character(c(x,y))) paste0(x,y) else base::"&"(x,y)} #Combine

#### A ####

AA=function(D,f=sum,dx=3,dy=3){
  D=as.matrix(D);X=Round(D,dx); s=deparse(substitute(f)) #  変数=>文字列
  C=matrix('-',1,NC(X)); rownames(C)=s; X=rbind(X, C)
  C=matrix('-',NR(X),1); colnames(C)=s; X=cbind(X, C)
  X[s,s]=Round(f(D,na.rm=T),dy); JustR(X)
} #Add all  行列に計算値(全:1)を追加  dx, dy: D,  計算値の小数桁数

Aa2=function(D,f1=min,f2=max,dx=3,d1=3,d2=3){
  D=as.matrix(D); X=Round(D,dx)
  s1=deparse(substitute(f1)) #  変数=>文字列
  s2=deparse(substitute(f2)) #  変数=>文字列
  C=matrix('-',1,NC(X)); rownames(C)=s1; X=rbind(X,C)
  C=matrix('-',1,NC(X)); rownames(C)=s2; X=rbind(X,C)
  C=matrix('-',NR(X),1); colnames(C)=s1; X=cbind(X,C)
  C=matrix('-',NR(X),1); colnames(C)=s2; X=cbind(X,C)
  X[s1,s1]=Round(f1(D),d1); X[s2,s2]=Round(f2(D),d2); JustR(X)
} #Add all  行列に計算値(全:2)を追加  dx, d1,d2: D,  計算値の小数桁数

AB=function(X,func=mean,dx=3,dy=3){ #d:  小数桁  <Rc
  X=as.matrix(X); str=deparse(substitute(func)) #  変数=>文字列
  X1=AP(X,1,func); X2=Round(X1,dy); colnames(X2)=str; X3=cbind(Round(X,dx),X2)
  Y=AP(X,2,func); Y1=Round(Y,dy); W=Round(func(X),dy); Y2=t(c(Y1,W))
  rownames(Y2)=str; JustR(rbind(X3,Y2))
} #Add both  行列に計算値(両:1)を追加  dx, dy: D,  計算値の小数桁数

AB2=function(D,f1=min,f2=max,dx=3,d1=3,d2=3){ # <Rc2
  D=as.matrix(D); s1=deparse(substitute(f1)); s2=deparse(substitute(f2)) #変数=>文字列
  C1=AP(D,1,f1); colnames(C1)=s1; C2=AP(D,1,f2); colnames(C2)=s2
  R1=AP(D,2,f1); rownames(R1)=s1; R2=AP(D,2,f2); rownames(R2)=s2
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 X=cbind(D,Round(C1,d1),Round(C2,d2)); Y=rbind(Round(R1,d1),Round(R2,d2))
 Z=BindV(X,Y); Z[s1,s1]=Round(f1(D),d1); Z[s2,s2]=Round(f2(D),d2); JustR(Z)
} ##Add both 行列に計算値(両:2)を追加 dx, d1,d2: D, 計算値の小数桁数

AC=function(X,func=mean,dx=3,dy=3){ #dx, dy: 小数桁 <Rv
 X=as.matrix(X); str=deparse(substitute(func)) # 変数=>文字列
 X1=AP(X,2,func); X2=Round(X1,dy); rownames(X2)=str; X3=rbind(Round(X,dx),X2)
 JustR(X3)
} #Add column 行列に計算値(列:1)を追加 dx, dy: D, 計算値の小数桁数

AC2=function(X,f1=mean,f2=median,dx=3,d1=3,d2=3){ #dx, d1, d2: 小数桁 <Rv2
 # s1=deparse(substitute(f1)) # 変数=>文字列
 # s2=deparse(substitute(f2)) # 変数=>文字列
 X=as.matrix(X); s1=deparse(substitute(f1)); s2=deparse(substitute(f2)) # 変数=>文字
列
 Z1a=AP(X,2,f1); Z1b=Round(Z1a,d1); rownames(Z1b)=s1
 Z2a=AP(X,2,f2); Z2b=Round(Z2a,d2); rownames(Z2b)=s2
 Z=rbind(Round(X,dx),Z1b,Z2b); JustR(Z)
} ##Add column 行列に計算値(列:2)を追加 dx, d1,d2: D, 計算値の小数桁数

Add=function(...) paste0(...)

AddA=function(A=D,x){A[Len(A)+1]=x; A
} #配列に要素を追加

AddGM=function(D,s=3){
 if(s==1|s==3) D=cbind(D,G.mean=RowGMs(D))
 if(s==2|s==3) D=rbind(D,G.mean=ColGMs(D))
 if(s==3) D[NR(D),NC(D)]=GM(D)
 D
}

AddInf=function(X,RR){
 SS=function(W,U,Cl){
  Combine=function(Z,C=NULL) {
   if(Len(C)==1) return(Z[,C])
   apply(Z[,C],1,paste,collapse='-')
  }
  WhereAB=function(A,B) {Pos=match(A,B); Pos[is.na(Pos)]=0; Pos}
  Na2StrD=function(D,str){
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    library(dplyr); mutate_all(D, ~ ifelse(is.na(.), str, .))
   }
   print('SS: 1/4'); B=Combine(U,1:Len(Cl)); U=cbind(B,U[,-(1:Len(Cl))])
   print('SS: 2/4'); A=Combine(W,Cl); Wh=WhereAB(A,B)
   #R=rep(0,NR(W)); E=DF(Crit=R,Norm=R,Lema=R,Cg=R,n=R)
   E=DF(matrix(0,NR(W),NC(U)-1)); names(E)=names(U)[-1]
   print('SS: 3/4'); indices=which(Wh > 0); E[indices, ]=U[Wh[indices], -1]
   print('SS: 4/4'); E=Na2StrD(E,0); cbind(W,E)
  }
  Li=list(); Col=list(1:5,1:4,2:5,2:4,1:3,3:5,2:3,3:4,3); nc=NC(X)
  for(i in 1:9){
   print(paste('File:',i))
   Rx=SS(X,RR[[i]],Col[[i]])
   Li[[i]]=Grep(Rx,nc+1,0,T)
   Li[[i]]=cbind(Li[[i]], g=rep(10-i,NR(Li[[i]])))
   X=Grep(Rx,nc+1,0,F)
   if(i<9) X=X[,1:nc] else Li[[10]]=cbind(X,g=rep(0,NR(X)))
  }
  do.call(rbind, Li)
} #IL: 作業ファイルに参照ファイルを結合

AddLack=function(D,E){
  fillLack=function(D,E){
   R1=RN(D); R2=RN(E); Wn=WhereNot(R1,R2)
   if(Len(Wn)==0) return(D)
   M=matrix(0,Len(Wn),NC(D)); colnames(M)=CN(D)
   N=rbind(M,D); rownames(N)[1:Len(Wn)]=R2[Wn]; N
  }
  D=fillLack(D,E); D=fillLack(Trans(D),Trans(E)); D=Trans(D)
  D=SortC(D,0); D=SortC(Trans(D),0); Trans(D)
} # Add to D lacking row existing in E. ex: AddLack(Ob,Al)

AddMean.T=function(D,O,A,s=3){
  if(s==1|s==3) D=cbind(D,Mean.T=RowMeans.T(O,A))
  if(s==2) D=rbind(D,Mean.T=ColMeans.T(O,A))
  if(s==3) {
   D=rbind(D,Mean.T=c(ColMeans.T(O,A),0))
   D[NR(D),NC(D)]=NS(Sum(O),Sum(A))
  }; D
}
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AddMean=function(D,s=3){
 if(s==1|s==3) D=cbind(D,Mean=RowMeans(D))
 if(s==2|s==3) D=rbind(D,Mean=ColMeans(D))
 if(s==3) D[NR(D),NC(D)]=Mean(D)
 D
}

AddMedian=function(D,s=3){
 if(s==1|s==3) D=cbind(D,Median=RowMedians(D))
 if(s==2|s==3) D=rbind(D,Median=ColMedians(D))
 if(s==3) D[NR(D),NC(D)]=Median(D)
 D
}

AddParen=function(D){
 Concat(D[,1] & " (" & D[,2] & ")") & "."
} #a (123), b(446)

AddPercent=function(D,b=','){
 R='('&Rnd(D/RowSums(D)*100)&'%)'
 R=matrix(R,nr=NR(D))
 colnames(R)=colnames(D)&'%'
 W=cbind(D,R); W=BM(W,b); W[,Alter(NC(W))]
} #Add horizontal percent to df (matrix), b: big mark

AddRCnum=function(D){
 colnames(D)=(1:NC(D))&'.'&CN(D) #列番号を付加
 rownames(D)=(1:NR(D))&'.'&RN(D); D #行番号を付加
}

AddSum=function(D,s=3){
 if(s==1|s==3) D=cbind(D,Sum=RowSums(D))
 if(s==2|s==3) D=rbind(D,Sum=ColSums(D))
 D
}

Adjacent=function(A,sel) {
 n=Len(A)
 if(sel==1) return(c("*",A[-n]))
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 if(sel==2) return(c("*","*",A[-c(n,n-1)]))
 if(sel==3) return(c(A[-1],"*"))
 if(sel==4) return(c(A[-(1:2)],"*","*"))
} #キーワードに隣接する語形 A1, A, P1, P2
# Adjacent.A1=function(A) {n=Len(A); c("*",A[-n])}
# Adjacent.A2=function(A) {n=Len(A); c("*","*",Cg[-c(n,n-1)])}
# Adjacent.P1=function(A) c(A[-1],"*")
# Adjacent.P2=function(A) c(A[-(1:2)],"*","*")

Adjust=function(D){
 D=rbind(CN(D),D)
 for(h in 1:NC(D)){
  A=D[,h]; mx=0; for(i in 1:Len(A)) if(Len(A[i])>mx) mx=Len(A[i])
  for(i in 1:Len(A)) A[i]=Join(rep(' ',mx-Len(A[i])),'')&A[i]
  D[,h]=A
 }; R=NULL; for(h in 1:NR(D)) R[h]=Join(D[h,], ' '); R
} # df をスペースで調整して vec にする

Agregar=function(df,str){ #ej. Arreglar(df,'{},(),[],_:,,,()')
 Rn=row.names(df); df=apply(df,2,as.character); row.names(df)=Rn
 Vr=VT(str); L=NULL
 for(i in 1:Len(Vr)){
  L[[i]]=Left(Vr[i],1)&Trim(df[,i])&Right(Vr[i],1)
  # L[[i]]=Left(Vr[i],1) & Format(df[,i]) & Right(Vr[i],1)
 }; R=DF(L); colnames(R)=CN(df); R
}

All=function(f) all(f, na.rm=TRUE)

Alpha=function(CV, a=.5) {
 #https://www.dataanalytics.org.uk/make-transparent-colors-in-r/
 A=CV; for(i in 1:Len(CV)){
  v=col2rgb(CV[i]); A[i]=rgb(v[1],v[2],v[3], max=255, alpha=a*255)
 }; A
} #色名を透明化：CV: 色名ベクトル, a: alpha (1:不透明)

Alter=function(x){
 h=x/2; B=NULL; n=0
 for(i in 1:h){n=n+1; B[n]=i; n=n+1; B[n]=h+i}; B
} #Alternative sequence, ex: Alter(6) # 1 4 2 5 3 6
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AM=function(X,s='s'){
 X=as.matrix(X)
 W=1-X; A=t(X)%*%X; B=t(X)%*%W; C=t(W)%*%X; N=t(W)%*%W
 if(s=='a') R=A #共起回数
 if(s=='s') R=(A+N)/(A+B+C+N) #Simple matching
 if(s=='j') R=A/(A+B+C) #Jaccard
 if(s=='d') R=2*A/(2*A+B+C) #Dice
 if(s=='rr') R=A/(A+B+C+N) #Russel & Rao
 if(s=='rr2') R=3*A/(3*A+B+C+N) #Russel & Rao-2
 if(s=='h') R=((A+N)-(B+C))/((A+N)+(B+C)) #Hamann
 if(s=='y') R=(A*N-B*C)/(A*N+B*C) #Yule
 if(s=='p') R=(A*N-B*C)/((A+B)*(C+N)*(A+C)*(B+N))^(1/2) #Phi
 if(s=='o') R=A/((A+B)*(A+C))^(1/2) #Ochiai
 if(s=='mi') R=log2(A*(A+B+C+N)/((A+B)*(A+C)))#相互情報量
 if(s=='mis') R=log(A*(A+B+C+N)/((A+B)*(A+C)))/log((A+N)/A) #標準相対情報量
 if(s=='ss') R=A/(A+B)#単純選択
 if(s=='cs') R=(A*N-B*C)*(A+N)/(N*(A+B)*(A+B+C+N))#比較選択
 R
}#連関行列 Association matrix (symmetric)

Any=function(f) any(f, na.rm=TRUE)

AP=function(D,s=1,f=sum){
 str=deparse(substitute(f)) # 変数=>文字列
 if(s==1) {W=as.matrix(apply(D,s,f)); colnames(W)=str; W} #vt vertical
 else if(s==2) {W=t(apply(D,s,f)); rownames(W)=str; W} #vt horizontal
 else f(D,na.rm=T) #scalar
} # general apply s=1:row/2:col, ex: AP(D,2,sum)

AR=function(X,func=mean,dx=3,dy=3){ #dx, dy: 小数桁 <Rh
 X=as.matrix(X); str=deparse(substitute(func)) # 変数=>文字列
 X1=AP(X,1,func); X2=Round(X1,dy); colnames(X2)=str; X3=cbind(Round(X,dx),X2)
 JustR(X3)
} #Add row 行列に計算値(行:1)を追加 dx, dy: D, 計算値の小数桁数

AR2=function(X,f1=mean,f2=median,dx=3,d1=3,d2=3){ #dx, d1, d2: 小数桁 <Rh2
 X=as.matrix(X); s1=deparse(substitute(f1)); s2=deparse(substitute(f2)) # 変数=>文字
列
 Z1a=AP(X,1,f1); Z1b=Round(Z1a,d1); colnames(Z1b)=s1
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 Z2a=AP(X,1,f2); Z2b=Round(Z2a,d2); colnames(Z2b)=s2
 Z=cbind(Round(X,dx),Z1b,Z2b); JustR(Z)
} ##Add row 行列に計算値(行:2)を追加 dx, d1,d2: D, 計算値の小数桁数

As.numeric=function(D) {if (is.vector(D)) D=as.numeric(D); D}

AS=function(X,s='s'){
 X=as.matrix(X); A=X ; B=MV(RowSums(X),X,'s')
 C=MV(ColSums(X),X,'s'); N=MV(MV(MV(sum(X),A,'s'),B,'s'),C,'s')
 if(s=='a') R=A #共起回数
 if(s=='s') R=(A+N)/(A+B+C+N) #Simple matching
 if(s=='j') R=A/(A+B+C) #Jaccard
 if(s=='d') R=2*A/(2*A+B+C) #Dice
 if(s=='rr') R=A/(A+B+C+N) #Russel & Rao
 if(s=='rr2') R=3*A/(3*A+B+C+N) #Russel & Rao-2
 if(s=='h') R=((A+N)-(B+C))/((A+N)+(B+C)) #Hamann
 if(s=='y') R=(A*N-B*C)/(A*N+B*C) #Yule
 if(s=='p') R=(A*N-B*C)/((A+B)*(C+N)*(A+C)*(B+N))^(1/2) #Phi
 if(s=='o') R=A/((A+B)*(A+C))^(1/2) #Ochiai
 R
}#連関得点 Association score (n*p)
#AsC=function(n){as.character(n)} #数値=>文字

AsCha=function(x) as.character(round(x,9))
#as.character(10-9.2) #"0.800000000000001"

AsN=function(X,sel=T){
 Rn=rownames(X); rn=NR(X); Cn=colnames(X); cn=NC(X)
 if(sel) X=as.numeric(X) else X=as.character(X)
 X=matrix(X,rn,cn); rownames(X)=Rn; colnames(X)=Cn; X
} #sel=T:文字行列=>数値行列, =F:数値行列=>文字行列

AsNum=function(D){
 nr=NR(D); Rn=rownames(D); Cn=colnames(D); D=unlist(D)
 R=matrix(as.numeric(D),nr); rownames(R)=Rn; colnames(R)=Cn; R
}# データフレーム=>数値

AsNumC=function(D){for(i in 1:NC(D)){
 if(all(IsNum(D[,i]))) D[,i]=as.numeric(D[,i])}; D} #df の文字型数値の列=>数値の列
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```
AsVt=function(A) unlist(as.vector(A)) #df の行・列=>ベクトル  AsVt(D[1,])

#### B ####

B.test.b=function(f,t,e=.5,side='s',cl=.95,r=3) {
 #f:frequency,t:total,e:expected-probability,cl:confidence-level
 #side='s':selective,'t':two-sided,'g':greater,'l':less,r:Rnd
 if(side=='s') {
  sc=Selsecurity(f,t,e); p=1-abs(sc); pw=Selpower(f,t,e,cl)
  Ci=binom.test(f,t,e,'t',cl)$conf.int[1:2]
  if(f<t/2) {Bt=binom.test(f,t,e,'l',cl); cv1=qbinom(1-cl,t,e)}
  else   {Bt=binom.test(f,t,e,'g',cl); cv2=qbinom(cl,t,e)}
 }
 else {
  Bt=binom.test(f,t,e,side,cl); p=Bt$p.value; sc=1-p
  Ci=Bt$conf.int[1:2]; pw=Power(f,t,e,cl,side)
  if(side=='g'){cv1=0; cv2=qbinom(cl,t,e)}
  if(side=='l'){cv1=qbinom(1-cl,t,e); cv2=t}
  if(side=='t'){cv1=qbinom((1-cl)/2,t,e); cv2=qbinom((1+cl)/2,t,e)}
 }
 rt=f/t; es=rt/e; lw=Ci[1]; up=Ci[2]; b=1-abs(pw)
 wd=(up-lw)/up; cf=HM(c(abs(sc),abs(pw),(1-wd))) #Hm: harmonic mean
 R=Rnd(c(rt,es,sc,p,b,pw,cv1,cv2,lw,up,wd,cf),r)
 names(R)=c('ratio','effect-size','security','p-value','beta','power',
         'cv1','cv2','lower-b.','upper-b.','rel.width','confidence'); R
} #Binomial test (using binom.test)
#f=60;t=100;e=0.5;side='t'; B.test(f,t,e,side)
# f=60;t=100;e=0.5;side='g'; B.test(f,t,e,side)
# f=42;t=100;e=0.5;side='l'; B.test(f,t,e,side)
# f=67;t=100;e=0.5;side='s'; B.test(f,t,e,side)
# f=42;t=100;e=0.5;side='s'; B.test(f,t,e,side)

B.test=function(f,t,e=0.5,side='s',cl=0.95,r=3) {
 #f:frequency,t:total,e:expected-probability,cl:confidence-level
 #side='t':two-sided/'g':greater/'l':less,r:Rnd
 rt=f/t; es=rt/e; cv1=0; cv2=t #ratio of sample
 if(side=='s'){
  sc=Selsecurity(f,t,e); p=1-abs(sc); pw=Selpower(f,t,e,cl); b=1-abs(pw)
  lw=BinE(f,t,(1+cl)/2); up=BinE(f+1,t,(1-cl)/2) #s:.975, .025
  if(f<t/2) {cv1=qbinom(1-cl,t,e)}
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  else {cv2=qbinom(cl,t,e)}
 }
 if(side=='t'){ #two sided
  p1=pbinom(f,t,e); p2=ifelse(f==0,1,pbinom(f-1,t,e,F)); p=2*min(p1,p2,0.5); sc=1-p
  lw=BinE(f,t,(1+cl)/2); up=BinE(f+1,t,(1-cl)/2) #s:.975, .025
  cv1=qbinom((1-cl)/2,t,e); cv2=qbinom((1+cl)/2,t,e)
  es=f/t/e; pw=pbinom(cv1-1,t,rt)+pbinom(cv2,t,rt,F); b=1-pw
 } #p:value-p,lw/up:lower/upper bound,cv1,cv2:crical value,pw:power,b:beta
 if(side=='g'){ #greater
  p=ifelse(f==0,1,pbinom(f-1,t,e,F)); sc=1-p; lw=BinE(f,t,cl); up=1
  cv2=qbinom(cl,t,e); pw=pbinom(cv2,t,rt,F); b=1-pw
 }
 if(side=='l'){ #less
  p=pbinom(f,t,e); sc=1-p; lw=0; up=BinE(f+1,t,1-cl) #up=qbeta(cl,f+1,t-f)
  cv1=qbinom(1-cl,t,e); pw=pbinom(cv1-1,t,rt); b=1-pw
 }
 #wd=up-lw; cf=abs(sc*pw*(1-wd))^(1/3)
 wd=(up-lw)/up; cf=HM(c(abs(sc),abs(pw),(1-wd))) #Hm: harmonic mean
 R=Rnd(c(rt,es,sc,p,b,pw,cv1,cv2,lw,up,wd,cf),r)
 names(R)=c('ratio','effect-size','security','p-value','beta','power',
         'cv1','cv2','lower-b.','upper-b.','rel.width','confidence'); R
} #Binomial test (using BinE)
# f=62;t=100;e=0.5;side='s'; B.test.b(f,t,e,side)
# binom.test(f,t,e,side)

Balance=function(A=D){A=A-median(A);  p=sum(A[A>0]);  n=-sum(A[A<0]);  (p-
n)/(p+n)
}#平衡係数(balance)

BD=function(...,rn=F){
 # Bind by column ex: BD(E1,E2,E3); BD(E1,E2,E3,'A,B,C') title:'A,B,C'
 L=list(...); ln=Len(L); Z=L[[ln]]
 if(any(class(Z)=='character')&any(class(Z)!='data.frame')) {C=VT(Z); ln=ln-1}
 mx=0; for(i in 1:ln) if (NR(L[[i]])>mx) mx=NR(L[[i]]) # max of nrow
 E=list(); Cn=NULL # initialize E; Cn:colnames
 for(i in 1:ln){
  D=L[[i]]; d=mx-NR(D); Rn=RN(D) #D:df; d:difference; Rn:rownames
  if(d>0){D=RBIND(D,DF(matrix('',d,NC(D)))); Rn=c(Rn,rep('',d))} #D; Rn
  E=c(E,list(Rn),list(D)); Cn=c(Cn,'['&C[i]&']',CN(D)) #E; Cn
 }; E=do.call(cbind, E); rownames(E)=NULL; colnames(E)=Cn; E}
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```
BinA=function(D, sel=1){ #sel=1:行, =2:列, =3:全体
 #Binomial distribution equal probability (matrix) pbinom (lower tail)
 nr=NR(D); nc=NC(D); Cs=ColSums(D); Rs=RowSums(D); Tt=Sum(D)
 for(i in 1:nr){for(j in 1:nc){
  if(is.na(D[i,j])) next
  if(sel==1) D[i,j]=Pbinom(D[i,j],Rs[i],1/nc)
  if(sel==2) D[i,j]=Pbinom(D[i,j],Cs[j],1/nr)
  if(sel==3) D[i,j]=Pbinom(D[i,j],Tt,1/(nr*nc))
 }}; D
} #二項分布確率(下側・行列), 等分期待確率　負値=>絶対値

BIND=function(..., f=''){
 L=list(...); W=L[[1]]; for(i in 2:Len(L)) W=Bind(W,L[[i]],f); W
} # 行列を横連結 BIND(A,B,C) =>A:B:C

BinD=function(f,t,e){ # f:frequency,t:total,e:expected probability
 A=NULL; for(i in 1:t) A[i]=ifelse(i==1,log(i),A[i-1]+log(i)) #log. of factorial
 if(f==0) exp(t*log(1-e))
 else if(f==t) exp(t*log(e))
 else exp(A[t]-A[f]-A[t-f]+f*log(e)+(t-f)*log(1-e)) #binomial probability
} # Indivisual binomial probability
#x=2; n=3; e=1/6; BinD(x,n,e); dbinom(x,n,e) # individual: 0.06944444

Bind=function(X,Y,f=''){
 X=as.matrix(X); Y=as.matrix(Y); rx=NR(X); ry=NR(Y)
 if(rx>ry) Y=rbind(Y, matrix(f,rx-ry,NC(Y)))
 if(rx<ry) X=rbind(X, matrix(f,ry-rx,NC(X)))
 W=cbind(X,lxx=rep(':',NR(X)),Y)
 colnames(W)=gsub('lxx',':',CN(W)); JustR(W)
} #行列を横結合 X:Y (行数不一致可) f: filler Bind(X,Y,'-')

BindByAnyColumn=function(D,E,d,e) RnSeq(cbind(D,E[match(D[,d],E[,e]),]))
#列(d,e)を参照して df.D に df.E を結合する

BindByFirstColumn=function(D,E) RnSeq(cbind(D,E[match(D[,1],E[,1]),]))
#第 1 列を参照して D に E を結合する

BindByRowname=function(D,E) cbind(D,E[match(RN(D),RN(E)),])
#行名を参照して D に E を結合する
```

```
# D=cbind(x=c(1,2,3),y=c(4,5,6)); rownames(D)=c("a","b","c"); D
# E=cbind(p=c(11,22),q=c(44,55)); rownames(E)=c("b","a"); E
# BindByRowname(D,E)

BindCooc=function(D,s,d=1){ #s(elect),d:decimal
 X=D; Xn=Paren(Round(X,d), Rank(X)) # 共起回数 (順位)
 Y=COOC(D,s); Yn=Paren(Round(Y), Rank(Y)) # Dice.m (順位)
 noquote(cbind(Xn,c('*','*'),Yn))
} #データ行列+類似係数

BinDif=function(x, y, e=0.5){ #(x, y: 頻度,e:x の期待確率) ex: BinDif(3,7,0.5) #
0.0546875
 if(x==0) return(0) else pbinom(x-1, x+y, e)
} #差の有意性

BindV=function(X,Y,f=''){
 cx=NC(X); cy=NC(Y)
 if(cx>cy) {Y=cbind(Y,matrix(rep(f,NR(Y)*(cx-cy)),NR(Y))); C=colnames(X)}
 if(cx<cy) {X=cbind(X,matrix(rep(f,NR(X)*(cy-cx)),NR(X))); C=colnames(Y)}
 Z=JustR(rbind(X,Y)); colnames(Z)=C; Z
} # 列数の異なる行列を縦に連結 f: filler

BinE=function(f,t,s=.95) qbeta(1-s,f,t-f+1)
# Expected probability. f:freq.,t:total,s:security
# BinE=function(f,t,s=.95){ #f:frequency,t:total,s:security
# library(stats); binom.test(f,t,0,'greater',s)$conf.int[1]
# # lower-b. of greater interval of confidence
# # the smallest plausible value for the true proportion of successes
# } # Expected probability (binom.test)
# BinE.z=function(f,t,s=.95){#f:frequency,t:total,s:security
# if(f==0) return(0) else {p=10^8; mx=p; mn=0; lw=s-1/p; up=s+1/p}
# #p:precision : mx:max, mn:min,lw:lower, up:upper
# for (i in 1:1000){
#   mid=(mx+mn)/2; e=mid/p; s=pbinom(f-1,t,e) #mid; expected prob.; security
#   if(s<lw) mx=mid   #raising of mx to mid
#   else if(s>up) mn=mid #lowering of mn to mid
#   else break # if s-1/p <= s <= s+1/p], break
# }; e
# } # Expected binomial probability (binary search)
```

```
BinF=function(t,e,s=.95) {f=qbinom(s,t,e); IE(f<t,f+1,f)}
# Expected frequency. (t:total,e:expected probability,s:security=.f:freq)
# BinF=function(t,e,s=.95){
# ifelse(e==0,0,which(pbinom(0:t,t,e)>s+1/10^8)[1]-1)}
# Expected frequency (t:total,e:expected probability,s:security)
# BinF=function(t,e,s=.99){ #t:total,e:expected probability,s:security
# ifelse(e==0,0,which(pbinom(0:t,t,e)>s)[1]-1)
# } # Expected frequency (t:total,e:expected probability,s:security)

BinL=function(x,n,s=.95){
 if(x==0) 0 else qbeta(1-s, x, n-x+1) # 信頼区間下限
} #二項分布信頼区間下側限界 (x:出現数,n:標本数,s:有意率)(正確)

BinM=function(D, s=3){ #s=1:row/2:col/3:all
 #Binomial distribution expected probability (matrix) pbinom (lower tail)
 Ex=Exp(D); Cs=ColSums(D); Rs=RowSums(D); Tt=Sum(D)
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  if(is.na(D[i,j])) next
  if(s==1) D[i,j]=Pbinom(D[i,j],Rs[i],Cs[j]/Tt)
  if(s==2) D[i,j]=Pbinom(D[i,j],Cs[j],Rs[i]/Tt)
  if(s==3) D[i,j]=Pbinom(D[i,j],Tt,Ex[i,j]/Tt)
 }}; D
}

BinP=function(D,s=3){
 #Binomial probability. s=1:row/2:col/3:all
 nr=NR(D); nc=NC(D); t=Sum(D); Rs=RowSums(D); Cs=ColSums(D); P=D
 for(i in 1:nr){for(j in 1:nc){
  if(is.na(D[i,j])) {P[i,j]=NA; next}
  if(s==1) P[i,j]=Pbinom(D[i,j],Rs[i],1/nr)
  if(s==2) P[i,j]=Pbinom(D[i,j],Cs[j],1/nc)
  if(s==3) P[i,j]=Pbinom(D[i,j],t,1/(nr*nc))}}; P}

BinR=function(f,t,e=.5,side='g'){
 #f:freq.,t:total,e:expected probability,test='l':less,'g':greater,'t':two-sided
 1-BinS(f,t,e,side)
} # Risk, P-value

BinS=function(f,t,e=0.5,side='g'){
 #f:freq.,t:total,e:expected probability,side='l':less,'g':greater,'t':two-sided
```

```
  if(side=='l') return(pbinom(f,t,e,F))
  if(side=='g') return(ifelse(f==0,0,pbinom(f-1,t,e)))
  if(side=='t') {
    p1=pbinom(f,t,e); p2=ifelse(f==0,1,1-pbinom(f-1,t,e)); p=2*min(p1,p2,0.5)
    return(1-p)
  }
} #Security (significance)

BinT=function(f,t,e) 2*min(pbinom(f,t,e),1-pbinom(f-1,t,e))

BM=function(D,b=',') format(D,big.mark=b) #Big mark 23,456

BS=function(D,s=3){
  # Binomial security score. s=1:row/2:col/3:all
  if(s==0) s=3
  W=D; Rs=RowSums(D); Cs=ColSums(D); sm=Sum(D); nr=NR(D); nc=NC(D)
  for(i in 1:nr){for(j in 1:nc){
    if(is.na(D[i,j])) {W[i,j]=NA; next}
    P=c(Rs[i],Cs[j],sm); C=1/c(nr,nc,nr*nc)
    W[i,j]=pbinom(D[i,j],P[s],C[s])}}; W}

Buscar=function(s, col, X=Lm){ #
  G=grep(s, X[,col]) #GREP 検索
  paste(X[G,2],' {*',X[G,3],'*} ',X[G,4],' ',X[G,5],sep='') #整形
} #検索

#### C ####

CB=function(x) writeClipboard(x,format=13) #クリップボードにコピー

CB2=function(x,rn=F,cn=T) {
  write.table(x,"clipboard",quote=F,sep="¥t",row.names=rn,col.names=cn)
} #クリップボードにコピー2

Celda.repetida=function(df,K=1:3){
  R=df; nr=NR(df); m=10^4
  for(i in 2:nr){
    if(floor(i/m)*m==i) print((i/m)&"/"&(nr/m))
    for(j in K){
      if((j==1) & (df[i,1]==df[i-1,1])){
```

```
      if(df[i,2]==df[i-1,2]) {R[i,j] = '='} else{R[i,j] = '=' & R[i,j]}
     }
     if((j>1) & all(df[i,1:j]==df[i-1,1:j])) {R[i,j]='='}
   }}; R
}#繰り返しセルを'='にする  50 sec

Celda.repetida2=function(df){
 R=df;
 for(i in 2:NR(df)){for(j in 1:1){
  if(df[i,j]==df[i-1,j]) {R[i,j]='='}
 }}; R
}#繰り返しセルを'='にする  50 sec

Celda.repetida3=function(df){
 R=df;
 for(i in 2:NR(df)){
  if(df[i,1]==df[i-1,1]) R[i,1]='='
 }; R
}#繰り返しセルを'='にする  50 sec

Central=function(A=D){A=A-mean(A); p=Len(A[A>0]); n=Len(A[A<0]); (p-n)/(p+n)}
#中心性係数(centrality)

CES=function(D,s=1){ #s=1: 差, 2: 比, 3:差比
 if(s==1) D-Exp(D) else if(s==2) D/Exp(D)else (D-Exp(D))/Exp(D)
} #比較期待値得点  Comparative Expectation Score

Chi.t=function(D) chisq.test(D)$statistic
# Chi=function(M){
# Rs=RowSums(M); Cs=ColSums(M); s=sum(M); E=M
# for(i in 1:NR(M)){for(j in 1:NC(M)){E[i,j]=Rs[i]*Cs[j]}}; E=E/s
# for(i in 1:NR(M)){for(j in 1:NC(M)){
#    M[i,j]=(M[i,j]-E[i,j])^2/E[i,j]}}; sum(M)
# } #Chi squared (M: matrix, table, DF)

Chi=function(D){
 Rs=RowSums(D); Cs=ColSums(D); s=Sum(D); nr=NR(D); nc=NC(D)
 E=D; for(i in 1:nr) {for(j in 1:nc) E[i,j]=(Rs[i]*Cs[j])/s}
 if(nr==2&nc==2) {
  a=D[1,1]; b=D[1,2]; c=D[2,1]; d=D[2,2]
```

```
   return(s*(abs(a*d-b*c)-s/2)^2/(a+b)/(c+d)/(a+c)/(b+d))
  } else return(Sum((D-E)^2/E))
} #Chi squared (D: matrix, table, DF)

ChiPV=function(D) chisq.test(D)$p.value #chisq.test's p.value

ChisqTest=function(M,cl=.95,r=3){
  Ch=chisq.test(M)
  U=unname(unlist(c(Ch[1], Ch[2], Ch[3]))); chi=U[1]; df=U[2]; p=U[3]
  es=sqrt(chi/sum(M)); es.max=sqrt(min(NR(M),NC(M))-1) #effect size; max
  pw=pwr.chisq.test(es,n,df,1-cl)$power #power
  R=Rnd(c(chi,df,1-p,p,es,es/es.max,pw),r)
  names(R)=VT('chi,df,security,p-value,es:effect-size,relative-es,power'); R
} #Chi-squared test: M:matrix,cl:confidence level,r:Rnd
#M=matrix(c(40,30,28,44,22,16,110,62,98),nr=3,byrow=T);          ChisqTest(M,.95,5);
chisq.test(M)

CI.b=function(f,t,cl=.95){
  lw=qbeta((1-cl)/2,f,t-f+1); up=qbeta((1+cl)/2,f+1,t-f)
  R=c(f/t,lw,up,up-lw); names(R)=c('ratio','conf.int.1','conf.int.2','width'); R
} # Confidence interval by binomial distribution (Clopper-Pearson)
#CI.b(3,10,0.95) # 0.30000000 0.06673951 0.65245285

Ci.L=function(f,t,s=.95) qbeta((1-s)/2,f,t-f+1) # Clopper-Pearson-interval (lower)
# Confidence-interval-lower-bound, f:success, t:trial, s:confidence level 信頼区間下限

CI.n=function(A,cl=.95){# A:data array, A: c(n,mean,variance), cl:security
  if(Len(A)==3){n=A[1];m=A[2];v=A[3]} else{n=Len(A);m=mean(A);v=var(A)}
  q=qnorm((1+cl)/2); x=q*sqrt(v/n)
  R=c(m, m-x, m+x); names(R)=c('mean','l-bound','u-bound'); R
} # Confidence interval by normal-distribution
# CI.n(c(200,50,10), .99) # 50.26667 49.59870 50.93463
# set.seed(0); A=Rnd(rnorm(30,50,10),0); CI.n(A,.99) # 50.26667 49.59870 50.93463

CI.t=function(A,cl=.95){ #A: data, cl:clecurity
  m=mean(A); u=var(A); n=Len(A); t=qt((1+cl)/2,n-1); em=t*sqrt(u/n)
  R=c(m, m-em, m+em, em, 2*em, 2*em/(max(A)-min(A)))
  names(R)=c('mean','l-bound','u-bound','error margin','width','width/range'); R
} # Confidence interval by t-distribution
#set.seed(1); A=rnorm(200,50,10); CIt(A,.95)
```

```
Ci.U=function(f, t, s=.95) qbeta(1-(1-s)/2,f+1,t-f) # Clopper-Pearson-interval (upper)
# Confidence interval upper bound, f:success, t:trial, s:confidence level 信頼区間上限

Class=function(x) if(exists(x)) class(get(x)) else 'none'
#Class('log') # "function"

Cls=function(n) hcl(seq(15,375,length=n+1),100,35)[1:n] #色指定 (n: 色数)
#CN=CN

CN=function(D,A=NULL) if(is.null(A))colnames(D) else{colnames(D)=A;D}
# CN=function(X=D,N=0){if(is.null(CN(X))) return(NULL)
# if(N[1]==0) N=1:NC(X); R=N;
# for(i in 1:Len(N)){R[i]=CN(X)[i]}; R
# } #列名(1 行でも可) cf Rn

Col1=function(D){
  D=DecimalAdjust(D); Adjust(D)
} #縦長の df を 1 列にした vt で返す(+スペース調整)

Col2=function(D){
  D=DecimalAdjust(D);
  nr=ceiling(NR(D)/2); nc=NC(D)
  K=DF(Matrix('',nr,nc*2))
  for(i in 1:nr) for(j in 1:nc) K[i,j]=D[i,j]
  for(i in (nr+1):NR(D)) for(j in 1:nc) K[i-nr,j+nc]=D[i,j]
  colnames(K)=rep(CN(D),2); Adjust(K)
} #縦長の df を 2 列にした vt で返す(+スペース調整)

Col2n=function(d=D,x){ifelse(IsNum(x),x,FN(x,CN(d),T))
} #列名=>列番号

Col3=function(D){
  D=DecimalAdjust(D);
  nr=ceiling(NR(D)/3); nc=NC(D)
  K=DF(Matrix('',nr,nc*3))
  for(i in 1:nr) for(j in 1:nc) K[i,j]=D[i,j]
  for(i in (nr+1):(nr*2)) for(j in 1:nc) K[i-nr,j+nc]=D[i,j]
  for(i in (nr*2+1):NR(D)) for(j in 1:nc) K[i-nr*2,j+nc*2]=D[i,j]
  colnames(K)=rep(CN(D),3); Adjust(K)
```

```
} #縦長の df を 3 列にした vt で返す(+スペース調整)

ColGMs=function(D) apply(D,2,function(x) (GM(x)))

ColMeans.T=function(O,A) NS(ColSums(O),ColSums(A)) #fraction mean-col

ColMeans=function(D) colMeans(D,na.rm=T) #NaN を除く列平均

ColMedians=function(D) apply(D,2,function(x) (median(x,na.rm=T)))

ColN=function(E=D){colnames(D)=Add('v',1:NC(D)); D} #列名=>v1, v2, ...

ColNum=function(D,i=1){names(D)=i:(i+NC(D)-1)&'.'&names(D); D}
#列に番号を付与 i:開始番号

ColorGradation=function(x='lightgray',y='darkgray',n=5){
 colorRampPalette(c(x, y))(n)
} #RGB カラーグラデーションを生成, from x to y, by n

Cols=function(M=D,x=1){
 if(is.null(x)) return(x)
 IE(IsN(x), x, FN(x,CN(M))) #フルネーム(r)
} #数値/列頭文字=>列名

ColSums=function(D,d=1) colSums(D,na.rm=T) #NaN を除く列平均

Combinar=function(Ar,mark='=',Add=' '){
 Wr=NULL; str=Ar[1]; k=0
 for (i in 2:Len(Ar)){
  if(Left(Ar[i],1) == mark) {str=str & Add & Ar[i]} # mark で開始する行を繋ぐ
  else{k=k+1; Wr[k]=str; str=Ar[i]} #mark 以外は Wr に格納
 }
 k=k+1; Wr[k]=str; Wr
} #ベクトル要素をマークで結合 Combinar fila con marca

CombineCol=function(D,A,s='_') {
 if(Len(A)==1) return(D[,A])
 R=D[,A[1]]; for(i in 2:Len(A)) R=paste(R,D[,A[i]],sep=s); R}
# Combine colums A of D by s ex.CombineCol(D,1:3)
```

```
CombineRow=function(D,C=NULL,s='-') {
 if(is.null(C)) C=1:NC(D); if(Len(C)==1) return(D[,C])
 apply(D[,C],1,paste,collapse=s)
} #D の行を s を使って繋ぐ ex. CombineRow(D,1:2,"/")

CompD=function(x,y,d=5,s=3){
 if(s==1) return(Rnd(x,d)<Rnd(y,d))
 if(s==2) return(Rnd(x,d)<=Rnd(y,d))
 if(s==3) return(Rnd(x,d)==Rnd(y,d))
 if(s==4) return(Rnd(x,d)>=Rnd(y,d))
 if(s==5) return(Rnd(x,d)>Rnd(y,d))
} # Compare with decimal. CompD(0.3-0.2,0.1,1,1): FALSE
#cf: 0.3-0.2==0.1 (FALSE?); cf. 3-2==1 (TRUE); 0.3-0.2<0.1 (TRUE?)

Concat=function(D, K='#'){
 nc=NC(D)-1; if(Len(K)==1) K=rep(K, nc)
 for(i in 1:nc){
  A=apply(D, 1, function(row) {paste(row[1:2], collapse =K[i])})
  D=cbind(A,D[,-c(1:2)])
 }; as.vector(D)
} #文字ベクトルを K で繋ぐ

Concent=function(D,s=0){
 # Diagonal concentration D:df, s=0:none/1:row/2:col/3:all
 nr=NR(D); nc=NC(D); CR=CubeRoot; RS=RowSums; CS=ColSums #nrow,ncol,rename
 if(s==3) {t=UpperLeft(D)
 for(i in 1:3){W=RevDF(D,i); u=UpperLeft(W); if(u>t) {D=W; t=u}}}
 R=Seq(-1,1,nr); names(R)=RN(D); Wr=matrix(R,nr,nc,byrow=F) #weight-row
 C=Seq(-1,1,nc); names(C)=CN(D); Wc=matrix(C,nr,nc,byrow=T) #weight-col
 for(i in 1:500) {
  W=D
  if(s==1|s==3){R=CR(Dv(RS((D*Wc)^3),RS(abs(D))));D=D[order(R),]} #row|all
  if(s==2|s==3){C=CR(Dv(CS((D*Wr)^3),CS(abs(D))));D=D[,order(C)]} #col|all
  if(s<3|all(D==W)) break
 }; R=sort(Rescale(R,T)); C=sort(Rescale(C,T)) #parepare
 list(sel=s, df=D, row=R, col=C, dg=GK(D,T), iter=i) #output
}

Contar=function(df,r=1:5){
 if(class(df)=='data.frame'){cat('N =',NR(df))} #データフレーム
```

```
 else{cat('N =',Len(df))} #文字ベクトルを縦に配置
} #数える r

Context=function(A,sel=1,f=1,w=10){
 n=Len(A); t=f+w-1; l=Len(f:t); D=DF(matrix(0,n,l)); x=0
 if (sel==1) for(i in t:f){x=x+1; D[,x]=c(rep('*',i), A[-(n:(n-i+1))])}
 if (sel==2) for(i in f:t){x=x+1; D[,x]=c(A[-(1:i)], rep('*',i))}
 if(l==1) return(as.vector(D[,1]))
 D=apply(D,1,paste,collapse=' ')
 ReplA(D,' ([,.:;!?>}¥¥)¥¥]])=>¥¥1::([<{¥¥(¥¥]]) =>¥¥1::^ +=>:: +$=>',sep='::')
} #KWIC 文脈, sel=1:前, 2:後, f:from, w:words
# Clave=Dt[1:20,9]; Ant=Context(Clave,1,1,5); Pos=Context(Clave,2,1,5)
# D=cbind(Ant,Clave,Pos); L(D,30) #100 sec

Contrib=function(D,s=1){
 R=D
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  E=D; E[i,j]=NaN
  if(s==1) R[i,j]=Mean(D[,j])/Mean(E[,j])
  if(s==2) R[i,j]=Mean(D[i,])/Mean(E[i,])
 }}; R
} # 寄与率 Contribution from NaN to freq (freq.mean/NaN.mean)

COOC=function(D,s='um'){
 nr=NR(D); nc=NC(D); m=nr+nc-2; Rs=RowSums(D); Cs=ColSums(D); n=sum(D) #m:
乗数
 for(i in 1:nr){for(j in 1:nc){
  a=D[i,j]; if(is.na(a)) next
  b=Rs[i]-a; c=Cs[j]-a; d=n-a-b-c
  if(s=='rr') D[i,j]=a/(a+b) # Relative-row
  if(s=='rc') D[i,j]=a/(a+c) # Relative-column
  if(s=='r') D[i,j]=a/n   # Relative-all.Russel & Rao
  if(s=='r3') D[i,j]=a*3/(a*3+b+c+d) #Russel & Rao-3
  if(s=='s') D[i,j]=(a+d)/n # Simple matching
  if(s=='d') D[i,j]=a*2/(a*2+b+c) # Dice.2
  if(s=='dm') D[i,j]=a*m/(a*m+b+c) # Dice.m
  if(s=='j') D[i,j]=a/(a+b+c) # Jaccard
  if(s=='j2') D[i,j]=a*2/(a*2+b+c) # Jaccard.2
  if(s=='jm') D[i,j]=a*M/(a*m+b+c) # Jaccard.m
  if(s=='u2') D[i,j]=(a*2-b-c)/(a*2+b+c) # Ueda.2
```

```
   if(s=='um') D[i,j]=(a*m-b-c)/(a*m+b+c) # Ueda.m
   if(s=='h') D[i,j]=(a+d-b-c)/n # Hamann
   if(s=='y') D[i,j]=(a*d-b*c)/(a*d+b*c) # Yule
   if(s=='p') D[i,j]=(a*d-b*c)/sqrt((a+b)*(c+d)*(a+c)*(b+d)) # Phi
   if(s=='c') D[i,j]=a/sqrt((a+b)*(a+c)) # Cosine.Ochiai
   if(s=='mi') D[i,j]=log2(a*n/(a+b)/(a+c)) # Mutual information
   if(s=='ts') D[i,j]=1/sqrt(a)*(a-(a+b)*(a+c)/n) # t-score
  }}; D
} #共起係数（データフレーム）

Copy=function(D,rn=T,cn=T) {#rn: row-names, cn: col-names
  D=DF(D); Rn=c('*',RN(D))
  if(cn) D=rbind(CN(D),D)
  if(rn) D=cbind(Rn,D)
  P=D[,1]
  if(NC(D)>1) {for(i in 2:NC(D)){P=paste(P,D[,i],sep='¥t')}}; D=P
  #insert tab
  writeClipboard(as.character(D),format=13)
} #Copy to clipboard

COR=function(X=D,s=0){
  #s=0:相関行列; 1:共分散行列
  if(s==0){cor(X)
  }else {Z=apply(X,2,function(X){X-mean(X)}); t(Z) %*% Z / NR(X)}
}#相関行列

CorCross=function(D,R=NULL,C=NULL){
  if(Any(D<0)) D=D+abs(Min(D))
  nr=NR(D); nc=NC(D); E=NULL
  if(is.null(R)) R=1:nr; if(is.null(C)) C=1:nc
  for(i in 1:nr){for(j in 1:nc){
    n=D[i,j]; if(is.na(D[i,j])|n==0) next
    E=rbind(E,W=matrix(c(R[i],C[j]),n,2,byrow=T))
  }}; cor(E[,1],E[,2])
} #correlation of cross table (D:df, R:row weight, C:col weight)
# D=DF(a=c(1,0),b=c(0,9)); D; CorCross(D) # 1
# D=DF(a=c(1,5),b=c(0,9)); D; CorCross(D) # 0.3273268
# D=DF(a=c(2,0,0),b=c(1,3,0),c=c(1,0,7)); D; CorCross(D) # 0.7654683
# D=DF(a=c(3,0,1),b=c(0,3,0),c=c(1,0,7),d=c(1,1,8)); D; CorCross(D) # 0.5288178
```

```
Corresp=function(D,s=3){
 #Correspondence analysis (diagonal).D:df,s=0:none/1:row/2:col/3:both
 D=as.matrix(D); nr=NR(D); nc=NC(D) #nrol; ncol
 if(s==1|s==2){ # s=1:row/2:col Unilateral analysis (Ueda)
  if(s==2) D=t(D) # s==2: col
  Snn=diag(nr)/RowSums(D)
  Yp=Std(1:nc); Xn=Snn%*%D%*%Yp; D=D[order(Xn),]
  if(s==2) {D=t(D); W=Xn; Xn=Yp; Yp=W}
 }
 if(s==3){ # both (row and col)
  Snn=diag(nr)/RowSums(D); Tpp=diag(nc)/sqrt(ColSums(D))
  App=Tpp%*%t(D)%*%Snn%*%D%*%Tpp
  E=eigen(App); Epp=E$vectors ; Rp=sqrt(abs(E$values[1:min(nr,nc)]))
  Yp=(Tpp%*%Epp*sqrt(sum(D)))[,2]; Xn=(Snn%*%D%*%Yp/Rp[2])
  D=D[order(Xn),order(Yp)]
 }; D=DF(D); if(is.null(RN(D))) rownames(D)=1:NR(D)
 Xn=as.vector(Xn); names(Xn)=RN(D); Yp=as.vector(Yp); names(Yp)=CN(D)
 list(sel=s, df=D,row=Xn,col=Yp,dg=GK(D,T)) #output
}

CorrespCs=function(M=D){
 M=as.matrix(M); CA=corresp(M,min(NR(M),NC(M))); CA$cscore[,1]
} #対応分析 1 軸:列スコア

CorrespEv=function(M=D){
 M=as.matrix(M)
 CA=corresp(M,min(NR(M),NC(M))) #対応分析(MASS)
 R=CA$cor; E=R^2; P=E/sum(E); C=cumsum(P) #R:相関係数,E:固有値,P:寄与率,C:累
積寄与率
 DF(E=Rnd(E,4),R=Rnd(R,4),P=perc(P),C=perc(C)) #出力
} #対応分析  R:相関係数,E:固有値,P:寄与率,C:累積寄与率

Correspond=function(D,E){
 A=D[,2]; B=E[,2]; C=E[,1]
 len.a=Len(A); len.b=Len(B); a=1; R=rep(0,len.a)
 for(i in 1:len.a){
  n=A[i]; w=WhereFirst(n,B[a:len.b])
  if(w==0) next else w=w+a-1
  if(w<(a+10)) {R[i]=C[w]; a=w+1} #10 以上離れているときは対応なし
 }; DF(D,New=R)
```

```
} #2 つの df の対応関係
# D=DF(Id=1:4,Tx=V('e,b,c,d'))
# E=DF(Id=11:22,Tx=V('a,b,c,d,b,d,d,d,d,d,d,e'))
# Correspond(D,E) #0 12 13 14

CorrespRs=function(M=D){
 M=as.matrix(M); CA=corresp(M,min(NR(M),NC(M))); CA$rscore[,1]
} #対応分析 1 軸:行スコア

CorrespSc=function(Dnp=D,s=0){
 Dnp=as.matrix(Dnp)
 nr=NR(Dnp); nc=NC(Dnp) #行数; 列数
 Snn=diag(nr)/RowSums(Dnp) #行和逆数対角行列
 Tpp=diag(nc)/sqrt(ColSums(Dnp)) #列和逆数対角行列
 App=Tpp%*%t(Dnp)%*%Snn%*%Dnp%*%Tpp #固有値方程式
 # E=eigen(App); Epp=E$vectors; Rp=sqrt(E$values) #固有行列;固有値=>相関係数
 E=eigen(App); Epp=E$vectors; Rp=sqrt(abs(E$values[1:min(nr,nc)])) #固有行列;固有
値=>相関係数
 #CA=corresp(Dnp,min(nr,nc));
 #Rp=CA$cor #CA:対応分析(MASS); Rp:相関係数
 #Epp=CA$cscore #固有行列
 #Epp=eigen(App)$vectors #固有行列
 # Ypp=(Tpp%*%Epp*sqrt(sum(Dnp))*RepR(Rp,nc)) #Yp=Tpp Rpp*rs*Rp
 # Xnp=(Snn%*%Dnp%*%Ypp/RepR(Rp,nr)) #Xn=Snn Dnp Yp Dnp / Rp
 Ypp=(Tpp%*%Epp*sqrt(sum(Dnp))) #Yp=Tpp Rpp*rs*Rp
 Xnp=Snn%*%Dnp%*%Ypp[,1:min(nr,nc)]/RepR(Rp,nr) #Xn=Snn Dnp Yp Dnp / Rp
 rownames(Xnp)=Rn(Dnp); rownames(Ypp)=Cn(Dnp); IE(s==0,Xnp[,-1],Ypp[,-1]) #行
名; 出力
} #対応分析.行/列スコア (s=0/1) MASS:corresp と同じ cf.CorrespRs(), CorrespCs()

CorTable=function(X,i1=10,i2=10,s=0){
 # X: df,mat(col.1=>row, col.2=>col), i1,i2:interval, s=0:floor, 1:Rnd
 f=ifelse(s==0,floor,Rnd); C1=f(X[,1]/i1)+1; C2=f(X[,2]/i2)+1
 m1=max(C1); m2=max(C2); M=matrix(0,m1,m2)
 for(i in 1:Len(C1)){x=C1[i]; y=C2[i]; M[x,y]=M[x,y]+1}
 t=ifelse(s==0,'','-')
 rownames(M)=t&(0:(m1-1))*i1&'-'; colnames(M)=t&(0:(m2-1))*i2&'-'
 tit=' *row:'&colnames(X)[1]&' / column:'&colnames(X)[2]&'¥n'
 M=JustRrownames(M); M=ifelse(M==0,'.',M); cat(tit); JustR(M)
} #相関表 Correlation table
```

```
Count=function(D,sel=F){
 if(sel) {D=DF(table(D)); Sort(D,1:(NC(D)-1))}
 else {D=count(D,D[,1:NC(D)]); Sort(D,1:(NC(D)))}
}# 質的データの組み合わせの個数, sel=T: Freq=0 を出力
#D=DF(x=VT('a,b,b,b'), y=VT('e,e,f,f'), z=VT('h,h,i,i')); Count(D,T)

CountSameRows=function(D) {
 R=D%>%group_by(across(everything()))%>%
  summarize(count=n(),.groups="drop"); DF(R)
}#df 内で同一の行の度数を計算

CR=function(r=1) cat(rep('¥n',r)) #charriage return r: repeat

Cramer.v=function(D) vcd::assocstats(as.matrix(D))[[5]] # id.
# D=DF(a=c(1,0),b=c(0,9)); D; Cramer(D) # 1
# D=DF(a=c(1,5),b=c(0,9)); D; Cramer(D) # 0.3273268
# D=DF(a=c(2,0,0),b=c(1,3,0),c=c(1,0,7)); D; Cramer(D) # 0.7806247
# D=DF(a=c(3,0,1),b=c(0,3,0),c=c(1,0,7),d=c(1,1,8)); D; Cramer(D) # 0.7309027

Cramer=function(D) {
 if(Any(D<0)) D=D+abs(Min(D))
 sqrt(Chi(D)/Sum(D)/min(NC(D)-1, NR(D)-1))}
#Cramer's measure of association Cramer's V

Cross=function(df=D,x=0,v=NULL,n=0,d=0,m=F,t=F){ #ver.2021-12-30
 #([df], x:個体列(単複), v:変数列(単複),n:数値列(単),d:丸目少数桁,m:平均値,t:入力列名付加)
 df=DF(df); R=NULL; S=NULL #準備
 # x=Cols(df,x); v=Cols(df,v); n=Cols(df,n) #数値/列頭文字=>列名
 if(Len(x)>1){ #複数個体
  for(i in 2:Len(x)){
   df[,x[1]]=paste0(df[,x[1]],'_',df[,x[i]])
   colnames(df)[x[1]]=paste0(Cn(df)[x[1]],'_',Cn(df)[x[i]])
  }; x=x[1]
 }
 if(is.null(v)){ #1 列(x)分析
  if(x==0&n==0) X=xtabs(~rownames(df))   #x==0: 行名, n==0: 個数
  if(x==0&n>0) X=xtabs(df[,n]~rownames(df)) #x==0: 行名, n >0: 合計
  if(x>0&n==0) X=xtabs(~df[,x])       #x >0: 列名, n==0: 個数
```

```
  if(x>0&n>0) X=xtabs(df[,n]~df[,x])   #x >0: 列名, n >0: 合計
  R=matrix(X,Len(X)); rownames(R)=Rn(X); colnames(R)='Sum'
 }else for(i in v){ #変数列数だけ繰り返す
  if(x==0&n==0) X=xtabs(~rownames(df)+df[,i])   #x==0: 行名, n==0: 個数
  if(x==0&n>0) X=xtabs(df[,n]~rownames(df)+df[,i]) #x==0: 行名, n >0: 合計
  if(x>0&n==0) X=xtabs(~df[,x]+df[,i])      #x >0: 列名, n==0: 個数
  if(x>0&n>0) X=xtabs(df[,n]~df[,x]+df[,i])   #x >0: 列名, n >0: 合計
  if(t) colnames(X)=paste0(colnames(df)[i],'.',colnames(X)) #入力列名付加
  R=cbind(R,X)
 }
 if(m){ #平均値
  for(i in v){ #変数列数だけ繰り返す
   if(x==0) Y=xtabs(~rownames(df)+df[,i])   #x==0: 行名 : 個数
   if(x>0) Y=xtabs(~df[,x]+df[,i])      #x >0: 列名 : 個数
   if(t) colnames(X)=paste0(colnames(df)[i],'.',colnames(X)) #入力列名付加
   S=cbind(S,Y)
  }; R=R/S
 }; R=Rnd(R,d) #小数桁(d)で四捨五入
 IE(IsStrA(Rn(R)),R,SortC(R,0,n=T)) #行名が数値であれば行名でソート
} #ピボットテーブル (文字行列=>数値行列)

Cruzar=function(df,x,y,n=0){ #ex:
 if(n==0){X=xtabs(~df[,x]+df[,y], df) #2 列(x,y)
 }else {X=xtabs(df[,n]~df[,x]+df[,y], df)} #3 列(x,y,n)
 X=DF(X); return(Ordenar(X,col=0,ren=0))
} #クロス集計

CS=function(X,f=mean,m='d',s=1){
 #(f=mean,median,mid; m(ethod)='d'(ifference), 'r'(atio), 'dr(dif.ratio)
 #s=1:行 ;  2:列, 3:全
 C=AP(X,s,f)
 if(m=='d') MV(X,C,'s') else if(m=='r') MV(X,C,'d') else MV(MV(X,C,'s'),C,'d')
} #比較得点

Csums=function(X) t(as.matrix(ColSums(X))) #  列和横行列
CubeRoot<-function(x) abs(x)^(1/3)*sign(x) #CubeRoot(-27) => -3   三乗根

CumRatio=function(A,m=100){
 R=A; for(i in 2:Len(A)) R[i]=R[i-1]+A[i]; R/sum(A)*m
}#Cummulative ratio (percent) of vector A; ex: A=c(1,3,5); CumRatio(A)
```

```
CutLeft=function(tx) {
 Lc=str_locate_all(tx,' ')[[1]]
 if(Len(Lc)==0) tx else substring(tx,Lc[1,1]+1)
}#文字列 tx の最初の空白から最後まで
#tx="faltan a quien tiene"; CutLeft(tx)

CutRight=function(tx) {
 Lc=str_locate_all(tx,' ')[[1]]
 if(Len(Lc)==0) tx else substring(tx,1,Lc[NR(Lc),1]-1)
}#文字列 tx の最初から最後の空白の前まで
#tx="faltan a quien tiene"; CutRight(tx)

#### D ####

D2Html=function(D) {
 D=DF(R=RN(D),D); A=IsNumCol(D)
 ht="<table class='styled-table'><thead><tr>"
 for(j in 1:NC(D)) {
  if(j %in% A) dir='right' else dir='left'
  ht=ht & "<th align='"&dir&"'>" & CN(D)[j]&"</th>"
 }; ht=ht & "</tr></thead><tbody>"
 for(i in 1:NR(D)) {ht=ht&"<tr>"
 for (j in 1:NC(D)) {
  if(j %in% A) dir='right' else dir='left'
  ht=ht & "<td align='"&dir&"'>" & D[i, j] & "</td>"
 }; ht=ht & "</tr>"
 }; ht & "</tbody></table>"
} #Df to HTML

D2Long=function(D){
 M=matrix(0,NR(D)*NC(D),4); rownames(M)=RN(D); colnames(M)=CN(D); x=0
 IN=Initial(RN); x=0
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  x=x+1; M[x,1]=RN[i]; M[x,2]=IN[i]; M[x,3]=CN[j]; M[x,4]=D[i,j]
 }}; colnames(M)=V('g,i,x,y')
 M=DF(M)
 M[,1]=as.character(M[,1]); M[,2]=as.character(M[,2])
 M[,3]=as.character(M[,3]); M[,4]=as.numeric(M[,4]); M
} #from df to long form
```

```
D2M=function(E=D,r=1,c=2,f=3,ir=0,ic=0){
 #E,r:出力行となる入力列位置,c:出力列となる入力列位置
 #f:累積和とする入力列位置(f=0:個数),ir:r の間隔,ic:c の間隔
 E=DF(E); n=1; p=1 #E に変換; n:出力行数; p:出力列数
 if(r>0 & ir>0) E[,r]=as.integer(E[,r]/ir)*ir #数値=>階級(r)
 if(c>0 & ic>0) E[,c]=as.integer(E[,c]/ic)*ic #数値=>階級(c)
 if(r>0){R=sort(unique(E[,r])); n=Len(R)} #出力行
 if(c>0){C=sort(unique(E[,c])); p=Len(C)} #出力列
 M=matrix(0,n,p)#出力行列
 if(r>0) rownames(M)=R else rownames(M)='*' #行名
 if(c>0) colnames(M)=C else colnames(M)='*' #列名
 for(i in 1:NR(E)){
  x=ifelse(r>0,which(R==E[i,r]),1) #行
  y=ifelse(c>0,which(C==E[i,c]),1) #列
  if(f==0){M[x,y]=M[x,y]+1   #外的数値がなければ個数
  }else   {M[x,y]=M[x,y]+E[i,f]}#外的数値があれば累積和
 }
 if(ir>0&NR(M)>1) rownames(M)=paste0(RN(M),'-') #行間隔があれば軸に'-'を付加
 if(ic>0&NC(M)>1) colnames(M)=paste0(CN(M),'-') #列間隔があれば軸に'-'を付加
 t(M)
} #データフレーム=>数値行列

D2S=function(D,sep=', ',sep2='; '){
 R=D[,1]; if(NC(D)>1) for(i in 2:NC(D))R=paste(R,D[,i],sep=sep)
 if(sep2=='v') return(R) else return(paste(R,collapse=sep2)&'.')
} #df to string sep2='v': output vector, ex.D2S(D,', ','; ')

D2SS=function(D,s1=' ',s2=', '){
 R=D[,-1]; if(NC(D)>2) R=as.vector(apply(R,1,paste,collapse=s1))
 A=D[,1]; P=which(A[-1]!=A[-Len(A)])+1; P=c(1,P)
 R[P]='¥n{'&D[P,1]&'.} '&R[P]
 gsub(', ¥¥n¥¥{','. ¥n{',paste(R,collapse=s2))&'.'
} #df to string, same {1.} ... {2.} ...

D2xyn=function(E=D,x=1,y=2,n=3,s=F){
 x=Col2n(E,x); y=Col2n(E,y); n=Col2n(E,n) #列名=>列番号
 DF(E[,x],E[,y],E[,n])
} #データフレーム=>データフレーム(s=T:v1,v2,n)
```

```
Dat=function(M=D,s='',r='',c='',sr=NULL,sc=NULL,d=F,n=F){ #NEW, r/c:文字列
 if(!is.null(sr)|!is.null(sc)) return(Sort(M,sr,sc,d,n)) #ソート
 if(s!='') {return(Ext(M,s))} #抽出
 if(IsN(r)) {if(r[1]==0) r=1:NR(M)} #デフォルト:全行
 if(IsN(c)) {if(c[1]==0) c=1:NC(M)} #デフォルト:全列
 if(!IsN(r)) {r=IE(r=='',1:NR(M),S2A(r))} #デフォルト:全行/~指定行
 if(!IsN(c)) {c=IE(c=='',1:NC(M),S2A(c))} #デフォルト:全列/~指定列
 if(!IsN(r)) r=FN(r,RN(M)) #フルネーム(r)
 if(!IsN(c)) c=FN(c,CN(M)) #フルネーム(c)
 R=M[r,c]; S=R #抽出
 if(Len(r)==1) {#1 行の処理
  S=matrix(R,1)
  if(!is.null(CN(M))) colnames(S)=CN(M,c)
  if(!is.null(RN(M))) rownames(S)[1]=RN(M)[r]}
 if(Len(c)==1) {#1 列の処理
  S=matrix(R,Len(R))
  if(!is.null(RN(M))) rownames(S)=RN(M,r)
  if(!is.null(CN(M))) colnames(S)[1]=CN(M)[c]}
 S #出力
} #データ抽出・ソート(df,mt) ex.Dat(D,'ca>=0.5','2,3','A,C'): 行列 D の 2,3 行, A,C 列を抽出
#例  s:'ca>=0.5', r:'2,3', c:'A,C sr:'', sc:'', d:T
#s:条件抽出(select), r:行抽出, c:列抽出 sr:行ソート, sc:列ソート, d:降順, n:数値処理

DC=function(D,d=0,s=T){
 #Diagonal-concentration.D:df,d=0:none/1:row/2:col/3:all,s:Concent/f:Corresp
 E=D; if(Any(E<0)) E=E-Min(E); E=ExpComp(E) # positivization, expectation
 if(s) Dc=Concent(E,d) else Dc=Corresp(E,d) # concentration/correspondence
 #E=Dc$df; Dc[[2]]=D[RN(E),CN(E)]; Dc # output ###
 E=Dc$df; Dc[[2]]=DFx(D,RN(E),CN(E)); Dc # output ###
}

DD=function(X,Y){return (MV(X,Y,'d'))} #行列・ベクトルの割り算 X / Y

Ddi=function(A=D){n=Len(A); sum(abs(A-mean(A)))/(2*sum(A)*n/(n-1))}
#下降分布係数 (Declining distribution index)

Decimal=function(x) {
 # Decimal places of x
```

```
 ch=as.character(round(x,9)); if(x==Rnd(x)) ch=ch&'.'; nchar(sub('.*¥¥.','',ch))
}

DECIMAL=function(x) {
 # Decimal places of x
 if(any(class(x)=='data.frame')|any(class(x)=='matrix')) return(DecimalDF(x))
 else if(any(Len(x)>1)) return(DecimalVT(x))
 else return(Decimal(x))
}

DecimalAdjust=function(D){
 for(h in 1:NC(D)){
  if(class(D[,h])=='numeric') D[,h]=FM(D[,h],DecimalMax(D[,h]))
 }; D
} # df の数値列の小数点以下桁数を最大桁数で揃える

DecimalDF=function(D) {
 #Decimal places of df (max): ex: DecimalDF(df)
 D=NA2zero(D); mx=0;
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  d=Decimal(D[i,j]); if(d>mx) mx=d}}; mx
}

DecimalMax=function(A){
 mx=0; for(i in 1:Len(A)){d=Decimal(A[i]); if(d>mx) mx=d}; mx
} # 数値ベクトルの最大小数桁数

DecimalVT=function(V) {
 #Decimal places of vt (max): ex: DecimalVT(vt)
 V=NA2zero(V); mx=0;
 for(i in 1:Len(V)){d=Decimal(V[i]); if(d>mx) mx=d}; mx
}

DelNA=function(X,s=1){
 if(s==1) X[which(RowSums(is.na(X))==0),]
 else X[,which(ColSums(is.na(X))==0)]
} #NA を含む行・列を除去 (s=1:行, 2:列)

DelX=function(D) {colnames(D)=ReplA(CN(D),'X¥¥d+¥¥.=>'); D}
# Delete 'X123.' from colnames
```

```
Detect=function(X,r){library(stringr);str_detect(X,r)} #X は r にマッチするか

Df2Rn=function(df){
 Df=DF(F=df[,-1]); rownames(Df)=df[,1]; Df
} #df[,1]を行名にする

DFx=function(D,R=NULL,C=NULL) {
 #Data-frame-extraction, R:rows, C:cols
 if(is.null(R)&is.null(C)) return(data.frame(D))
 if(is.null(R)) R=RN(D); if(is.null(C)) C=CN(D)
 E=data.frame(D[R,C]); rownames(E)=R; colnames(E)=C
 return(E)
}
# DFx=function(D,R=NULL,C=NULL) {
# #Data-frame-extraction, R:rows, C:cols
# if(is.null(R)&is.null(C)) return(data.frame(D))
# Rn=RN(D); if(is.null(R)) R=Rn; Wr=Where(R,Rn)
# Cn=CN(D); if(is.null(C)) C=Cn; Wc=Where(C,Cn)
# E=data.frame(D[R,C]); rownames(E)=Rn[Wr]; colnames(E)=Cn[Wc]
# return(E)
# }

Diag=function(D){
 if(Any(D<0)) D=D+abs(Min(D))
 nr=NR(D); nc=NC(D); Rs=RowSums(D); E=MATRIX(0,nr,nc); d=e=0
 r=Rnd(nr/2); E[1:r,nc]=Rs[1:r]; E[(r+1):nr,1]=Rs[(r+1):nr]
 P=Rnd(seq(1,nc,length.out=nr))
 for(i in 1:nr) {p=P[i]; for(j in 1:nc) {
  if(is.na(D[i,j])) next
  else {d=d+abs(p-j)*D[i,j]; e=e+abs(p-j)*E[i,j]}
 }}; unname(1-d/e)
} #Diagonality [0,1]
# D=DF(a=c(1,0),b=c(0,9)); D; Diag(D) # 1
# D=DF(a=c(1,5),b=c(0,9)); D; Diag(D) # 0.6666667
# D=DF(a=c(2,0,0),b=c(1,3,0),c=c(1,0,7)); D; Diag(D) # 0.88
# D=DF(a=c(3,0,1),b=c(0,3,0),c=c(1,0,7),d=c(1,1,8)); D; Diag(D) # 0.7164179

Diagonal=function(D,d){
 E=D;  nr=NR(E);  nc=NC(E);  CR=CubeRoot;  RS=RowSums;  CS=ColSums
```

```
#nrow,ncl,rename
  if(Any(E<0)) E=E-Min(E) #convert into positive number
  E=ExpComp(E); R=E; t=UpperLeft(R) #expected completion; uppper-left-part
  if(d==3) {for(i in 1:3){V=RevDF(E,i); u=UpperLeft(V); if(u>t) {R=V; t=u}}; E=R}
  R=Seq(-1,1,nr); names(R)=RN(E); Wr=matrix(R,nr,nc,byrow=F) #weight-row
  C=Seq(-1,1,nc); names(C)=CN(E); Wc=matrix(C,nr,nc,byrow=T) #weight-col
  for(i in 1:500) {
    W=E
    if(d==1|d==3){R=CR(Dv(RS((E*Wc)^3),RS(abs(E))));E=E[order(R),]} #row|all
    if(d==2|d==3){C=CR(Dv(CS((E*Wr)^3),CS(abs(E))));E=E[,order(C)]} #col|all
    if(d<3|all(E==W)) break
  }; D=D[RN(E),CN(E)]; R=sort(Rescale(R,T)); C=sort(Rescale(C,T)) #parepare
  list(df=D,row=R,col=C,dg=GK(E,T),iter=i) #output
} # Diagonal concentration D:df, d=0:none/1:row/2:col/3:all

Diccionario=function(D,col,Add){
  D=SortM(D,col) #ソート  Ordenar (10 segundos)
  D=Agregar(D,Add) #  左右記号付加  Agregar en ambos lados
  D=Celda.repetida(D) #繰り返しセルを'='にする  Convertir celda repetida en '=' (50
sec)
  D=Concat(D,' ') #df の横行を空白' 'で繋ぐ  Concat filas con ' '
  D=Combinar(D,'=',') #ベクトルの開始が'='の要素を',' で繋ぐ  Combinar vector por
'='
  D=Sustituir(D,1,'=¥¥{.*?¥¥}=> ----;==>;[ ]{2,}=> ;$=>.;,=>, ',sep=';') #置換  Sustituir
  D
} #Editar diccionario
# Diccionario=function(D,col,Add){
# Col=CN(D); Col[1:5]=VT(col); D=D[,Col] # Cambiar orden de columnas
# f='áàâéèêëíìïóòôúùüý'; t='aaaeeeeiiiooouuuy'; s='ñ:nzz,ç:czz'; d='[_<>]'
# #  ソートパラメータ  Parámetros de Ordenar
# D=Ordenar(D,col,fx=f,tx=t,sp=s,del=d,ren=1) #ソート  Ordenar (10 segundos)
# D=Agregar(D,Add) #  左右記号付加  Agregar en ambos lados
# D=Celda.repetida(D) #繰り返しセルを'='にする  Convertir celda repetida en '=' (50
sec)
# D=Concat(D,' ') #df の横行を空白' 'で繋ぐ  Concat filas con ' '
# D=Combinar(D,'=',') #ベクトルの開始が'='の要素を',' で繋ぐ  Combinar vector por
'='
# D=Sustituir(D,1,'=¥¥{.*?¥¥}=> ----;==>;[ ]{2,}=> ;$=>.;,=>, ',sep=';') #置換  Sustituir
# D
# } #Editar diccionario
```

```
DF=data.frame

DifM=function(X,sta='mean'){
 M=Stat(X,F,sta); D=s(t(M),M) #列統計量; 縦ベクトル-横ベクトル
 colnames(D)=colnames(X); rownames(D)=colnames(X); D #表頭; 表側; 出力
} #差行列(Distance matrix)

DifTestCase=function(d, x, y, sel=1){
 if(abs(d)>max(x,y)) return (0)
 if(d>=0) {a=x-d+1; b=a-y} else {a=y+d+1; b=a-x}
 if(b<0) {b=0}; c=sum(a:b)
 if(sel==0) {c} else {c/((x+1)*(y+1))}
} # 差の有意性 (場合の数) d: 差, x: X の最大値, y: Y の最大値

DifTestCaseA=function(d, x, y, sel=1){
 c=0; for(i in 0:x){for(j in 0:y){
  if(d>=0 & i>=(j+d)) c=c+1
  if(d<0 & i<=(j+d)) c=c+1
 }}; if(sel==0) {c} else {c/((x+1)*(y+1))}
} # 差の有意性 (場合の数) 総チェック d: 差, x: X の最大値, y: Y の最大値

DifTestNorm=function(d,R1,R2,sel=F){ #d: 差, R1, R2: ベクトル, sel=F: 上側, T:下側
 m=mean(R1)-mean(R2); s=sqrt(SDp(R1)^2+SDp(R2)^2)
 pnorm(d, mean=m, sd=s, lower.tail=sel)
} #差の有意性(正規分布)

Digit=function(X=D,d) noquote(format(X,digits=d+1)) #小数表示(引用符なしの文字列)

Digit3=function(x){
 format(x, big.mark=",", scientific=F)
} #３桁区切り "12,345"

DigitUp=function(x) if(is.na(x)||x==0) return(1) else return(floor(log10(abs(x)))+1)
#x の小数点以上桁数 ex: 123.45 => 3

DISVEC=function(D,mn=-1,mx=1,it=NULL){
 R=D; for(i in 1:NR(D)) R[i,]=DisVec(unlist(D[i,]),mn=mn,mx=mx,mx/20); R}
```

```
DisVec=function(V,mn=-1,mx=1,it=NULL){
 # Distance vector. V:vt, it:interval
 N=names(V); len=Len(V); V=sort(V); NV=names(V)
 #if(len>10){R=Seq(-1,1,len); names(R)=names(V); return(R[N])}
 if(len>15){R=Seq(mn,mx,len); names(R)=names(V); return(R[N])}
 if(is.null(it)) it=mx/10
 for(h in 1:200){
  GG=list(); n=0; Cg=V[1]; W=V
  for (i in 2:len) {
   if (V[i]-V[i-1]>it) {n=n+1; GG[[n]]=Cg; Cg=V[i]} else Cg=c(Cg, V[i])
  }; n=n+1; GG[[n]]=Cg; V=NULL
  for(i in 1:n){
   Ip=GG[[i]]; Or=1:Len(Ip)-median(1:Len(Ip))
   Iv=median(Ip)+Or*it;
   #Iv[Iv<mn]=mn;Iv[Iv>mx]=mx;
   if(any(Iv<mn)) Iv=Iv+abs(mn-Iv)
   if(any(Iv>mx)) Iv=Iv-abs(mx-Iv)
   V=c(V,Iv)
  }; names(V)=NV
  if(all(V==W)) break
 }; V[N]
}

DivideByFirstWord=function(A){
 A=Trim(A); A=gsub('^([¡¿({//[]+)','¥¥1 ',A); A=ifelse(A=="","#",A)
 A=gsub('^([^,.;:!?)>}¥¥]+)([,.;:!?)>}¥¥]+)','¥¥1 ¥¥2',A)
 D=DF(
  X=sapply(strsplit(A," "),function(x)x[1]),
  Y=sapply(strsplit(A," "),function(x)paste(x[-1],collapse=" "))
 ); #Na2Str(D)
 D
} #vec.A の要素の最初の語で分割し，2 列の df.D を作成
#A=c("a.) bb c","," ¡dd e ff","¿ggg ¿h iii "); DivideByFirstWord(A)

DivideByLastWord=function(A){
 A=Trim(A); A=gsub('([,.;:!?)>}¥¥]+)$',' ¥¥1',A); A=ifelse(A=="","#",A)
 D=DF(
  X = sapply(strsplit(A, " "),function(x) paste(x[-Len(x)], collapse = " ")),
  Y = sapply(strsplit(A, " "),function(x) x[Len(x)])
 ); #Na2Str(D)
```

```
 D
} #vec.A の要素の最後の語で分割し, 2 列の df.D を作成

DivideDf=function(D,div){
 nr=NR(D); n=floor(nr/div); LI=list()
 for(i in 1:n){
  fr=(i-1)*div+1; to=i*div; LI=append(LI,list(D[fr:to,]))
 }; fr=n*div+1; LI=append(LI,list(D[fr:nr,])); LI
} #データフレームをリストに分割

DM.r=function(M,md='e',s=F,t=F,d=3){
 md=Fn(md,c('canberra','euclidean','maximum','manhattan','minkowski')) #距離計測方
法
 if(t) M=t(M); if(s) M=SS(M,2) #t:転置; s:正規化(列)
 Rnd(as.matrix(dist(M,method=md,diag=T,upper=T)),d)
} #距離行列-R (distance matrix)
#Dm(M=D,md='e',s=F,t=F,d=3)
#M:数値行列,s:正規化(列),t:転置,d:小数桁
#md:  距  離  計  測  方  法
('[c]anberra','[e]uclidean'(def.),'[max]imum','[man]hattan','[mi]nkowski')

DM=function(D,s='',d='r'){
 #s='l':limitation/'s':standarization,
 #d='s':simple dis./'m':mean dis/'r':relative dis
 n=NR(D); p=NC(D)
 R=matrix(0,p,p); colnames(R)=CN(D); rownames(R)=CN(D)
 if(s=='l') D=LS(D,2); if(s=='s') D=STD(D,2) #limit.;standard
 for(i in 1:p){for (j in 1:i-1){
  A=D[,i]; B=D[,j]; ssd=Sum((A-B)^2) #ssd:sum of squared difference
  if(d=='s') R[i,j]=sqrt(ssd/n)      #'s':simple distance
  if(d=='m') R[i,j]=Sum((A-B)^2/(A^2+B^2))/n #'m':mean distance
  if(d=='r') R[i,j]=ssd/(Sum(A^2)+Sum(B^2)) #'r':relative distance
  R[j,i]=R[i,j]
 }}; R
} #Distance matrix

DM2=function(A,B,s='',d='r') DM(DF(A,B),s,d)[1,2] #Distance, 2 vectors
#s='l':limitation/'s':standarization, d='s':simple dis./'m':mean dis/'r':relative dis

Dpower=function(X,Y){
```

```
 log_x=log(X); log_y=log(Y); model=lm(log_y~log_x)
 intercept=coef(model)[1]; slope=coef(model)[2]; names(slope)='slope'
 list(intercept,slope,exp(intercept)*X^(slope))
} #Power distribution, density, ex. Dpower(1:5,c(20,10,5,3,1))[[2]]
#dg=function(D,x=1) noquote(format(Rnd(D,x),nsmall=x)) #小数桁数  12.05, 1 => 12.0

DS=function(X,s=1){ #X:データ行列, s=1:行,2:列,3:全
 Me=AP(D,s,mean); Sd=AP(D,s,SDp)
 for(i in 1:NR(X)){for(j in 1:NC(X)){
  if(s==1) X[i,j]=pnorm(X[i,j],Me[i,1],Sd[i,1])
  if(s==2) X[i,j]=pnorm(X[i,j],Me[1,j],Sd[1,j])
  if(s==3) X[i,j]=pnorm(X[i,j],Me,Sd)
 }}; X
} #逸脱得点

DT=function(E=D,r=10,c=0,n=F,rn=F,cn=F,d='',j=F){
 # D:データ, r:行数,c:列数,n:行/列名,rn:行名,cn:列名,d:データ名など,j:右揃え
 if(is.null(NR(E))&is.null(NC(E))) {cat(d,'Class: ',class(E),': ',E,sep='') #E がスカラーならば
 } else { #E が matrix, df, table ならば
  cat(d,'Class: ',Str(class(E)),' / Rows: ',NR(E),' / Columns: ',NC(E),sep='')
  E=DF(E)
  CR(2)
  if(IsT(E)) E=T2M(E) #E が table ならば行列に
  if(r==0|r>NR(E)) r=NR(E); if(c==0|c>NC(E)) c=NC(E) #行数/列数
  E=Dat(E,'',1:r,1:c)
  # if(!IsJpD(E)) E=format(E,justify='left')
  print(E,right=j) #右揃え(T/F)
 } #先頭行/列抽出
 if(n) {CR(1); cat('Row names:',SN(RN(E))); CR(2); cat('Column names:',SN(CN(E)))}
 if(rn) {CR(1); cat('Row names:',SN(RN(E)))}
 if(cn) {CR(1); cat('Column names:',SN(CN(E)))}
} #データ表示

Dummy=function(C=D){
 if(class(C)=='table') C=T2D(C)
 nr=NR(C); nc=NC(C); L=as.list(NULL); c=0; Cn=rep(0,nc)
 for (i in 1:nc){
  L[[i]]=sort(unique(C[,i])); c=c+Len(L[[i]])
  if(i < nc){Cn[i+1]=Cn[i]+Len(L[[i]])}
```

```
   if(i==1){cnames=Add(colnames(C)[i],':',L[[i]])
   }else {cnames=c(cnames,Add(colnames(C)[i],':',L[[i]]))}
  }; R=matrix(0,nr,c)
  for (i in 1:nr){for (j in 1:nc){
   w=which(L[[j]]==C[i,j])[1]; R[i,Cn[j]+w]=1
  }}; rownames(R)=rownames(C); colnames(R)=cnames
  W=t(R[1,])
  for (i in 2:nr){ #同じ行を合計
   if(same(R[i,],R[i-1,])){W[NR(W),]=W[NR(W),]+R[i,]
   }else{W=rbind(W,R[i,])}
  }
  if(NR(W)==NR(R)){R}else {rownames(W)=1:NR(W); W}
} #文字行列->数値行列(ダミー行列)

Duplicate=function(A) {W=duplicated(A); which(W)} #重複要素の位置
#A=c(1, 2, 2, 2, 3, 4, 4, 5); Duplicate(A) # 3, 4, 7

DuplicateDel=function(D,C) {
  library(dplyr); distinct(D,D[,C], .keep_all=T)
}
#D の C 列が重複した行を削除, ex: DuplicateDel(D,c(1:2))

Dv=function(x,y) ifelse(x==0, 0, x/y) # 0/0 -> 0

#### E ####

EditDist=function(A,B){
  n=0; len=Len(A)
  Id=function(x) {
   n<<-n+1; print(n&'/'&len)
   Dt=stringdistmatrix(x,B,"jw"); mn=which.min(Dt)
   if(Dt[mn] < 1) return(mn) else return(0)
  }; sapply(A,Id)
}
#A=c("aa","ab","cc","d"); B=c("cx","xaa","aax","aa"); EditDist(A,B)

EditDistMat=function(A,B){
  M=stringdistmatrix(A,B,"jw"); rownames(M)=A; colnames(M)=B; M
} #Editotial distance matrix
#A=c("aa","ab","cc","d"); B=c("cx","xaa","aax","aa"); EditDistMat(A,B)
```

```
EliminarNaN=function(df){
 for(i in 1:NC(df)){
  df=df[!str_detect(df[,i],'([A-Za-z])'), ]
 }; df
} # 数値以外がある行を除去

Ent=function(L, s=0){ # L: Lemas en vector; s=1: normalizar
 D=DF(table(L)) # D: Frecuencia
 d=NR(D); if(d==1) return (0) # d: Type
 P=D[,2]/sum(D[,2]) # P: Probabilidad
 e=sum(-P*log2(P)) # e: entropía
 ifelse(s==0, e, (e/log2(d))) # devolver
} #Entropy Ent(c('a','a','a','a','b'),s) # 0.7219281

Entropy.r=function(A=D){P=A/sum(A); -sum(P*log2(P))/log2(Len(A))
} #Relative entropy

Entropy=function(A=D){P=A/sum(A); -sum(P*log2(P))
} #Entropy

EP=function(X,s=1,c=.99){
 #X:データ行列, s=1:行,2:列,3:全, p:母数, c:信頼水準
 W=X; Rs=RowSums(X); Cs=ColSums(X); sm=sum(X)
 for(i in 1:NR(X)){for(j in 1:NC(X)){
  P=c(Rs[i],Cs[j],sm); W[i,j]=BinE(X[i,j],P[s],c)
 }}; W
} #期待確率得点

EQ.AddSta=function(N,a){
 # add statistic to EQ
 if(a==0) return(N)
 if(a==1) return(AddSum(N))
 if(a==2) return(AddMean(N))
 if(a==3) return(AddMedian(N))
 if(a==4) return(AddGM(N))
}

EQ.PutSta=function(N,R,p,a){
 # put statistic to EQ
```

```
 if(p==0) N=EQ.AddSta(N,a) # add statistic
 if(p==1){
  if(a==1) {N=RowSums(N); d=DECIMAL(N)}
  if(a==2) {N=RowMeans(N); d=1}
  if(a==3) {N=RowMeans.T(O,A); d=1}
  if(a==4) {N=RowGMs(N); d=1}
 }
 if(p==2){
  if(a==1) {N=ColSums(N); d=DECIMAL(N)}
  if(a==2) {N=ColMeans(N); d=1}
  if(a==3) {N=ColMeans.T(O,A); d=1}
  if(a==4) {N=ColGMs(N); d=1}
 }
 if(p==3&Len(R)==2){ # p=3:2 rows > row&col
  if(a==1) {N=RowSums(N); d=DECIMAL(N)}
  if(a==2) {N=RowMeans(N); d=1}
  if(a==3) {N=RowMedians(N); d=1}
  if(a==4) {N=RowGMs(N); d=1} # p=3:2 rows > row&col
  N=cbind(SplitA(names(N),':'),N);N=PVm(N,1,2,3)
 }; N
}

EQ=function(O,A,R=1,C=0,n=0,s=5,c=0,r=0,a=0,p=0,e=T){
 #Equilibration.O:object-df,A:all-df,R:op-rows,C:op-cols,n:number-col,
 #s=1:obj/2:all/3:bin.P/4:ns/5:sf
 #c:concentration=0:none/1:row/2:con/3:both ~ sort=1:asc/2:desc,
 #a:add=0:none/1:mean/2:sum/3:median/4:mean by fraction
 #p=0:addSta/1:row/2:col/3:row divided into row and col,e:expected completion
 O=PVm(O,R,C,n);A=PVm(A,R,C,n);O=AddLack(O,A);A=AddLack(A,O) # O:obj;A:all
 if(e) {O=ExpComp(O); A=ExpComp(A)} # if (e): expected completion
 else O[Which(A==0)]=NA       # else: if A==0, O=NA
 if(s==1) {N=O; d=0}      # 1.object data; d:decimal=0
 if(s==2) {N=A; d=0}      # 2.all data; d:decimal=0
 if(s==3) {N=BinP(O,A); d=3} # 3.binomial probability; d:decimal=3
 if(s==4) {N=NS(O,A); d=1} # 4.normalization O/A; d:decimal=1
 if(s==5) {N=SFS(O,A); d=0} # 4.secure frequency; d:decimal=0
 if(r==1) {N=RS(N); d=3}; if(r==2) {N=COOC(N); d=3} # +1:relative/2:COOC Score
 if(NR(N)!=1 & NC(N)!=1) N=DC(N,c)$df # +diagonal concentration
 else if(c==1) N=SortC(N,1,F) else if(c==2) N=SortC(N,1,T) # +sort.c=1:ascend/2:desc.
 N=EQ.PutSta(N,R,p,a) # + put / add statistic
```

```
 Rnd(N,d) #output
}

Equi=function(V){
 V=unlist(V); m=Median(V); lw=Sum(m-V[V<m]); up=Sum(V[V>m]-m)
 (up-lw)/(up+lw)
} # Equivalence. V=c(1,2,5,20,35); Equi(V) # 0.7307692

EquiDis=function(Fx, mx){
 ln=Len(Fx)+1; ds=mx/ln; Dx=ds*(1:ln); Dx[-ln]
 # mx=max(Fx); ln=Len(Fx)+1; ds=mx/ln; Dx=ds*(1:ln); Dx[-ln]
} # 均等距離

Escape=function(str){
 r=''; for(i in 1:nchar(str)){
  m=Mid(str,i,1); a=''; if(str_detect(m,'[¥¥[¥¥]¥¥(¥¥)¥¥^¥¥$¥¥.¥¥?¥¥ ]')){a ="¥¥"}
  r=r & a & m
 }; r
} # []()^$.?に¥¥を付けてエスケープする

Esp=function(df=D){ # cf.石田 2012: 79-82
 R=RowSums(df) %*% t(ColSums(df)) / sum(df); rownames(R)=rownames(df); R
} #期待値 Frecuencia esperada

Eval=function(s){eval(parse(text=s))
} #文字列(s)を R スクリプトとして実行

EX=function(D,E){
 # adequate exponent D,E:df~vt-scalar
 for(i in 1:20) if(DigitUp(Max(D/E*10^i))>DigitUp(Max(D))) {e=i-1; break}; e
}

Exp=function(D){
 Rs=RowSums(D); Cs=ColSums(D); s=Sum(D)
 for(i in 1:NR(D)){for(j in 1:NC(D)){D[i,j]=Rs[i]*Cs[j]}}; D/s
} #期待値行列 Expectation

ExpComp=function(D){
 W=which(is.na(D),arr.ind=T); a=Sum(D); d=DecimalDF(D) # W:position of NA
 if(NR(W)==0) return(D)
```

```
 for(i in 1:1000){
  D[W]=RowSums(D)[W[,1]]*ColSums(D)[W[,2]]/a # expectation
  t=Sum(D); if(abs(t-a) < 1/10^6) break else a=t
 }; Rnd(D,d)
} #Expected completion of missing data (D:df, r:round decimal)

Ext=function(E=D,s='v1>0'){
 s=gsub('==','=',s); s=gsub('([^<>])=','¥¥1==',s) #==に統一
 C=CN(E); E=ColN() #列名保持; 列名=>v1, v2, ...
 sb=gsub(' *([&|,]) *','¥¥1',s) #&,|の左右の空白除去
 sb=gsub('([=<>]=|[<>])([^&|,]+)( *[&|,]* *)',"¥¥1'¥¥2'¥¥3",sb) #Ideal => 'Ideal'
 Sp=Split(sb,',')
 for(i in 1:Len(Sp)){
  Sq=Split(Sp[i],' *([=<>]=|[<>#]) *')    # ==, >などでスプリット
  sp=gsub('.*([=<>]=|[<>#]).*','¥¥1',Sp[i]) #sp:セパレータ
  vv=gsub('^v','',Sq[1])        #語頭の'v'除去
  if(vv==''|IsStr(vv)){Sq[1]=Add('v',FN(vv,C,T))} #列名イニシャル=>v+列番号
  if(sp!='#') Sp[i]=Join(Sq,sp) #Sq を sp で繋ぐ: v1=='E'
  if(sp=='#') Sp[i]=Add("Detect(",Sq[1],",'",Sq[2],"')") #Detect(v4,"^S")
 }
 sc=Join(Sp,'&'); sc=Add("subset(E,",sc,")")
 S=eval(parse(text=sc)); colnames(S)=C; S #スクリプト実行; 列名 ; 出力
} #データ抽出  extract Ext([D],s='v1=0', 'v1>5,v1<10','v=='Good', etc)

Extract=function(s,r){str_match(s,r)[2]
} #文字列 s の中で正規表現(r)にマッチする文字列

ExtractRe=function(A,re) Na2Str(str_match(A,re)[,1])
#vt.A の要素が re に一致する文字列を抽出したベクトル

#### F ####

Fac2Cha=function(D){for(i in 1:NC(D)){
 if(class(D[,i])=='factor') D[,i]=as.character(D[,i])}; D}
#df の factor を character に
#ff=function(E=D){DF(E)} #データフレームに

FDM=function(D){
 A=NULL; for(i in 1:NC(D)){A[i]=FreqDistMean(D,0,i)}
 names(A)=colnames(D); Rnd(A,2)
```

```
} #Frequency Distribution Mean (D: matrix of numeric rownames)

FDS=function(X,it,s=1,fr=0,cs=1){
 #s=1:row, 2:col, it: interval,fr=0:floor, 1:Rnd, cs=1: count, 2:sum
 if(s==2) X=t(X); L=apply(X,1,function(X){FreqDist(X,it,fr)})
 mx=max(sapply(L, NR)); W=matrix(0,Len(L),mx); Cn=NULL
 for(i in 1:Len(L)){for(j in 1:NR(L[[i]])){
  Cn[j]=L[[i]][j,1]; W[i,j]=L[[i]][j,cs+1]
 }}; W[is.na(W)]=0; rownames(W)=rownames(X); colnames(W)=Cn
 if(s==2) {W=t(W); W=JustRrownames(W)}; W=ifelse(W==0,'.',W); JustR(W)
} #度数分布得点 Frequency distribution score

FDSd=function(D){
 A=NULL; for(i in 1:NC(D)){A[i]=FreqDistVarp(D,i)^(1/2)}
 names(A)=colnames(D); Rnd(A,2)
} #Frequency Distribution standard deviation (D: matrix of numeric rownames)

FDSr=function(X,d,s=1){ #s=1:row, 2:col, d: division
 if(s==2) X=t(X); L=apply(X,1,function(X){FreqDistR(X,d)})
 mx=max(sapply(L, NR)); W=matrix(0,Len(L),mx); Cn=NULL
 for(i in 1:Len(L)){for(j in 1:NR(L[[i]])){
  Cn[j]=L[[i]][j,1]; W[i,j]=L[[i]][j,4]
 }}; W[is.na(W)]=0; rownames(W)=rownames(X); colnames(W)=Cn
 if(s==2) {W=t(W); W=JustRrownames(W)}; W=ifelse(W==0,'.',W); JustR(W)
} #度数分布得点: Frequency distribution score by rank

File=function(f=''){
 if(!Match('¥¥.txt',f)) f=Add(f,'.txt') #ファイル名に'.txt'を付加
 file.edit(f) #エディット
} #ファイル編集 (スクリプト画面)

FillBlankV=function(Nv, f='0', a='. '){
 Rv=NULL; Len(Nv); mx=max(nchar(Nv))
 for(i in 1:Len(Nv)){
  Rv[i]=Rep(f, mx-nchar(Nv[i])) & Nv[i] & a
 }; Rv
} # 数値の前に空白を埋める, f:埋める文字, a: 追加文字

Fillrow=function(df,A){
 Rn=RN(df); nc=NC(df); M=Matrix(0,max(A),nc)
```

```
 rownames(M)=A; colnames(M)=CN(df)
 for(i in A){
  i=as.character(i)
  if(i%in%Rn) M[i,]=df[i,] else {M[i,]=rep(0,nc)}
 }; M
} #Fill empty rows Fillrow(df,A=1:20)

FillUB=function(A){
 mx=max(nchar(A))
 for(i in 1:Len(A)){
  A[i]=A[i]&paste(rep('_',mx-nchar(A[i])),collapse='')
 }; A
} #Fill under bar after string with max number of characters

Filtering=function(D,str){
 A=unlist(strsplit(str,';')); B=NULL #分割；初期化
 for(i in 1:Len(A)){
  if(IsNum(Right(A[i],1))){ B[i]=A[i]
  }else if(FindRE(A[i],'!=')>0){B[i]=gsub("(.*)!=(.*)", "!grepl('¥¥2', ¥¥1)", A[i])
  }else{B[i]=gsub("(.*)=(.*)", "grepl('¥¥2', ¥¥1)", A[i])}
 }; str=paste(B,collapse=','); str='filter(D,'&str&')'
 eval(parse(text=str)) #実行
} #フィルタリング：D, 'A<=30;N=^B'
# D=DF(N=V("J,J,B"),A=c(25,30,22),G=V("M,F,M")); str='A<=30;N=^B'
# Filtering(D,str) # B, 22, M

FindDiff=function(D1, D2) {
 W=which(D1!=D2, arr.ind=T); d1=D1[W]; d2=D2[W]
 D=DF(W,d1,d2); rownames(D)=NULL; D
}#２つのデータフレームの中で異なるデータの位置とデータを求める
# D1 <- DF(A = c(1, 2, 3), B = c("a", "b", "c")); D1
# D2 <- DF(A = c(1, 2, 4), B = c("a", "b", "c")); D2
# FindDiff(D1, D2)

FindIndex=function(A,rex,ic=F) which(grepl(rex,A,ic,perl=T))
# 正規表現 rex を含む要素のインデックスを取得
#A=c("apple", "banana", "kiwi"); FindIndex(A,'a')

FindRE=function(str, re){unlist(gregexpr(pattern =re,str))[1]} #str の中の re の最初の位置
```

```
Fisher=function(M){stats::fisher.test(M)$p.value} # Fisher's Exact Test (p)

FM=function(x, d=NULL, s=F) {
 #Format. d:number of decimal places, s:Spanish
 if(any(class(x)=='character')|any(class(x)=='noquote')) return(x)
 D=x; if(is.null(d)) d=DECIMAL(RemoveNA(AsNum(D)))
 D=FMsp(D,d,s);
 D[Which(D==NA)] = '*'
 D
}
# FM=function(x, d=NULL, s=F) {
# #Format. d:number of decimal places, s:Spanish
# D=DF(x); R=D; if(is.null(d)) d=DECIMAL(RemoveNA(AsNum(D)))
# for(i in 1:NR(D)){for(j in 1:NC(D)){
#   v=D[i,j]; R[i,j]=ifelse(is.na(v), "*", FMsp(v,d,s))}}
# if(class(x)=='data.frame'|class(x)=='matrix') R=noquote(R)
# else if (Len(x)>1) R=noquote(as.vector(R))
# #else if (Len(x)>1) noquote(R)
# else R=noquote(R[1,1])
# R
# }
# FM=function(x, d=NULL, s=F) {
# #Format. d:number of decimal places, s:Spanish
# if(is.null(d)) d=DECIMAL(RemoveNA(AsNum(x)))
# if(any(class(x)=='data.frame')|any(class(x)=='matrix')) {
#   for(i in 1:NC(x)) x[,i]=FMsp(x[,i],d,s); return(x)
# } else return(FMsp(x,d,s))
# }

FMa=function(A,d=0,s=F) {
 R=A; for(i in 1:Len(A)) R[i]=FMsp(A[i],d,s); R
} #小数点以下 d 桁, 3 桁区切り文字=>文字型 データフレーム D
#A=VT('2, 3.5, 7.16'); FmA(A,1)

FMd=function(D, d=0, s=F) {
 for(i in 1:NC(D)) D[,i]=FMsp(D[,i],d,s); D
} #小数点以下 d 桁, 3 桁区切り文字=>文字型 データフレーム D
#D=DF(N=VT('a,b,c'), A=VT('2,3.5,7.36')); FMd(D,1)
```

```
FMsn=function(x,s=F) format(x,scientific=s) #scientific notation

FMsp=function(n,d=0,s=F) {
 # if(s) r=format(Rnd(as.numeric(n),d),nsmall=d,decimal.mark=',',big.mark='.')
 # else r=format(Rnd(as.numeric(n),d),nsmall=d,decimal.mark='.',big.mark=',')
 if(s) r=format(Rnd(n,d),nsmall=d,decimal.mark=',',big.mark='.')
 else r=format(Rnd(n,d),nsmall=d,decimal.mark='.',big.mark=',')
 noquote(r)
} #小数点以下 d 桁, 3 桁区切り文字=>文字型, s:Spanish

FN=function(str,C,s=F){
 S=Split(str); R=NULL
 for(i in 1:Len(S)){for(j in 1:Len(C)){
  re=Escape(S[i])
  if(str_detect(C[j],Add('^',re))){R=AddA(R,ifelse(s,j,C[j])); break}
 }}; R
}#語頭文字(列)=>フルネーム (s=T: 列番号)

Format0=function(X,d=3){
 X=as.matrix(X)
 if(d==3) W=substring(sprintf("%4.3f", X), 2)
 if(d==4) W=substring(sprintf("%5.4f", X), 2)
 M=matrix(W,NR=NR(X)); colnames(M)=CN(X); M
} # 書式 0.1234 => .123

FrecNorm=function(df,Rf,m=10000){
 #col: 参照列, Ar: 連想配列, m:乗数
 Ar=Vector.asociativo(Rf) #連想配列 Vector asociativo
 Fn=1:NR(df); col=colnames(Rf)[1]
 for(i in 1:NR(df)){
  ch=as.character(df[i,col]); Fn[i]=df[i,'frec']/Ar[ch]*m
 }; cbind(df,frec.n.=Rnd(Fn,1))
}#正規頻度追加

FrecProb=function(df,Rf,m=10000){
 #col: 参照列, Ar: 連想配列, m:乗数
 Ar=Vector.asociativo(Rf) #連想配列 Vector asociativo
 Fn=1:NR(df); col=colnames(Rf)[1]
 for(i in 1:NR(df)){
  #ch=as.character(df[i,col]); Fn[i]=BinE(df[i,'frec'],Ar[ch])*m
```

```
   #ch=as.character(df[i,col]); Fn[i]=Format(BinE(df[i,'frec'],Ar[ch])*m, 1)
   ch=as.character(df[i,col]); Fn[i]=FM(BinE(df[i,'frec'],Ar[ch])*m, 1)
  }
  #cbind(df,frec.n.=Rnd(Fn,1))
  cbind(df,frec.n.=Fn)
}#確率頻度追加

Frecuencia=function(df){
  Df=cbind(df,a=rep(1, NR(df))) #å• ˜ ä½• ãƒ ™ã, ¯ãƒ ˆ ãƒ «ã, ’ è¿½åŠ
  Fx=aggregate(x=Df['a'], by=list(Df[,1], Df[,2]), sum) # è¤‡ æ• °æ• ¡ä»¶ sum
  colnames(Fx)=c('Lema','Cg','Pers','Frec'); Fx
} #é »åº¦ Lema, Cg, Pers, Frec

Freq=function(df,col=1,frec=0, s=T){
  # col:文字列 ex.'Lema,Cg'; , frec: 'Np'数値列, ex.'a,b,cc', s: 数値列ソート
  D=df; if(frec==0) {D=cbind(df,frec=rep(1,NR(df))); frec='frec'} # Agregar vector de unidad
  #D[is.na(D)]=0; Ag=aggregate(x=D[frec], by=D[VT(col)], sum) # 複数条件 Condiciones múltiples
  D[is.na(D)]=0; Ag=aggregate(x=D[frec], by=D[VT(col)], sum) # 複数条件 Condiciones múltiples
  if(s) {
   #SortS(Ag,frec&':T:xx'&(','&VT(col)&':F:xx'))
   SortC(Ag,NC(Ag),T)
  }
  rownames(Ag)=1:NR(Ag); Ag # 数値列でソート
} #頻度 (複数条件) Frecuencia con condiciones múltiples

FreqB=function(D){
  Cn=colnames(D); E=D[,NC(D)]; D=D[,-NC(D)]; R=NULL
  D=apply(D,1,paste,collapse=":#")
  for(i in 1:Len(D)){
   n=D[i]; f=E[i]; if(is.null(R[n])||is.na(R[n])) R[n]=f else R[n]=R[n]+f
  }
  R=sort(R,T); D=DF(names(R),R)
  D=DF(strsplit(D[,1],":#")); D=t(D)
  D=cbind(D,R); rownames(D)=1:NR(D)
  colnames(D)=Cn; D=DF(D)
  D[,NC(D)]=as.numeric(D[,NC(D)]); D
} # 頻度(全カラム連合)＋頻度カラム
```

```
FreqC=function(D){
 Cn=colnames(D); D=DF(D)
 D=DF(table(apply(D,1,paste,collapse=":#")))
 Fr=D[,2]; D=as.character(D[,1])
 D=DF(strsplit(D, ":#"))
 D=t(D); rownames(D)=1:NR(D); D=cbind(D,Fr);
 colnames(D)=c(Cn,'F'); D=DF(D)
 D[,NC(D)]=as.numeric(D[,NC(D)]); D
} #頻度(全カラム連合)

FreqDist=function(A){
 Uq=unique(A); Fq=sapply(Uq, function(x) sum(A==x)); DF(Data=Uq, Freq=Fq)
} # Frequency-distribution (A: array)

FreqDistBreak=function(A,brk=30){
 Hs=hist(A,breaks=brk,plot=F) #hist: freq. distribution
 DF(mids=Hs$mids,counts=Hs$counts) #data frame(mids,counts)
} #度数分布  Frequency distribution by breaks (A:array, brk: breaks)

FreqDistInt=function(A,it=10,s=0){
 A=unlist(A)
 f=ifelse(s==0,floor,Rnd); Id=f(A/it)+1; mx=max(Id); Ct=Sm=rep(0,mx)
 for(i in 1:Len(Id)) {id=Id[i]; Ct[id]=Ct[id]+1; Sm[id]=Sm[id]+A[i]}
 st=ifelse(s==0,'','-'); DF(value=st&0:(mx-1)*it&'-', count=Ct, sum=Sm)
} #度数分布  Frequency distribution by interval (A:array, it: interval,s=0:floor, 1:Rnd)

FreqDistInt=function(A,st=0,it=10){
 dg=nchar(sub('.*¥¥.','',as.character(it)))
 Br=Rnd(seq(from=st,to=max(A),by=it),dg)
 Ft=table(cut(A,breaks=Br,include.lowest=T,right=F))
 names(Ft)=Br[-Len(Br)]; D=DF(names(Ft),Ft)
 D[,1]=as.numeric(D[,1]); D[,-2]
} #度数分布  Frequency distribution by interval (A:array,st:start,it:interval)

FreqDistMean=function(D,v=0,f=1) {
 if(v==0){R=as.numeric(rownames(D)); m=sum(R*D[,f])/sum(D[,f])
 } else {m=sum(D[,v]*D[,f])/sum(D[,f])}; m
} # Frequency dist. mean
# Mean-in-frequency-distribution (v:value, f:frequency)
```

```
FreqDistMid=function(A,it=0.5,brk=NULL){
 if(is.null(brk)) brk=seq(min(A)-it,max(A)+it,by=it)
 Hs=hist(A,breaks=brk,plot=F)#度数分布
 DF(mids=Hs$mids,counts=Hs$counts)
} #度数分布  Frequency distribution by mid (A:array, it: interval)

FreqDistNum=function(D,f=2) sum(D[,f])
# Number-of-data-in-frequency-distribution (f:frequency)

FreqDistR=function(A,d=3){ #A: array, d: number of division
 A=unlist(A); A=sort(A); dv=Rnd(Len(A)/d); Fr=To=Ct=Sm=Vf=Vt=NULL
 for(i in 1:d){
  Fr[i]=(i-1)*dv+1; To[i]=ifelse(i<d,i*dv,Len(A))
  Ct[i]=Len(A[Fr[i]:To[i]]); Sm[i]=sum(A[Fr[i]:To[i]])
  Vf[i]=A[Fr[i]]; Vt[i]=A[To[i]]
 }; DF(rank=Fr&'-'&To, value=Vf&'-'&Vt, count=Ct, sum=Sm)
} #Frequency distribution by rank

FreqDistV=function(A,B,prob=F){ #A: array, B: vector of breaks
 Tb=table(cut(A,c(B,Inf),NULL,T,F))
 R=DF(Tb); colnames(R)=c('b','f'); R[,1]=B
 if(prob) {R[,2]=R[,2]/Len(A); colnames=c('b','prob')}
 R
} #Frequency distribution by vector of breaks
# A=c(12,23,35,45,17,29,38,51,26,15,30,41,19,42); B=c(10,20,30,40,50)
# FreqDistV(A,B) #A: data vector, B: breaks
# FreqDistV(A,B,T) #prob: probability=True

FreqDistVar=function(D,f=1) var(FreqDistVec(D[,f]))

FreqDistVarp=function(D,f=1) varp(FreqDistVec(D[,f]))
# Variance-in-frequency distribution (v:value, f:frequency)

FreqDistVec=function(A){
 n=Len(A); Y=NULL; for(i in 1:n) Y=c(Y,rep(i,A[i])); Y
} #Frequency Distribution to plain vector: 1,1,1,1,2,2,2,2,3,3

FreqE=function(X,col){
 if(all(is.numeric(col))) Cn=colnames(X)[col] else Cn=col
```

```
  X=as.matrix(X[,col]); X=apply(X,1,paste,collapse='::') #Bind row with ::
  X=sapply(split(X,X),length) #Freq of each element
  M1=matrix(Split(names(X),'::'),Len(X),byrow=T) # Matrix
  X=DF(M1,X); rownames(X)=1:NR(X); colnames(X)=c(Cn,'F'); X #Data frame
} #頻度

Ftest=function(A,B,side='g',cl=.95,r=5){
  v1=var(A);v2=var(B); f=v1/v2; a=1-cl; df1=Len(A)-1;df2=Len(B)-1
  if(side=='l') {p=pf(f,df1,df2,lower.tail=T);ci=c(0,f*qf(1-a,df1,df2))} #'l'
  if(side=='g') {p=pf(f,df1,df2,lower.tail=F);ci=c(f*qf(a,df1,df2), Inf)} #'g'
  if(side=='t') {p=2*min(pf(f,df1,df2),1-pf(f,df1,df2));
  ci=c(f*qf(a/2,df1,df2),f*qf(1-a/2,df1,df2))} #'t'
  inside=ifelse(f>=ci[1]&f<=ci[2],1,0)
  R=Rnd(c(v1,v2,f,df1,df2,df1+1,df2+1,1-p,p,ci[1],ci[2],inside),r)
  names(R)=c('v1:var-1','v2:var-2','f:v1/v2','df1','df2','n1','n2',
          'security','p-value','lower-bound','upper-bound','inside:1'); R
}# F-test (ratio of variances)
# A=c(23, 28, 32, 25, 30); B=c(21, 26, 29, 24, 27); cl=.95; side='l'; r=4
# Ftest(A,B,side,cl,r); var.test(A,B,1,side)

Functions=function(D) D[sapply(D,function(obj)is.function(get(obj)))]
#list of custum functions: Functions(ls())

#### G ####

gA=function(G,a){
  # G+theme(axis.text.x=element_text(angle=a,vjust=.9,hjust=ifelse(a>0,1,.5)))
  # G+theme(axis.text.x=element_text(angle=a,vjust=.4,hjust=ifelse(a>0,1,.5)))
  G+theme(axis.text.x=element_text(angle=a,vjust=.4,hjust=ifelse(a>0,0,.5)))
} #横軸(x)名角度

gAdd=function(x,y,c='red',s=15) {
  annotate("point",x,y,color=c,size=s,shape=21,alpha=.7)}
#Add circle x,y:coordinate,c:color,s:size

gAddSegment=function(G,D){
  E=D; for(i in 1:NC(D)){for(j in (NR(D)-1):1){E[j,i]=D[j,i]+E[j+1,i]}}
  for(i in 1:(NC(D)-1)){for(j in 1:NR(D)){
    G=G+geom_segment(x=i+.4,xend=i+.6,
y=E[j,i],yend=E[j,i+1],linewidth=.5,color='black')
```

```
 }}; G
} #Add segment line between bars

gAddText=function(G,D){
 E=D
 for(i in 1:NC(D)){for(j in (NR(D)-1):1){E[j,i]=D[j,i]+E[j+1,i]}}
 for(i in 1:NC(D)){for(j in (1:NR(D))){
  if(j==NR(D)) E[j,i]=E[j,i]/2
  else     E[j,i]=(E[j,i]-E[j+1,i])/2+E[j+1,i]
 }}
 for(i in 1:NC(D)){for(j in 1:NR(D)){
  G=G+geom_text(x=i, y=E[j,i], label=rownames(D)[j],color='black')
 }}; G
} #Add text in bar-stack
#gB()=element_blank #theme のエレメントなし

gArea=function(d=D,x=0,y=0,n=0,p='s',lm='',lx='',ly='',lg='',X='',Y='',a=0,f=12,c=1,l=F,
z=T,k=F,v=F,t=F){
 #(d:データ,x,y,n:軸,p:配置([d]odge,[s]tack,[f]ill),lx,ly,lg:ラベル,X,Y:並べ替え
 #a:ラベル角度,f:フォントサイズ,c:パレット番号,e:Y 軸拡張,l:対数軸,z:軸ゼロ開
始,k:数値,v:縦図,t:転置
 if(x!=0 && X=='') {X=paste(d[,x],',',sep='',collapse=''); X=gsub(',$','',X)} #X 軸表示順
 if(y!=0 && Y=='') {Y=paste(d[,y],',',sep='',collapse=''); Y=gsub(',$','',Y)} #X 軸表示順
 R=gDf(d,x,y,n,v,X,Y,t); d=R[[1]]; x=R[[2]]; y=R[[3]]; n=R[[4]]; X=R[[5]]; Y=R[[6]] #
データフレーム+ファクター
 p=Fn(p,c('dodge','stack','fill')) #p:ポジション
 G=ggplot(d,aes(x=v1,y=n))+geom_area(aes(group=v2,fill=v2),position=p)
 if(k&p=='stack')
G=G+geom_text(aes(label=n),position=position_stack(vjust=0.5),size=f/5)#数値表示
 if(k&p=='fill')
G=G+geom_text(aes(label=n),position=position_fill(vjust=0.5),size=f/5)#数値表示
 if(p=='fill') G=G+scale_y_continuous(labels=scales::percent)
 else G=G+scale_y_continuous(labels=comma) #y 軸コンマ

G=gPF(G,c,v,nc);G=gLg(G,l);G=gZ(G,z);G=gV(G,v);G=gA(G,a);G=gF(G,f);G=gL(G,lm
,lx,ly,lg);G
 #P:パレット; L:対数軸; Z:ゼロ開始軸; V:縦図; A:横軸名角度; F:フォントサイズ;
L:軸ラベル; G:出力
} #面グラフ
```

```
gB=function() element_blank() #theme のエレメントなし

gBar=function(A=D,x=0,y=0,n=0,p='d',lm='',lx='',ly='',lg='',X='',Y='',a=0,b=5,f=12,c=1,
e=5,

w=.9,cn=F,d=0,sp=T,l=F,z=F,k=F,ln=F,v=F,t=F,sl=T,xn=F,yp=F,pc=F,pm=c(5,5,5,5)){
 #(A:データ,x,y,n:軸,p:配置([A]odge,[s]tack,[f]ill),lx,ly,lg:ラベル,X,Y:並べ替え
 #a:ラベル角度,b:breaks 数 f:フォントサイズ,c:パレット番号(0,13:白黒, 99:パタン),e:右余白,w:棒の幅[.1-.9],cn=T:結合線,d:出力小数点,sp:スペイン式,
 #l:対数軸,z:軸ゼロ開始,k:数値,v:縦図,t:転置,sl:凡例出力,xn:X 軸番号,yp:Y 軸(v=F.右, v=F.上),pc:パーセント表示,pm:余白(上右下左)
 A=DF(A)
 x=y=n=0; nr=NR(A); nc=NC(A); gry='gray20'
 if(v) {A=ReverseDf(A,3)} # 縦図ならばデータを逆転
 if(p=='f') {A=round(A/rowSums(A)*100,1); p='s'} # フィル (パーセント)
 H=A; for(i in 1:nr){for(j in 1:nc){H[i,j]=sum(A[i,j:nc])}}# H: スタックの高さ行列
 if(xn) rownames(A) = FillBlankV(1:NR(A)) & rownames(A) # X 軸番号
 if(pc) {A=DF(A, P=Round(A[,1]/sum(A[,1]),1) & '%')} # パーセント表示
 R=gDf(A,x,y,n,v,X,Y,t); B=R[[1]]; x=R[[2]]; y=R[[3]]; n=R[[4]]; X=R[[5]]; Y=R[[6]]
#データフレーム+ファクター
 p=Fn(p,c('dodge','stack','fill')) #p:ポジション
 # if(v) G=ggplot(B,aes(x=reorder(v1,
dplyr::desc(v1)),y=n,group=v2,fill=v2))#+coord_flip()+guides(fill =
guide_legend(reverse = TRUE))
 # else G=ggplot(B,aes(x=v1,y=n,group=v2,fill=v2))
 G=ggplot(B,aes(x=v1,y=n,group=v2,fill=v2))
 if(c==99) { # パタンバー
  G=G+geom_bar_pattern(aes(pattern=v2), position=p,
stat='identity',fill='white',width=w,
           colour='black', pattern_alpha=.2, pattern_density=.2, pattern_spacing =
0.025,show.legend=sl)+
   scale_pattern_manual(values=c('circle', 'stripe', 'crosshatch', 'wave',
'weave'))+labs(pattern=Add(lg,'¥n'))
  if(v) G=G+coord_flip()+guides(pattern=guide_legend(reverse=T))
 } else{ # パタンバーでなければ
  G=G+geom_bar(stat='identity',position=p,width=w,show.legend=sl,alpha=.7)
  G=G+theme(legend.key.height=unit(6,'mm'),legend.key.width= unit(3,'mm')) #凡例キーサイズ
 }
 if(cn&p!='dodge'){# 結合線
```

```
  cf=F; if(IsStr(c)){cf=T; P=Split(c);if(v) P=rev(P[1:nc])} #色パレット
  cl='gray40'
  for(i in 1:(nr-1)){for(j in 1:nc){x1=i+w/2; x2=i+1-w/2; y1=H[i,j]; y2=H[i+1,j]
  if(cf) cl=P[j]
  G=G+geom_segment(x=x1, xend=x2, y=y1, yend=y2, color=cl) }}
 }; if(c==99) G=G+guides(fill = FALSE)
 # 数値表示
 if(p=='dodge'&k&v==F)
G=G+geom_text(aes(label=FM(n,d=d,sel=sp)),position=position_dodge(width=1),size=f
/4,vjust=0.4, hjust=-.2,color=gry, angle=90)#数値表示
 if(p=='dodge'&k&v==T)
G=G+geom_text(aes(label=FM(n,d=d,sel=sp)),position=position_dodge(width=1),size=f
/4,hjust=-.2, color=gry)#数値表示
 #        if(p=='fill')        G=G+scale_y_continuous(position=ifelse(yp,'right','left'),
labels=percent) #y 軸パーセント
 else
G=G+scale_y_continuous(position=ifelse(yp,'right','left'),labels=comma,breaks=pretty_
breaks(b),
                    expand=expansion(mult=c(0.05,e/100))) #y 軸コンマ, 余白(下・上)

G=G+theme(text=element_text(color="black"),axis.text.x=element_text(color=gry),axis.
text.y=element_text(color=gry))
 if(v==T) G=G+theme(axis.text.y=element_text(vjust=.4,hjust=0)) #Y 軸を左寄りに
 if(v==T) G=G+theme(legend.position = 'top') # 縦図ならば凡例をトップに
 if(c!=99) G=gV(G,v) # 縦図ならばフリップ
 G=G+theme(plot.margin = unit(pm, "mm")) # プロットマージン

G=gPF(G,c,v,nc);G=gLg(G,l);G=gZ(G,z);G=gA(G,a);G=gV(G,v);G=gF(G,f);G=gL(G,lm
,lx,ly,lg);if(p!='dodge') G=gKb(G,A,H,k,f,w,v,c,ln); G
 #P:パレット; L:対数軸; Z:ゼロ開始軸; V:縦図; A:横軸名角度; F:フォントサイズ;
L:軸ラベル; G:出力
} #棒グラフ

gBAR=function(D,cl=T,sh=F,lt=F,ln=F,v=F,f=11,lx=NULL,ly=NULL){
 #D:df,cl:color,sh:shape,lt:line-type,ln:letter+number,v=verical-x
 #f:font size,lx:label-x,ly:label-y
 if(v) {colnames(D)=FillUB(colnames(D));a=90; hj=0} else {a=0; hj=0}
 Lg=gCom1(D,ln) #共通要素-1
 Li=VT('solid,dashed,dotted,dotdash,longdash,twodash')
 if(cl) G=ggplot(Lg,aes(x, y, fill=g, color=g))
```

```
 else G=ggplot(Lg,aes(x, y, fill=g, color=NULL))
 G=G+geom_bar(stat="identity", position="dodge")
 if(ln) G=G+geom_text(aes(label=i),position=position_dodge(width=0.9),
                  vjust=-0.7,size=f/3.5,color='black',show.legend=F)
 if(sh) G=G+geom_bar_pattern( #no color, with pattern
  aes(pattern=g),stat="identity", position="dodge",fill='gray70',color='black',
  pattern_fill="black",pattern_density=0.1,pattern_spacing=0.05)
 if(!cl)
G=G+scale_fill_manual(values=ColorGradation('gray70','gray30',Len(unique(Lg[,'g']))))
 gCom2(G,f,a,hj,lx,ly) #共通要素-2
} #棒グラフ（分離）
# D=DF(x2=c(1,2,3),x1=c(5,4,2)); rownames(D)=VT('bxxxx,ax,c'); D
# gBAR(D,T,T,T,F) #1.cl=T;2.sh=T;3.lt=T;4.ln=T;5.v=T

gBarFacet=function(d=D,x=0,y=0,n=0,lm='',lx='',ly='',X='',Y='',a=0,e=F,f=12,c=1,l=F,z=c(0,0),k=T,v=F,t=F){
 if(x!=0 && X=='') {X=paste(d[,x],',',sep='',collapse=''); X=gsub(',$','',X)} #X 軸表示順
 if(y!=0 && Y=='') {Y=paste(d[,y],',',sep='',collapse=''); Y=gsub(',$','',Y)} #X 軸表示順
 R=gDf(d,x,y,n,v,X,Y,t,r=v);d=R[[1]];x=R[[2]];y=R[[3]];n=R[[4]];X=R[[5]];Y=R[[6]] #データフレーム+ファクター
 if(c==0){G=ggplot(d,aes(x=v2,y=n))+geom_bar(stat='identity',fill='grey50')
 }else {G=ggplot(d,aes(x=v2,y=n,fill=v2))+geom_bar(stat='identity',color='white')}
 # if(k) G=G+geom_text(aes(label=n),position=position_stack(vjust=0.4),size=f/5) #数値表示
 if(k)
G=G+geom_text(aes(label=format(n,decimal.mark='.')),position=position_stack(vjust=0.4),size=f/5) #数値表示
 G=G+facet_wrap(~v1,NC=1,strip.position='left') #ファセット=>左
 G=G+theme(strip.text.y.left=element_text(angle=ifelse(e,90,0))) #ファセット角度
 G=G+theme(legend.position='none')      #凡例なし
 G=G+scale_y_continuous(sec.axis=dup_axis())+gDel() #右に Y 軸コピー+目盛消去

G=gPF(G,c,v,nc);G=gLg(G,l);G=gE(G,z);G=gV(G,v);G=gA(G,a);G=gF(G,f);G=gL(G,lm,lx,ly,'');G
 #P:パレット; L:対数軸; Z:ゼロ開始軸; V:縦図; A:横軸名角度; F:フォントサイズ; L:軸ラベル; G:出力
} #棒グラフ(ファセット)
# (d:データ,x,y,n:軸,lm,lx,ly:ラベル,X,Y:並べ替え
# a:ラベル角度,e:縦ファセット,f:フォントサイズ,c:パレット番号,l:対数軸,z:e:y 軸
```

範囲,k:数値,v:縦図,t:転置

```
gBarLine=function(D,brk=NULL,lx=NULL,ly=NULL){
 G=ggplot(data=D, aes(x=D[,1]))
 #G=G+geom_bar(aes(y=D[,2],fill="bar"),color='black',stat="identity",width=1)
 G=G+geom_bar(aes(y=D[,2],fill="bar"),color='gray',stat="identity",
          position=position_dodge(width = 0))
 G=G+geom_line(aes(y=D[,3],color="line"))
 G=G+scale_fill_manual(values="lightblue",name=NULL,labels=colnames(D)[2])
 G=G+scale_color_manual(values="red",name=NULL,labels=colnames(D)[3])
 #if(brk>0) G=G+scale_x_continuous(breaks=brk)
 if(!is.null(brk)) G=G+scale_x_continuous(breaks=brk)
 G+labs(x=lx,y=ly)
}
# D=DF(x=0:3,y1=c(1,2,3,4),y2=c(2,3,2,5))
# gBarLine(D,'Binomial dist.','Normal dist.')

gBarLineMS=function(Df,lm='',lx='',ly='',lg='',a=0,f=12,d=4,sel=2,log=F,w=F){
 #title, angle, font, digit, sel=2(m,sd), w:gray/black
 Lb=rownames(Df); Av=format(round(Df[,1],d), nsmall=d); m=Df[,1]
 if(sel==2) {Sd=format(round(Df[,2],d), nsmall=d); sd=Df[,2]}
 if(!w) {c1='steelblue'; c2='red'} else {c1='gray60'; c2='black'}
 G=ggplot(Df,aes(x=Lb,y=Df[,1]))+
  geom_bar(aes(),stat= 'identity',color=c1,fill=c1,width=0.4,show.legend=F)+
  geom_line(aes(group=1),stat='identity',color=c2,linewidth=.5)+
  theme(axis.title.x=gB(),axis.title.y=gB())+
  theme(axis.text.x=element_text(angle=a))+
  theme(text=element_text(size=f))
 if(sel==1){G=G+scale_x_discrete(limit=Lb,labels=paste(Lb,'¥n',Av,sep=''))}
 if(sel==2){G=G+scale_x_discrete(limit=Lb)}
 if(sel==2){G=G+geom_errorbar(aes(ymax=m+sd,                    ymin=m-
sd),width=0.2,linewidth=.5)}
 if(log){G=G+scale_y_continuous(trans = 'log1p')}
 gL(G,lm,lx,ly,lg,f)
} #棒線誤差グラフ
#D=DF(Mean=c(2,5,3),SD=c(.5,.8,.3));                rownames(D)=VT('a,b,c');
gBarLineMS(D,sel=2,w=T)

gBarsLine=function(D,lx=NULL,ly=NULL,lg1='Bar:',lg2='Line:',y=0,w=F){
 D=DF(cat=rownames(D),D); nc=NC(D)
```

```
 Cn=colnames(D); ln=Cn[nc]
 if(nc==3) Color=hue_pal()(3)[3] else Color=scales::hue_pal()(nc-2)
 #Color=ifelse(nc==3, hue_pal()(3)[3], scales::hue_pal()(nc-2))
 if(w) Color='gray'
 C=NULL; C[1:(nc-2)]=Color[1:(nc-2)]; names(C)=Cn[2:(nc-1)]
 DL=pivot_longer(D,cols=colnames(D)[-1],names_to='var',values_to='Value')
 colnames(DL)[1]='x'
 DL$x=factor(DL$x,levels=unique(DL$x))
 DL$var=factor(DL$var,levels=unique(DL$var))
 G=ggplot(DL,aes(x=x,y=Value,fill=var,group=var))
 G=G+geom_bar(data=subset(DL,var%in%colnames(D)[c(-1,-nc)]),
          aes(fill=var),stat='identity',position='dodge',width=0.9)
 G=G+geom_line(data=subset(DL,var==colnames(D)[nc]),linewidth=.7,aes(color=ln))
 G=G+scale_color_manual(values='gray20')
 G=G+scale_fill_manual(values =C,breaks=names(C))
 if(lg1=='' & lg2=='') G=G+theme(legend.position = "none")
 G=G+labs(title=NULL,x=lx,y=ly,fill=lg1,color=lg2)
 if(y!=0) G=G+scale_y_continuous(limits=c(0, y), labels=scales::comma)
 else G=G+scale_y_continuous(labels=scales::comma)
 G+guides(
  fill=guide_legend(order=1), #legend of bar chart
  color=guide_legend(order=2)#legend of line chart
 )
} #Bars and LIne chart:
# D=DF(v1=c(10,15,8,12,6),v2=c(5,8,6,10,3),Normal.dist.=c(1,4,5,3,1))
# rownames(D)=c("A","B","C","D","E")
# gBarsLine(D)

gBARstack=function(D,cl=T,sh=F,lt=F,ln=F,v=F,f=11,lx=NULL,ly=NULL){
 #D:df,cl:color,sh:shape,lt:line,ln:letter+number,v=verical-x
 #f:font size,lx:label-x,ly:label-y
 if(v) {colnames(D)=FillUB(colnames(D));a=90; hj=0} else {a=0; hj=0}
 Lg=gCom1(D,ln) #共通要素-1
 if(cl) G=ggplot(Lg,aes(x, y, fill=g, color=g))
 else G=ggplot(Lg,aes(x, y, fill=g, color=NULL))
 G=G+geom_bar(stat="identity", position="stack", width=.6)
 if(ln) {rownames(D)=Initial(rownames(D)); G=gAddText(G,D)} #letter+number
 wd=ifelse(lt, .6, .8)
 if(sh){ #with pattern
  if(is.null(cl)){
```

```
    G=G+geom_bar_pattern( #no color

aes(pattern=g),stat="identity",position="stack",width=wd,fill='gray70',color='black',
      pattern_fill="black",pattern_density=0.1,pattern_spacing=0.05)}
   else{
    G=G+geom_bar_pattern( #color
      aes(pattern=g),stat="identity",position="stack",width=wd,
      pattern_fill="black",pattern_density=0.1,pattern_spacing=0.05)}
 }
 if(!cl) G=G+scale_fill_manual(
  values=ColorGradation('gray70','gray30',Len(unique(Lg[,'g']))))
 #'lightgray','darkgray'
 if(lt) G=gAddSegment(G,D)
 gCom2(G,f,a,hj,lx,ly) #共通要素-2
} #棒グラフ(積み上げ)
# D=DF(x2=c(1,2,3),x1=c(5,4,2)); rownames(D)=VT('bxxxx,ax,c'); D
# gBARstack(D,T,T,T,F) #1.cl=T;2.sh=T;3.lt=T;4.ln=T;5.v=T

gBarU=function(D,x=0,y=0,n=0,lm='',lx='',ly='',lg='',X='',Y='',a=0,
            b=5,f=12,c=1,e=5,w=.9,cn=F,d=0,m=0,sp=T,l=F,z=F,k=F,
            ln=F,v=F,t=F,sl=T,yp=F,nn=.2,na=90,hj=1,fm=F,sel=F){
 #(A:データ,x,y,n:軸,lx,ly,lg:ラベル,X,Y:並べ替え,a:ラベル角度,
 #b:breaks 数 f:フォントサイズ,c:パレット番号(0,13:白黒, 99:パタン)
 #e:右余白,w:棒の幅[.1-.9],cn=T:結合線,d:出力小数点,m:Y 軸最大値,
 #sp:スペイン式,l:対数軸,z:軸ゼロ開始,k:数値,v:縦図,t:転置,sl:凡例出力,
 #xn:X 軸番号,yp:Y 軸(v=F.右, v=F.上),pm:余白(上右下左), nn:数値軸の位置,
 #na:数値角度,hj=hjust,fm=T:Y 軸 3 桁書式,sel=T: 1 列を行名に
 D=DF(D)
 if(sel) D=Df2Rn(D)
 x=y=n=0; nr=NR(D); nc=NC(D); gry='gray15'; nd=max(max(D),m)*nn # nd:  数値の位置(nudge)
 point=format_format(big.mark = " ", decimal.mark=",", scientific=FALSE)
 if(v) {D=ReverseDf(D,3)} #  縦図ならばデータを逆転
 R=gDf(D,x,y,n,v,X,Y,t); E=R[[1]]; x=R[[2]]; y=R[[3]]; n=R[[4]]; X=R[[5]]; Y=R[[6]]
#データフレーム+ファクター

G=ggplot(E,aes(x=v1,y=n,fill='gray20'))+geom_bar(stat='identity',width=w,show.legend
=sl,fill='steelblue',alpha=.7)

G=G+theme(text=element_text(color=gry),axis.text.x=element_text(color=gry),axis.text
```

```
.y=element_text(color=gry))
 G=G+theme(axis.text.y=element_text(size = f/1.5))
 if(v==T) G=G+theme(axis.text.y=element_text(vjust=.4,hjust=0)) #Y 軸を左寄りに
 G=G+theme(plot.margin = unit(c(2,2,2,2), "mm")) # プロットマージン t, r, b, l
 if(fm) G=G+scale_y_continuous(labels=scales::comma_format(big.mark=" ",
decimal.mark=",", accuracy=1))
 G=gPF(G,c,v,nc);G=gZ(G,z);G=gA(G,a);G=gV(G,v);G=gF(G,f);G=gL(G,lm,lx,ly,lg)
 # if(k&na==0)
G=G+geom_text(aes(label=NumForm(n),y=nd,hjust=.5),size=f/4,color=gry, angle=na)#
数値表示
 # if(k&na!=0) G=G+geom_text(aes(label=NumForm(n),y=nd,hjust=1),
size=f/4,color=gry, angle=na)#数値表示

 if(k) G=G+geom_text(aes(label=NumForm(n,2),y=nd,hjust=hj),size=f/4,color=gry,
angle=na)#数値表示

 # if(k&v==F)
G=G+geom_text(aes(label=NumForm(n),y=nd,hjust=1),size=f/4,color=gry, angle=na)#
数値表示
 # if(k&v==T)
G=G+geom_text(aes(label=NumForm(n),y=nd,hjust=1),size=f/4,color=gry)#数値表示
 if(m>0) G=G+ylim(0, m) # Y 軸最大値
 G
 #G+ scale_y_continuous(labels = point)
 #P:パレット; L:対数軸; Z:ゼロ開始軸; V:縦図; D:横軸名角度; F:フォントサイズ;
L:軸ラベル
} #棒グラフ (単一ベクトルデータ: 1 列)
#D3=c(3,5,8,2,4); names(D3)=LETTERS[1:5]; gBarU(D3)

gBD=function(...){
 #Bind graph by column ex: gBC(E1,E2,E3); gBC(E1,E2,E3,c(1,1,1)) with width
 L=list(...); ln=Len(L); if(class(L[[ln]])[1]=='numeric') ln=ln-1
 if(ln==2) gBD2(...) else if(ln==3) gBD3(...) else if(ln==4) gBD4(...)
}

gBD2=function(G1,G2,W=c(1,1)){
 # Arrange 2 graphs. w:width ratio
 g=ggplotGrob; gridExtra::grid.arrange(g(G1),g(G2),widths=W)}

gBD3=function(G1,G2,G3,W=c(1,1,1)){
```

```
 # Arrange 3 graphs. w:width ratio
 g=ggplotGrob; gridExtra::grid.arrange(g(G1),g(G2),g(G3),widths=W)}

gBD4=function(G1,G2,G3,G4,W=c(1,1,1,1)){
 # Arrange 4 graphs. w:width ratio
 g=ggplotGrob; gridExtra::grid.arrange(g(G1),g(G2),g(G3),g(G4),widths=W)}

gBiplot=function(D1=V,D2=I,lm='',lx='',ly='',s=0,c='V=>blue',a=T,w=F,f=12){ #OK
 #gBiplot(D1=V,D2=I,lm='',lx='',ly='',s=0,c='',a=T,w=F,f=12,p=1)
 #D1:変数 2 列,D2:個体 2 列,lm,lx,ly:ラベル,s=[0]:変数+個体,s=1:変数,s=2:個体,
 #c:色指定(例:'V=>blue,I:i3=>red'),a:矢印,w:白黒,f:フォントサイズ,m:変数 V の乗数
 rownames(D1)=paste0('V:',rownames(D1)) #D1 に'V:'を付与
 rownames(D2)=paste0('I:',rownames(D2)) #D2 に'I:'を付与
 if(s==0) D=rbind(D1,D2); if(s==1) D=D1; if(s==2) D=D2
 colnames(D)=c('XR','YR'); D=DF(D); Rn=rownames(D) #D1,D2 を行バインド
 if(w||c=='') {C=rep('black',NR(D))}else {C=gRepColor(Rn,c)} #色指定
 Pn=gPointNum(Rn,w,c); L=ReplA(Rn,'^..=>') #ラベル(先頭 2 文字削除)
 G=ggplot(D,aes(XR,YR))+geom_point(color=C,shape=Pn,size=2) #2 列+点
 G=G+geom_vline(xintercept=0,lty=3); G=G+geom_hline(yintercept=0,lty=3) #基線
 if(a&s!=2) {for(i in 1:NR(D1)){ #変数の座標に矢印線
   G=G+geom_segment(x=0,xend=D1[i,1],y=0,yend=D1[i,2],
              arrow=arrow(length=unit(.2,'cm')),color=ifelse(w,'black',C[i]))}}
 G=G+geom_text_repel(aes(label=L),size=f/3.4,color=C,min.segment.length=0) #repel
 G=G+scale_y_continuous(position='right') #右 y 軸
 G=gL(G,lm,lx,ly,'',f); G #gL:ラベル; G:出力
} #バイプロット

gBox=function(D,s=F,j=T,w=F,lx='',ly=''){
 # X, s:mean+sd, j:jitter, w:black & white, lx:label-x,ly:label-y
 stats=function(x) {
  if(!s) {Q=quantile(x); lower=Q[2]; middle=Q[3]; upper=Q[4]}
  else {m=mean(x); sd=sdp(x); lower=m-sd; middle=m; upper=m+sd}
  W=c(min(x), lower, middle, upper, max(x))
  names(W)=c('ymin', 'lower', 'middle', 'upper', 'ymax'); W
 }; dat=stack(DF(D)) # Matrix=>dat
 if(w) G=ggplot(dat, aes(x=dat[,2], y=dat[,1]))
 else G=ggplot(dat, aes(x=dat[,2], y=dat[,1], fill=ind))
 G=G+stat_summary(fun.data=stats, geom='boxplot')
 if(j) G=G+geom_jitter(width=0,shape=1,size=2) #jitter
 #
```

```
G=G+stat_summary(fun=ifelse(s,median,mean),geom="point",shape=15,size=2.5,color=
ifelse(w,"black","red"))
  G=G+stat_summary(fun=ifelse(s,mean,median),geom="point",shape=15,
                size=1.5,color=ifelse(w,"black","red"))
  G=G+stat_summary(fun=max,geom="point",shape=16,size=2.5,color="black")
  G=G+stat_summary(fun=min,geom="point",shape=16,size=2.5,color="black")
  G=G+scale_x_discrete(limit=colnames(D))
  if(lx=='') G=G+theme(axis.title.x=gB()) else G=G+labs(x=Add('¥n',lx))
  if(ly=='') G=G+theme(axis.title.y=gB()) else G=G+labs(y=Add(ly,'¥n'))
  G=G+geom_errorbar(stat="summary",fun.data=function(x){
    return(DF(y=max(x),ymin=max(x),ymax=max(x)))
  },position=position_dodge(width=.5),width=.15)
  G=G+geom_errorbar(stat="summary",fun.data=function(x){
    return(DF(y=min(x),ymin=min(x),ymax=min(x)))
  },position=position_dodge(width=.5),width=.15)
  G+theme(legend.position='none')
} # Box chart with jitter, mean, max, min
# A=c(117.1,121.3,127.8,121.9,117.4,124.5,119.5,115.1)
# B=c(123.5,125.3,126.5,127.9,122.1,125.6,129.8,117.2); D=DF(A,B)
# gBox(D) # long horizontal line: median, red square: mean

gBoxList=function(D,s=F,j=T,w=F,lx='',ly=''){
  # X, s:mean+sd, j:jitter, w:black & white, lx:label-x,ly:label-y
  stats=function(x) {
    if(!s) {Q=quantile(x); lower=Q[2]; middle=Q[3]; upper=Q[4]}
    else {m=mean(x); sd=sdp(x); lower=m-sd; middle=m; upper=m+sd}
    W=c(min(x), lower, middle, upper, max(x))
    names(W)=c('ymin', 'lower', 'middle', 'upper', 'ymax'); W
  };
  #dat=stack(DF(D)) # Matrix=>dat
  dat=List2Df(D); colnames(dat)=VT('values,ind') # List=>dat
  dat$ind=factor(dat$ind,levels=unique(dat$ind))
  if(w) G=ggplot(dat, aes(x=dat[,2], y=dat[,1]))
  else G=ggplot(dat, aes(x=dat[,2], y=dat[,1], fill=ind))
  G=G+stat_summary(fun.data=stats, geom='boxplot', width=.5)
  if(j) G=G+geom_jitter(width=0,shape=1,size=2) #jitter
  G=G+stat_summary(fun=ifelse(s,mean,median),geom="point",shape=15,
                size=1.5,color=ifelse(w,"black","red"))
  # G=G+stat_summary(fun=max,geom="point",shape=16,size=2.5,color="black")
  # G=G+stat_summary(fun=min,geom="point",shape=16,size=2.5,color="black")
```

```
 G=G+scale_x_discrete(limit=colnames(D))
 if(lx=='') G=G+theme(axis.title.x=gB()) else G=G+labs(x=Add('¥n',lx))
 if(ly=='') G=G+theme(axis.title.y=gB()) else G=G+labs(y=Add(ly,'¥n'))
 # G=G+geom_errorbar(stat="summary",fun.data=function(x){
 # return(DF(y=max(x),ymin=max(x),ymax=max(x)))
 # },position=position_dodge(width=.5),width=.15)
 # G=G+geom_errorbar(stat="summary",fun.data=function(x){
 # return(DF(y=min(x),ymin=min(x),ymax=min(x)))
 # },position=position_dodge(width=.5),width=.15)
 G+theme(legend.position='none')+ylim(0, 10)
} # Box chart with jitter, mean, max, min
# A=c(117.1,121.3,127.8,121.9,117.4,124.5,119.5,115.1)
# B=c(123.5,125.3,126.5,127.9,122.1,125.6,129.8,117.2); D=DF(A,B)
# gBox(D) # long horizontal line: median, red square: mean

gBrk=function(A){Sc=scale_x_continuous; if(is.null(A)) Sc() else Sc(breaks=A)}
#Breaks

gBrkA=function() scale_x_continuous() #Breaks (automatic)

gC=function(G,w){
 G+scale_fill_gradient(low='white',high=ifelse(w,'grey50','firebrick1'))
} #fill 色 : 白~赤

gCHART=function(D,cl=T,sh=F,lt=F,ln=F,v=F,f=11,lx=NULL,ly=NULL){
 if(cl) {c1='lavender';c2='royalblue'} else{c1='white';c2='gray60'}
 if(v) {a=90; hj=0;colnames(D)=FillUB(colnames(D))} else {a=0; hj=0.5}
 D=D[NR(D):1,]; rownames(D)=FillUB(rownames(D))
 Lg=gCom1(D,ln) #共通要素-1
 G=ggplot(Lg,aes(x,g))
 G=G+geom_tile(aes(fill=y),color='gray80',alpha=0.9,lwd=0.5) #タイル
 if(NR(D)<NC(D))
{G=G+geom_text(aes(label=y),hjust=1,vjust=.5,angle=90,position=position_nudge(y=0.
15))}
 else
{G=G+geom_text(aes(label=y),hjust=1,vjust=.5,angle=0,position=position_nudge(x=0.1
5))}
 G=G+scale_fill_gradient(low=c1,high=c2) #段階色
 G=G+theme(axis.text.y=element_text(hjust=0)) #Y 軸を左寄せ
 G=G+theme(legend.position='none') #:凡例表示
```

```
 G=G+theme(text=element_text(size=f)) # Font size
 G=G+theme(axis.text.x=element_text(angle=a,hjust=hj,vjust=.5)) # X-axis, a, hj
 G+labs(x=lx,y=ly) #Label-x, y
} #チャート ver.2022-1-6
#D=DF(x1=c(1,2,3),xxxx2=c(5,4,2)); rownames(D)=VT('aaaaa,b,c'); D;
gCHART(D,F,v=T)

gChart=function(D,s=0,lm=NULL,lx=NULL,ly=NULL,lg=NULL,X='',Y='',a=0,b=15,f=14,
          k=T,ir=F,ic=F,t=F,w=F,d=0,c=F,gx=0,gy=0,ar=F,ac=F,m=5,mn=0,mx=0,
          c1='lavender',c2='royalblue'){
 #(D=D,s=0,lm='',lx='',ly='',lg='',X='',Y='',a=0,b=15,f=12,k=T,t=F,w=F,
 #d=0,c=F,gx=0,gy=0,ar=F,ac=F)
 #[D]:数値行列,s:チャート選択=0/'h':ヒートチャート
 #s=1/'b':バブルチャート, s=2/'bf':バブルフィルチャート,s=3/'s':スクエアチャート:
s=4/'sf':スクエアフィルチャート:
 #lm,lx,ly,lg:ラベル,X,Y:並べ替え,a:X 軸ラベル角度,b:バブルサイズ,f:フォントサイズ,
 #k:数値表示,ir:行反転,ic:列反転,t:転置,w:白黒,d:対角化=0:なし,1:行,2:列,3:行列,c:
連続軸,gx.gy:グループ数(x 軸,y 軸),
 #ar:行軸間隔調整(d>0,c=T),ac:列軸間隔調整(d>0,c=T), m:左マージン,mn:最小値,mx:最大値,
 D=DF(D); if(mn==0) mn=min(D); if(mx==0) mx=max(D)
 D=D[NR(D):1, ] #行を反転
 if(d==0) c=F; if(a==T) a=90 #d:対角化; a:ラベル角度(x 軸)
 if(s=='h') s=0; if(s=='b') s=1; if(s=='bf') s=2; if(s=='s') s=3; if(s=='sf') s=4 #s:チャート選択
 #D=Corresp(D,d)$df; Cns=CN(D); Rns=RN(D); nc=min(NC(D),4); nr=min(NR(D),4) #
対応分析対角化

 Cct=Diagonal(D,d,T)
 D=Cct$df; Cns=CN(D); Rns=RN(D); nc=Min(NC(D),3); nr=Min(NR(D),3) #集中分析
対角化
 # Uc=Corresp(D,d)$df; Hc=hclust(dist(Uc)); Cc=dendextend::cutree(Hc,1:nc) #クラスター.col
 # Ur=Corresp(D,d)$df; Hr=hclust(dist(Ur)); Cr=dendextend::cutree(Hr,1:nr);
Cr=Cr[NR(Cr):1,] #クラスター.row
 Uc=Cct$col; Hc=hclust(dist(Uc)); Cc=dendextend::cutree(Hc,1:nc) #クラスター.col
 Ur=Cct$row; Hr=hclust(dist(Ur)); Cr=dendextend::cutree(Hr,1:nr); Cr=Cr[NR(Cr):1,] #
クラスター.row
```

```
 if(ir) D=D[NR(D):1,] #行を反転
 if(ic) D=D[,NC(D):1] #列を反転
 R=gDf(D,0,0,0,F,X,Y,t,r=T); D=R[[1]]; X=R[[5]]; Y=R[[6]] #データフレーム+ファクター
 cmn=min(Uc); cmx=max(Uc); cpd=(cmx-cmn)/20 #列：最小値；最大値；パディング
 rmn=min(Ur); rmx=max(Ur); rpd=(rmx-rmn)/20 #行：最小値；最大値；パディング
 # Pc=seq(cmn,cmx,length.out=Len(unique(Uc))) #準備:列
 # Pr=seq(rmn,rmx,length.out=Len(unique(Ur))) #準備:行
 Pc=seq(cmx,cmn,length.out=Len(unique(Uc))) #準備:列
 Pr=seq(rmx,rmn,length.out=Len(unique(Ur))) #準備:行
 Ur=rev(Ur); Pr=rev(Pr); Uc=rev(Uc); Pc=rev(Pc);
Sr=Sc=Wr1=Wr2=Wc1=Wc2=Qr=Qc=rep(0,NR(D))
 for(i in 1:NR(D)){
  rn=as.numeric(D[i,1]); cn=as.numeric(D[i,2]) #行番号；列番号
  Sr[i]=Ur[rn]; Sc[i]=Uc[cn] #行スコア；列スコア
  Qr[i]=Pr[rn]; Qc[i]=Pc[cn] #行位置；列位置
  Wr1[i]=IE(rn==Len(Ur),0,abs(Ur[rn]-Ur[rn+1])) #行左幅
  Wr2[i]=IE(rn==1,0,abs(Ur[rn]-Ur[rn-1]))    #行右幅
  Wc1[i]=IE(cn==1,0,abs(Uc[cn]-Uc[cn-1]))    #列左幅
  Wc2[i]=IE(cn==Len(Uc),0,abs(Uc[cn]-Uc[cn+1])) #列右幅
 }

D=transform(D,sr=Sr,sc=Sc,qr=Qr,qc=Qc,wr1=Wr1/2,wr2=Wr2/2,wc1=Wc1/2,wc2=Wc2/2) #列結合
 D[,4:11]=round(D[,4:11],3) #小数桁=3

 D[,1]=factor(D[,1],levels=unique(D[,1]))
 D[,2]=factor(D[,2],levels=unique(D[,2]))

 if(s==0) { #ヒートチャート
  if(!c) {#離散軸
   G=ggplot(D,aes(x=factor(v2,levels=unique(v2)),y=factor(v1,levels=unique(v1))))
   #G=ggplot(D,aes(v2,v1))
   G=G+geom_tile(aes(fill=n),color='gray80',alpha=0.9,lwd=0.5) # 離散軸 discrete axis=>タイル
   G=G+scale_fill_gradientn(colors = c(c1,c2),values = scales::rescale(c(mn, mx)), limits = c(mn, mx))

#G=G+scale_fill_gradient(name=Add(lg,'¥n'),low='white',high=ifelse(w,'grey50','firebri
```

```
ck1')) #段階色
    G=gK(G,k,n,0.5,f)+scale_y_discrete(limits=rev(levels(factor(D$v1))))
  }
  if(c){ #連続軸  continuous axis
   G=ggplot(D,aes(xmin=sc-wc1,xmax=sc+wc2,ymin=sr-wr1,ymax=sr+wr2)) #ヒートチャート
   G=G+geom_rect(aes(fill=n),color='grey80',lwd=.5) #ヒートチャート
   G=G+scale_fill_gradientn(colors = c(c1,c2),values=scales::rescale(c(mn, mx)),limits=c(mn, mx))

#G=G+scale_fill_gradient(name=Add(lg,'¥n'),low='white',high=ifelse(w,'grey50','firebrick1')) #段階色
   if(k) G=G+geom_text(aes(x=sc+(wc2-wc1)/2,y=sr+(wr2-wr1)/2,label=n),size=f/4,vjust=1,color='black') #数値
   G=G+geom_text(aes(x=sc,y=sr,label='*'),size=f/3,vjust=.5,color='black') #ポイント(*)
  }
 }
 if(s>0) { #バブルチャート (s=1:丸, s=2:四角)
  if(!c) G=ggplot(D,aes(x=v2,y=v1,size=n)) #離散軸  discrete axis
  # if(c) G=ggplot(D,aes(x=sc,y=sr,size=n)) #連続軸  continuous axis
  if(c) G=ggplot(D,aes(x=qc,y=qr,size=n)) #連続軸  continuous axis

G=G+geom_point(alpha=.3,shape=c(1,16,0,15)[s],color=ifelse(w,'grey50','firebrick1')) #バブルの透明度,色 21 丸 22■
  G=G+scale_size(range=c(1,b),name=Add(lg,'¥n')) #バブルサイズ・名
  G=gK(G,k,n,0.5,f) #数値表示
 }
 if(!c) { #離散軸
  G=G+scale_x_discrete(position='top') #上 x 軸
  G=G+theme(axis.text.x=element_text(hjust=0,color='black')) #X 軸を左寄せ
  G=G+theme(axis.text.y=element_text(hjust=0,color='black')) #Y 軸を左寄せ
 }else{ #連続軸
  G=G+scale_y_continuous(position='right', breaks=round(Ur,2), sec.axis=dup_axis(name='', labels=rev(Rns)))
  G=G+scale_x_continuous(position='bottom',breaks=round(Uc,2), sec.axis=dup_axis(name='', labels=Cns))
 }
 if(d>0&gx>1) { #分離線縦:x,col
  for(i in 2:gx){for(j in 1:(NR(Cc)-1)){
```

```
    if(Cc[j,i]!=Cc[j+1,i])
G=G+geom_vline(xintercept=IE(c,(Uc[j]+Uc[j+1])/2,j+.5),color='gray70',size=4-i)}}
 }
 if(d>0&gy>1) { #分離線横:y,row
  for(i in 2:gy){for(j in 1:(NR(Cr)-1)){
   if(Cr[j,i]!=Cr[j+1,i])
G=G+geom_hline(yintercept=IE(c,(Ur[j]+Ur[j+1])/2,j+.5),color='gray70',size=4-i)}}
 }
 G=G+theme(axis.text.y=element_text(hjust=0)) #Y 軸を左寄せ
 # if(lg=='') G=G+theme(legend.position='none') #:凡例表示
 # if(lx=='') G=G+theme(axis.title.x=gB()) #x 軸タイトルなし
 # if(ly=='') G=G+theme(axis.title.y=gB()) #x 軸タイトルなし
 G=gA(G,a); G=gF(G,f); G=gT(G,X,Y)
 #A:横軸名角度; F:フォントサイズ; L:軸ラベル; gT:軸タイトル; G:出力
 if(d>0&c&(ar|ac)){ #対角化 & 連続値 & 軸間隔調整
  coord_cartesian(xlim=c(cmn,cmx),ylim=c(rmn,rmx),clip='off') #プロットの範囲
  G=G+theme(panel.background=gB()) #背景なし
  G=G+geom_rect(aes(xmin=cmn-cpd,xmax=cmx+cpd,ymin=rmn-
rpd,ymax=rmx+rpd),fill=NA,color='grey',size=1) #四角
  #                G=G+geom_text                (D,mapping=aes(x=cmn-
cpd*m,y=IE(ar,qr,sr),label=v1),hjust=0,size=f/4)+   #左側
  #          geom_segment(D,mapping=aes(x=cmn-cpd*2,y=IE(ar,qr,sr),xend=cmn-
cpd,yend=sr),size=.1,color='grey')
  G=G+geom_text                                    (D,mapping=aes(x=cmn-
cpd*m,y=IE(ar,qr,sr),label=v1),hjust=0,size=f/4)+   #左側
   geom_segment(D,mapping=aes(x=cmn-cpd*2,y=IE(ar,qr,sr),xend=cmn-
cpd,yend=sr),size=.1,color='grey')
  G=G+geom_text                                (D,mapping=aes(x=cmx+cpd*2,
y=IE(ar,qr,sr),label=sr),hjust=0,size=f/4)+   #右側

geom_segment(D,mapping=aes(x=cmx+cpd*1.5,y=IE(ar,qr,sr),xend=cmx+cpd,yend=sr),
size=.1,color='grey')
  G=G+geom_text
(D,mapping=aes(x=IE(ac,qc,sc),y=rmx+rpd*3,label=v2),angle=a,hjust=0,size=f/4)+#  上
側
   geom_segment(D,mapping=aes(x=IE(ac,qc,sc),y=rmx+rpd*2,
xend=sc,yend=rmx+rpd ),size=.1,color='grey')
  G=G+geom_text                              (D,mapping=aes(x=IE(ac,qc,sc),y=rmn-
rpd*3,label=sc),angle=a,hjust=IE(a==90,1,0),size=f/4)+ #下側
   geom_segment(D,mapping=aes(x=IE(ac,qc,sc),y=rmn-rpd*2.5,   xend=sc,yend=rmn-
```

```
rpd),size=.1,color='grey')
  G=G+geom_segment(D,mapping=aes(x=cmn-
cpd,y=sr,xend=cmx+cpd,yend=sr),size=.1,color='grey',lty=3,alpha=.3)
  G=G+geom_segment(D,mapping=aes(x=sc,y=rmx+rpd,xend=sc,yend=rmn-
rpd),size=.1,color='grey',lty=3,alpha=.3)
  G=G+theme(axis.ticks=gB(),axis.text.x=gB(),axis.text.y=gB()) #デフォルト軸除去
 }
 G=G+xlab(lx)+ylab(ly)+ggtitle(lm)
 G=G+theme(plot.title.position = "plot"); G+uTM(w,f,a)
 #G #出力
} #チャート ver.2022-1-6
#D=DF(x1=c(1,2,3),x2=c(5,4,2),x3=c(3,8,9)); rownames(D)=VT('a,b,c'); D;
gChart(D,d=3,gx=2)

gChc=function(M=D,d=0,gx=2,gy=2,lm='',lx='',ly='',rx=0,ry=0,f=12,k=F,t=F,w=F){
 M=Corresp(M,d)$df; if(t) M=t(M); X=t(M); nc=min(NC(M),gx); nr=min(NR(M),gy) #
対応分析対角化; 転置
 Uc=CorrespCs(M); Ur=CorrespRs(M) #対応分析列/行スコア=>距離行列(dist)
 Hc=hclust(dist(Uc)); Dc=as.dendrogram(Hc); Cc=cutree(Hc,1:nc) #樹形図.col
 Hr=hclust(dist(Ur)); Dr=as.dendrogram(Hr); Cr=cutree(Hr,1:nr); Cr=Cr[NR(Cr):1,] #樹
形図.row
 if(w) Color=grey(seq(1,0.6,-0.01)) else Color=cm.colors(100) #色(w:白黒)
 G=lattice::levelplot( #Deepayan Sarkar
  X[,NC(X):1],aspect='fill',col.regions=Color,colorkey=F,
  scales=list(x=list(rot=rx,cex=f/15),y=list(rot=ry,cex=f/15),tck=c(1,0)),
  xlab=list(lx,cex=f/12),ylab=list(ly,cex=f/12),
  panel=function(...){panel.levelplot(...) #分離線
   if(d==0) {for (i in 2:nc){for (j in 1:(NR(Cc)-1)){
    if(Cc[j,i]!=Cc[j+1,i]) panel.abline(v=j+.5,lwd=6-i,col='gray')}}}
   if(d==0) {for (i in 2:nr){for (j in 1:(NR(Cr)-1)){
    if(Cr[j,i]!=Cr[j+1,i]) panel.abline(h=j+.5,lwd=6-i,col='gray')}}}})
 if(k) {M=M[NR(M):1,]; df=M2Dn(M) #df:data frame for layer (numeric)
 G=G+layer(data=df,panel.text(v2,v1,n,cex=.5))}; G #数値表示; 出力
} #対応分析ヒートチャート Correspondent heat chart (ueda. 2021/12/07)
#gChc(M=D,d=0,gx=2,gy=2,lm='',lx='',ly='',rx=0,ry=0,f=12,k=F,t=F,w=F){
#M:数値行列=D,d:対角化(0:なし,1:行,2:列,3:行列),gx,gy:グループ数(x,y),lx,ly:ラベ
ル(x,y),
#rx,ry;ラベル回転(x,y),f:フォントサイズ,k:数値表示,t:行列転置,w:白黒

gCI=function(f,t,e=.5,side='t',cl=.95,lt='Confidence interval',
```

```
          lx='Ratio',ly='Probability',lc='n',sz=6.5,A=NULL,a=0){
  r=f/t; if(side=='s') side='t'
  if(f<t/2) {q1=qbinom(0.001,t,r); q2=qbinom(0.999,t,e)}
  else    {q1=qbinom(0.001,t,e); q2=qbinom(0.999,t,r)}
  A=q1:q2; B=seq(0,1,0.1)
  # if(is.null(A)) {
  # if(f>=t/2) {p1=e; p2=f/t} else {p1=f/t; p2=e}
  # A=qbinom(0.001,t,p1):qbinom(0.999,t,p2)
  # }
  if(max(A)>t) A=min(A):t
  Bt=binom.test(f,t,e,side,cl); Ci=Bt$conf.int[1:2] #p-value; conf.int.
  if(side=='t') {lw=Ci[1]; up=Ci[2]} #lw:lower-b., up:upper-b.
  if(side=='g') {lw=Ci[1]; up=1} #lw:lower-b., up:upper-b.
  if(side=='l') {lw=0; up=Ci[2]} #lw:lower-b., up:upper-b.
  P1=dbinom(A,t,r); P2=dbinom(A,t,e)
  D=DF(x=rep(A/t,2),prob=c(P1,P2),
       Dist=rep(c('H1','H0'),each=Len(A)))
  m=max(D[,2])
  G=ggplot(D,aes(x=D[,1],y=D[,2],color=D[,3]))+geom_line(linewidth=1)
  if(lc=='n') lc='(E:exp.p., R:ratio, CI:conf.i., L:low.b., U:Up.b.)'
  G=G+scale_x_continuous(breaks=B,expand=c(.1,.1)) #espand X axis
  G=G+labs(title=lt,x=lx,y=ly,caption=lc)
  G=G+scale_color_manual(values=c('H0'='lightblue','H1'='pink')) #color of lines
  G=G+geom_hline(yintercept=0,linetype=1,color='gray40')
  G=G+geom_vline(xintercept=e,linetype=3,color='blue') #expected probability
  G=G+geom_vline(xintercept=r,linetype=3,color='red') #ratio
  if(lw>=min(A/t))   G=G+geom_vline(xintercept=lw,linetype=1,color='gray10')   #lower
bound
  if(up<=max(A/t))   G=G+geom_vline(xintercept=up,linetype=1,color='gray10')   #upper
bound
  if(f<t/2) {

G=G+geom_text(x=q2/t,y=.8*m,label='H.0',color='blue',fontface='bold',hjust=0,size=sz/
2)
    G=G+geom_segment(x=q2/t,xend=e,y=.8*m,yend=.8*m, color="gray10",linetype=3)

G=G+geom_text(x=q1/t,y=.8*m,label='H.1',color='red',fontface='bold',hjust=1,size=sz/2
)
    G=G+geom_segment(x=q1/t,xend=r,y=.8*m,yend=.8*m, color="gray10",linetype=3)
    G=G+geom_text(x=q2/t,y=.7*m,label='E:    '&FM(e,3),color='blue',hjust=0,size=sz/2)
```

```
#e.p.
   G=G+geom_segment(x=q2/t,xend=e,y=.7*m,yend=.7*m, color="gray10",linetype=3)
   G=G+geom_text(x=q1/t,y=.7*m,label='R:     '&FM(r,3),color='red',hjust=1,size=sz/2)
#ratio
   G=G+geom_segment(x=q1/t,xend=r,y=.7*m,yend=.7*m, color="gray10",linetype=3)
  }else{

G=G+geom_text(x=q1/t,y=.8*m,label='H.0',color='blue',fontface='bold',hjust=1,size=sz/
2)
   G=G+geom_segment(x=q1/t,xend=e,y=.8*m,yend=.8*m, color="gray10",linetype=3)

G=G+geom_text(x=q2/t,y=.8*m,label='H.1',color='red',fontface='bold',hjust=0,size=sz/2
)
   G=G+geom_segment(x=q2/t,xend=r,y=.8*m,yend=.8*m, color="gray10",linetype=3)
   G=G+geom_text(x=q1/t,y=.7*m,label='E:    '&FM(e,3),color='blue',hjust=1,size=sz/2)
#e.p.
   G=G+geom_segment(x=q1/t,xend=e,y=.7*m,yend=.7*m, color="gray10",linetype=3)
   G=G+geom_text(x=q2/t,y=.7*m,label='R:     '&FM(r,3),color='red',hjust=0,size=sz/2)
#ratio
   G=G+geom_segment(x=q2/t,xend=r,y=.7*m,yend=.7*m, color="gray10",linetype=3)
  }
  G=G+geom_text(x=(lw+up)/2,y=.4*m,label='                CI:                '&FM(up-
lw,3),color='gray10',size=sz/2) #C.I.
  G=G+geom_segment(x=lw,xend=up,y=.3*m,yend=.3*m,   color="gray10",alpha=.5)   #
C.I.line
  G=G+geom_text(x=q1/t,y=.2*m,label='L:
'&FM(lw,3),color='gray10',hjust=1,size=sz/2) #l.b
  if(side!='l')                G=G+geom_segment(x=q1/t,xend=lw,y=.2*m,yend=.2*m,
color="gray10",linetype=3)
  G=G+geom_text(x=q2/t,y=.2*m,label='U:
'&FM(up,3),color='gray10',hjust=0,size=sz/2) #u.b.
  if(side!='g')                G=G+geom_segment(x=q2/t,xend=up,y=.2*m,yend=.2*m,
color="gray10",linetype=3)
  G+theme(legend.position="none")+gLabelSize(sz)+
    theme(plot.caption=element_text(hjust=.5))
}# Confidence interval
#gCI(40,100)

gClip=function(plot=last_plot(),width=1000,height=600, pointsize = 40){
  win.graph(width = width, height = height, pointsize = pointsize)
```

```
 plot %>% print(); savePlot("clipboard", type = "wmf"); dev.off()
} # copy graph to clipboard
#ggplot(data = mtcars, aes(x = mpg))+geom_histogram(); gClip()

gCluster=function(M=D,md='e',mc='w',s=F,t=F,g=0,lm='',lx='',ly='',v=F,f=12,m=5,w=F)
{
 md=Fn(md,c('canberra','euclidean','maximum','manhattan','minkowski', 'correl')) #距離計測方法
 mc=Fn(mc,c('average','single','complete','ward.D2')) #クラスタリング方法
 f=f/12; M=EliminarNaN(M); if(t) M=t(M); if(s) M=SS(M,2) #転置; 正規化(列)
 if(md=='correl') {d=as.dendrogram(hclust(as.dist(1-abs(cor(M))),method=mc))} #相関係数
 else{d=as.dendrogram(hclust(dist(M,md),method=mc))} #距離係数
 if(v) Mg=c(2,4,2,m)else Mg=c(m,4,2,2) #下・右マージン
 labels_cex(d)=f; par(cex.axis=f*.8,cex.lab=f*1.2,mar=Mg) #cex, mar: bottom, left, top, and right
 if(g<2|w==T) {plot(d,ylab=ly,horiz=v) #樹形図(グループなし|白黒)
 }else {plot(color_branches(d,k=g),xlab='',ylab=ly,horiz=v)} #樹形図
 if(v) x=2 else x=m-1 #縦 X 軸のときはライン数(x)=2, そうでなければ m(マージン)-1
 title(xlab=lx,line=x,cex.lab=f*1.2) #X 軸ラベル
 if(g>1) rect.dendrogram(d,k=g,horiz=v,lty=5,border='gray') #分割直方体(灰色点線)
} #クラスター樹形図 (cluster dendrogram)border = 8, lty = 5, lwd = 2
#gClusterDd(M=D,md='e',mc='w',s=F,t=F,g=0,lm='',lx='',ly='',v=F,f=12,m=10,w=F)
#M:数値行列,s:正規化(列),t:転置,g:グループ数,lm,lx,ly:ラベル,v:X 軸縦,f:文字サイズ,m:マージン幅,w:白黒
#md:距離計測方法('[c]anberra','[e]uclidean','[max]imum','[man]hattan','[mi]nkowski')
#mc:クラスタリング方法('[a]verage','[s]ingle','[c]omplete','[w]ard.D2')

gClusterDd=function(M=D,md='e',mc='w',s=F,t=F,g=0,lm='',lx='',ly='',v=F,f=12,m=10,
w=F){
 md=Fn(md,c('canberra','euclidean','maximum','manhattan','minkowski')) #距離計測方法
 mc=Fn(mc,c('average','single','complete','ward.D2')) #クラスタリング方法
 f=f/12; if(t) M=t(M); if(s) M=SS(M,2) #転置; 正規化(列)
 d=as.dendrogram(hclust(dist(M,md),method=mc)) #データ
 if(v) Mg=c(4,5,0,m)else Mg=c(m,5,0,2) #下・右マージン
 labels_cex(d)=f; par(cex.axis=f*.8,cex.lab=f*1.2,mar=Mg) #cex, mar
 if(g<2|w==T) {plot(d,ylab=ly,horiz=v) #樹形図(グループなし|白黒)
 }else {plot(color_branches(d,k=g),xlab='',ylab=ly,horiz=v)} #樹形図
```

```
 if(v) x=2 else x=m-1 #縦 X 軸のときはライン数(x)=2, そうでなければ m(マージン)-1
 title(xlab=lx,line=x,cex.lab=f*1.2) #X 軸ラベル
 if(g>1) rect.dendrogram(d,k=g,horiz=v,lty=5,border='gray') #分割直方体(灰色点線)
} #クラスター樹形図 (cluster dendrogram)border = 8, lty = 5, lwd = 2
#gClusterDd(M=D,md='e',mc='w',s=F,t=F,g=0,lm='',lx='',ly='',v=F,f=12,m=10,w=F)
#M:数値行列,s:正規化(列),t:転置,g:グループ数,lm,lx,ly:ラベル,v:X 軸縦,f:文字サイズ,m:マージン幅,w:白黒
#md:距離計測方法('[c]anberra','[e]uclidean','[max]imum','[man]hattan','[mi]nkowski')
#mc:クラスタリング方法('[a]verage','[s]ingle','[c]omplete','[w]ard.D2')

gColorSet=function(Str,Ini,p='Set1'){
 ns=Len(Str); ni=max(3,Len(Ini)); R=rep('black',ns)
 P=brewer.pal(name=p,n=ni)
 for(i in 1:ns){for(j in 1:ni){
  if(str_detect(Str[i],Add('^',Ini[j]))){R[i]=P[j]}}}; R #語頭一致; 出力
} #色指定 Str:対象文字配列, Ini:先頭文字配列, p:パレット

gCom1=function(D,ln){
 Lg=D2Long(D) # df to long-form
 if(ln) Lg[,1]=Lg[,2]&': '&Lg[,1] #r: Letter+number+r
 Lg[,1]=factor(Lg[,1],levels=unique(Lg[,1])) #factorize-r
 Lg[,3]=factor(Lg[,3],levels=unique(Lg[,3])) #factorize-c
 Lg
} #共通要素-1

gCom2=function(G,f,a,hj,lx,ly){
 G=G+scale_y_continuous(labels=scales::comma) #Y-axis with comma
 G=G+theme(text=element_text(size=f)) # Font size
 G=G+theme(axis.text.x=element_text(angle=a,hjust=hj,vjust=.5)) # X-axis, a, hj
 G=G+theme(legend.key.width=unit(1,'cm')) #Legend: width=1ch
 G=G+theme(legend.position="bottom",legend.box="horizontal") #Legend: bottom
 G=G+theme(legend.title=gB()) #Legend: with no title
 G+labs(x=lx,y=ly) #Label-x, y
} #共通要素-2

gCorrel=function(df,d=4,sl=1.2,sc=1.2){
 library(psych); df=EliminarNaN(df) # 数値以外がある行を除去
 pairs.panels(df,lm=T,digits=d, cex.labels=sl, cex.cor=sc)
} # 相関グラフ
```

```
gCorrelation=function(Df,d=4,sl=1.5,sc=1.5){
 library(psych)
 psych::pairs.panels(Df,lm=T,digits=d, cex.labels=sl, cex.cor=sc)
}# 相関グラフ

gCorrespBp=function(M=D,lm='',lx='',ly='',s=0,c='VT=>blue',a=T,w=F,f=12,m=1){
 M=as.matrix(M)
 CA=corresp(M,min(NR(M),NC(M))); R=CA$cor #CA:対応分析(MASS); R:相関係数
 # V=DF(XR=CA$cscore[,1]*R[1],YR=CA$cscore[,2]*R[2])*m
 # I=DF(XR=CA$rscore[,1]*R[1],YR=CA$rscore[,2]*R[2])#行

 S=CorrespSc(M,1); V=DF(XR=S[,1]*R[1],YR=S[,2]*R[2])*m #列スコア
 S=CorrespSc(M,0); I=DF(XR=S[,1]*R[1],YR=S[,2]*R[2]) #行スコア

 R=CA$cor; E=R^2; P=E*100/sum(E) #R:相関係数,E:固有値,P:寄与率

 if(lx=='') lx=Add('¥nCorresp. Biplot: Dim.1 (',round(P[1],1),' %)') #1 軸ラベル(デフォルト)
 if(ly=='') ly=Add('Dim.2 (',round(P[2],1),' %)') #2 軸ラベル(デフォルト)
 gBiplot(V,I,lm,lx,ly,s,c,a,w,f) #バイプロット
}#対応分析バイプロット
#gCorrespBp(M=D,lm='',lx='',ly='',s=0,c='',a=T,w=F,f=12,m=1)
#M:数値行列,lm,lx,ly:ラベル,s=[0]:変数+個体/s=1:変数/s=2:個体,
#c:色指定(例:'V=>blue,..'),a:矢印,w:白黒,m:変数 V の乗数

gCpc=function(M=D,d=0,lm='',lx='',ly='',rx=0,ry=0,f=12,k=F,t=F,w=F){
 M=Corresp(M,d)$df; if(t) M=t(M); X=t(M); nc=min(NC(M),4); nr=min(NR(M),4) #対応分析対角化; 転置
 Uc=CorrespCs(M); Ur=CorrespRs(M) #対応分析列/行スコア=>距離行列(dist)
 Hc=hclust(dist(Uc)); Dc=as.dendrogram(Hc); Cc=cutree(Hc,1:nc) #樹形図.col
 Hr=hclust(dist(Ur)); Dr=as.dendrogram(Hr); Cr=cutree(Hr,1:nr); Cr=Cr[NR(Cr):1,] #樹形図.row
 if(w) Color=grey(seq(1,0.6,-0.01)) else Color=cm.colors(100) #色(w:白黒)
 G=lattice::levelplot( #Deepayan Sarkar
  X[,NC(X):1],aspect='fill',col.regions=Color,colorkey=F,
  scales=list(x=list(rot=rx,cex=f/15),y=list(rot=ry,cex=f/15)),
  xlab=list(lx,cex=f/12),ylab=list(ly,cex=f/12),
  panel=function(...){panel.levelplot(...) #分離線
   if(d==0) {for(j in 1:(NR(Cc)-1)){
```

```
      if(Cc[j,2]!=Cc[j+1,2]) panel.abline(v=j+.5,lty=3)}}
    if(d==0) {for(j in 1:(NR(Cr)-1)){
      if(Cr[j,2]!=Cr[j+1,2]) panel.abline(h=j+.5,lty=3)}}},
   legend=list(
    right=list(fun=dendrogramGrob(x=Dr,side='right',size=2)),
    top= list(fun=dendrogramGrob(x=Dc,side='top', size=2))))
 if(k) {M=M[NR(M):1,]; df=M2Dn(M) #df:data frame for layer (numeric)
 G=G+layer(data=df,panel.text(v2,v1,n,cex=.5))}; G #数値表示; 出力
} #対応パタンクラスター Correspondent pattern cluster (ueda, 2019)
#gCpc(M=D,d=0,lm='',lx='',ly='',rx=0,ry=0,f=12,k=F,t=F,w=F){
#M:数値行列=D,d:対角化(0:なし,1:行,2:列,3:行列),lm,lx,ly:ラベル(x,y),
#rx,ry;ラベル回転(x,y),f:フォントサイズ,k:数値表示,t:行列転置,w:白黒

gDel=function(){
 theme(plot.title=element_text(hjust=0.5),
      axis.text.y.left=gB(),
      axis.ticks.y.left=gB(),
      axis.title.y.right=gB())
} #ラベル目盛消去(左目盛消去/右タイトル消去)

gDf=function(d,x,y,n,v,X,Y,t,r=F,s=F){
 # if(!t) d=t(d)
 if(X!='') {X=VT(X); Fn(X,rownames(d))} else X=rownames(d)
 if(Y!='') {Y=VT(Y); Fn(X,colnames(d))} else Y=colnames(d)
 d=M2D(d)
 if(NC(d)==2) d=mutate(d,v1=factor(v1,levels=X)) #ファクター
 else     d=mutate(d,v1=factor(v1,levels=X),v2=factor(v2,levels=Y)) #ファクター
 return(list(d,x,y,n,X,Y))
} #データフレーム+ファクター

gE=function(G,e){if(all(e==c(0,0))) G else G+expand_limits(y=e)}#ゼロ開始軸

GetFunc=function(Func,upper=F){
 Body=as.character(body(Func))
 if(upper) Str=str_extract_all(Body,'[A-Z][A-Za-z0-9.]+¥¥(')
 else    Str=str_extract_all(Body,'[A-Za-z0-9.]+¥¥(')
 Str=sort(unique(unlist(Str))); noquote(gsub('¥¥(','',Str))
} #Get function names from a function: upper=T: initial upper case
#GetFunc(BinTest,T)
```

```
gF=function(G,f) G+theme(text=element_text(size=f)) #フォントサイズ

gGraphUS=function(F1=F1,m=0,f=12,la=90,a=90,na=90,b=90,ba=90,nn=3,nd=.5,wd=1,
w=570,h=400,fn='00',sel=T){
 #la: ラベル角度, na: 数値角度
 G1=gBarU(F1,v=F,sl=F,c=0,k=T,m=m,e=15,f=f,a=la,nn=nn,na=na,sel=sel) # 棒グラフ
 if(sel) F2=Df2Rn(F1) else F2=F1
 # F2[,1]=1-F2[,1]/max(F2[,1]) # 有標度 (GM)
 F2[,1]=Gm(F2[,1]) # 有標度 (GM)
 G2=gScale(F2,p='h',nd=nd, wd=1,f=f, a=b, na=ba) # スケール図
 # G2=gScale(F2,p='h',w=T, pt=.1, nd=nd, wd=1,fm='%s (%.3f)', f=f, a=a) # スケール
図
 G=gBC(G1, G2, wd=wd); G # 2 つのグラフを横に並べる
 gSave(p=G,f='DQ/Fig/f-'&fn&'.jpg',w=w,h=h,d=600) # Fig.5. Categoria
 C(c(NR(F1), sum(F1[,'frec'])),F,F) # Total: ** lemas, ** formas
}

gHeat=function(M=D,x=1,y=2,n=3,d=0,gx=0,gy=0,lm='',lx='',ly='',lg='',X='',Y='',a=0,f=
12,l=F,k=T,t=F,w=F){
 M=Corresp(M,d)$df; nc=min(NC(M),4); nr=min(NR(M),4) #対応分析対角化; 転置
 # Uc=CorrespCs(M); Ur=CorrespRs(M) #対応分析列/行スコア=>距離行列(dist)
 if(d>0&gx>1) {Uc=Corresp(M,d,2)$df; Hc=hclust(dist(Uc));
Cc=dendextend::cutree(Hc,1:nc)} #クラスター.col
 if(d>0&gy>1) {Ur=Corresp(M,d,1)$df; Hr=hclust(dist(Ur));
Cr=dendextend::cutree(Hr,1:nr); Cr=Cr[NR(Cr):1,]} #クラスター.row
 R=gDf(M,x,y,n,F,X,Y,t,r=T); M=R[[1]]; X=R[[5]]; Y=R[[6]] #データフレーム+ファ
クター
 G=ggplot(M,aes(v2,v1))
 G=G+geom_tile(aes(fill=n),color='gray80',alpha=0.9,lwd=0.5) #タイル
 G=G+theme_bw()+theme(panel.border=gB()) #パネル枠線消去
 G=G+scale_fill_gradient(low='white',high=ifelse(w,'grey50','firebrick1')) #段階色
 if(d>0&gx>1) {for(i in 2:gx){for(j in 1:(NR(Cc)-1)){ #分離線縦:x,col
  if(Cc[j,i]!=Cc[j+1,i]) G=G+geom_vline(xintercept=j+.5,color='gray70',size=5-i)}}}
 if(d>0&gy>1) {for(i in 2:gy){for(j in 1:(NR(Cr)-1)){ #分離線横:y,row
  if(Cr[j,i]!=Cr[j+1,i]) G=G+geom_hline(yintercept=j+.5,color='gray70',size=5-i)}}}
 G=G+scale_x_discrete(position='top') #上 x 軸
 G=G+theme(axis.text.x=element_text(hjust=0,color='black')) #X 軸を左寄せ
 G=G+theme(axis.text.y=element_text(hjust=0,color='black')) #Y 軸を左寄せ
 if(!l) G=G+theme(legend.position='none') #l:凡例表示
 G=gK(G,k,n,0.5,f); G=gA(G,a); G=gF(G,f); G=gL(G,lm,lx,ly,lg,f); G=gT(G,X,Y); G
```

```
 #gK:数値; gA:横軸名角度; gF:フォントサイズ; gL:軸ラベル; gT:軸タイトル; G:出力
} #ヒートチャート

gHeatDd=function(M=D,d=F,r=4,c=4,s=F,gr=2,gc=2,lm='',lx='',ly='',l=F,v=F,f=12,k=F,t=F,w=F,dn=0){
 #Oren Ben-Kiki: https://tanaylab.github.io/slanter/reference/sheatmap.html
 #                                                                                    gHeatDd(M=D,md='e',mc='w',d=F,r=4,c=4,s=F,gr=2,gc=2,lm='',lx='',ly='',l=F,v=F,f=12,k=F,t=F,w=F)
 #M:数値行列=D,md(*),mc(*),d:対角化,r:樹形図の高さ(行)(0:なし),c:樹形図の高さ(行)(0:なし)
 #s:正規化(列),gr:行グループ数=2,gc:列グループ数=2
 #lm,lx,ly:ラベル,l:凡例表示,v;縦 X 軸ラベル,f:フォントサイズ,k:数値表示,t:行列転置,w:白黒,dn:小数桁
 #md(*):  距  離  計  測  方  法 ('[c]anberra','[e]uclidean','[max]imum','[man]hattan','[mi]nkowski')
 #mc(*):クラスタリング方法('[a]verage','[s]ingle','[c]omplete','[w]ard.D2')
 if(t) M=t(M); if(s) M=SS(M,2) #転置; 正規化(列)
 if(w) Color=grey(seq(1,0.6,-0.01)) else Color=cm.colors(100) #タイル色(w:白黒)
 if(v) {dcn='draw_colnames_90'}else {dcn='draw_colnames_0'} #縦 X 軸ラベル
 if(gr==0) gr=1; if(gc==0) gc=1 #グループなし
 assignInNamespace(x='draw_colnames',value=dcn,ns=asNamespace('pheatmap')) # '
 clr=ifelse(r>0,T,F); clc=ifelse(c>0,T,F) #cluster_rows, cluster_cols #樹形図表示
 nf=paste0('%.',as.character(dn),'f') #number format
 # setHook('grid.newpage',function() #XY ラベル用
 #
pushViewport(viewport(x=1,y=1,width=0.9,height=0.9,name='vp',just=c('right','top'))))
 slanter::sheatmap(M,color=Color,display_numbers=k, #cf.pheatmap
                   order_rows=d,cluster_rows=clr,oclust_rows=F,cutree_rows=gr,
                   order_cols=d,cluster_cols=clc,oclust_cols=F,cutree_cols=gc,
                   fontsize_number=f*.8,fontsize_row=f,fontsize_col=f,
                   treeheight_row=r*10,treeheight_col=c*10,legend=l,number_format=nf)
 # setHook('grid.newpage', NULL, 'replace') #XY ラベル用
 grid.text(lx,gp=gpar(fontsize=f),y=ifelse(v,-.08,0)) #X 軸ラベル
 grid.text(ly,gp=gpar(fontsize=f),x=-.05,rot=90)   #Y 軸ラベル
} #クラスターヒートチャート (sheatmap)

gHist=function(df=D,x=1,g=0,p='d',lm='',lx='',ly='',lg='',c=1,b=10,f=12,l=F,z=F,k=F,v=F){
```

```
 df=DF(df); x=colnam(df,x); if(g==0) g=NULL; g=colnam(df,g) #列番号->列名
 if(lx=='') lx=x; if(ly=='') lx='N'; if(lg=='') lg=g
 p=ReplaceStr(p,c('d.*=>dodge','s.*=>stack','f.*=>fill')) #p:ポジション
 G=ggplot(df,aes_string(x,fill=g),alpha=1)

if(is.null(g)){G=G+geom_histogram(bins=b,color='white',fill=ifelse(c==0,'gray30','steel
blue'))
 }else {G=G+geom_histogram(bins=b,color='white',position=p)}
 if(k&v)        G=G+stat_bin(position=p,aes(label=..count..),geom='text',bins=b,hjust=-
0,size=3) #数値
 if(k&!v)
G=G+stat_bin(position=p,aes(label=..count..),geom='text',bins=b,vjust=0,size=3)
 if(z) G=G+expand_limits(x=0) #x 軸ゼロ開始
 if(p=='fill') G=G+scale_y_continuous(labels=percent) #y 軸パーセント
 else G=G+scale_y_continuous(labels=comma) #y 軸コンマ
 G=gPF(G,c,v,nc);G=gLg(G,l);G=gV(G,v);G=gF(G,f);G=gL(G,lm,lx,ly,lg);G
 #L:対数軸; V:縦図;; F:フォントサイズ; L:軸ラベル; G:出力
} #ヒストグラフ
#df,x:x 軸列,g:グループ列,p:[d]odge,[s]tack,[f]ill),lm,lx,ly:ラベル(x,y),
#c:パレット,b:棒数,z:0 を含む x 軸,f:フォントサイズ,l:対数軸,z:x 軸ゼロ開始,k:数
値出力,v:縦図

gHl=function(y,lt,cr,al=1)        geom_hline(yintercept=y,linetype=lt,color=cr,alpha=al)
#hline

Gini.r=function(A=D){n=Len(A); gini(A)*n/(n-1)
}#相対ジニ係数(A: データ配列)

Gini=function(A=D){
 s=sum(A); n=Len(A); A=sort(A) #s:和; n:個数; A:昇順ソート
 q=2*sum(cumsum(A)) - s; t=n*s; 1 - q/t #q: 累積和
} #ジニ係数(A: データ配列)

gInnerScale=function(xvals, yvals, xgeo=0, ygeo=0, ticks=10){
 #https://stackoverflow.com/questions/17753101/center-x-and-y-axis-with-ggplot2
 color="gray50"; size=.5; textsize=3
 xlimit=max(abs(xvals),abs(yvals)); ylimit=max(abs(yvals),abs(xvals))
 eps=max(xlimit,ylimit)/50
 xaxis=DF(x_ax=c(-xlimit, xlimit),y_ax=rep(ygeo,2))
 yaxis=DF(x_ax=rep(xgeo, 2),y_ax=c(-ylimit, ylimit))
```

```
 R=list(theme_void(),
       geom_line(aes(x=x_ax, y=y_ax), color=color, size=size, data=xaxis),
       geom_line(aes(x=x_ax, y=y_ax), color=color, size=size, data=yaxis),
       xlim(-xlimit-7*eps, xlimit+7*eps),ylim(-ylimit-7*eps, ylimit+7*eps))
 ticks_x=round(seq(-xlimit, xlimit, length.out=ticks),2)
 ticks_y=round(seq(-ylimit, ylimit, length.out=ticks),2)
 nlist=Len(R)
 for (k in 1:ticks){
  xtick=DF(xt=rep(ticks_x[k], 2), yt=c(xgeo+eps, xgeo-eps))
  ytick=DF(xt=c(ygeo+eps, ygeo-eps),yt=rep(ticks_y[k], 2))
  R[[nlist+4*k-3]]=geom_line(aes(x=xt, y=yt),data=xtick, size=size)
  R[[nlist+4*k-2]]=
   ggplot2::annotate("text", x=ticks_x[k], y=ygeo-2.5*eps, size=textsize,
             color=color, label=paste(ticks_x[k]))
  R[[nlist+4*k-1]]=geom_line(aes(x=xt, y=yt), data=ytick, size=size)
  R[[nlist+4*k-0]]=
   ggplot2::annotate("text", x=xgeo-2.5*eps,y=ticks_y[k],
             color=color, size=textsize,label=paste(ticks_y[k]))
 }; return(R)
} #グラフ内スケール

GK=function(D,w=T){
 #D=NA2zero(D); if(Any(D<0)) D=D+abs(Min(D))
 D=ExpComp(D); if(Any(D<0)) D=D+abs(Min(D))
 nr=NR(D); nc=NC(D); p=n=0 #p:positive; n:negative
 for(i in 1:(nr-1)) {for(j in 1:nc) {
  for(k in (i+1):nr) {for(h in 1:nc) {
   if(w) wt=(k-i)*abs(h-j) else wt=1 # weight
   if(h>j) p=p+D[i,j]*D[k,h]/wt
   if(h<j) n=n+D[i,j]*D[k,h]/wt
  }}}}; unname((p-n)/(p+n))
}# Goodman and Kruskal's rank measure of association, W=T:weighted [-1,1]

gK=function(G,k,n,vj,f){
 if(k) G+geom_text(aes(label=n),size=f/4,vjust=vj,color='black',alpha=.8) else G
}#数値表示

gKb=function(G,D,H,k,f,w,v,c=0,ln=F,stac=T){ if(!k) return(G)
 # ln:ライン, stac=T: スタック棒グラフ
 nr=NR(D);   nc=NC(D);   hmx=max(D);   ym=hmx/max(nc-1,1)*.8;   mg=hmx*.18;
```

```
ymn=hmx; al=1.0
 # xm: X 軸の移動距離単位; cl: 色; nr:行数; nc:列数; hmx:H の最大値; ym: Y 軸の移動距離単位; mg:マージン
 Cn=colnames(D); dmx=DecimalMax(D)# 数値ベクトルの最大小数桁数
 Xn=Yn=Nn=numeric(nr*nc); n=0 # 初期値=0
 for (i in 1:nr){for (j in 1:nc){ # データフレーム作成 (数値テーブル)
  n=n+1; Xn[n]=i+.25; Yn[n]=ym*(nc-j)+mg; Nn[n]=D[i,j]
 }}; K=DF(v1=Xn, v2=Yn, lb=Nn)
 G=G+geom_text(data=K,aes(v1,v2,label=FM(lb,dmx)), hjust=1, size=f/4, color='black', alpha=1)
 Xn=Yn=Nn=numeric(nc); n=0 # 初期値=0
 for (i in 1:nc){ # データフレーム作成 (列名)
  n=n+1; Xn[n]=nr+.7; Yn[n]=ym*(nc-i)+mg; Nn[n]=Cn[i]
 }; K=DF(v1=Xn, v2=Yn, lb=Nn)
 G=G+geom_text(data=K,aes(v1,v2,label=lb), hjust=1, size=f/4, color='black', alpha=1)
 if(v==F) G=G+geom_rect(aes(xmin=1-.4, xmax=nr+.4, ymin=hmx*.1, ymax=hmx*1.1), fill=NA, color='gray30') # テーブル枠 ***
 if(v==T) G=G+geom_rect(aes(xmin=1-.7, xmax=nr+.7, ymin=hmx*.05, ymax=hmx*.9), fill=NA, color='gray30') # テーブル枠
 G
} #数値表示 (棒/線グラフ)

GKv=function(D) vcdExtra::GKgamma(D)[[1]]
# Measures of Ordinal Association, Gamma [-1,1]

gL=function(G,lm='',lx='',ly='',lg='',f=12,c=1,sel=F){
 if(lm!='') G=G+labs(title=lm)
 if(lx!='') G=G+labs(x=Add(lx,'¥n'))
 if(ly!='') G=G+labs(y=Add(ly,'¥n'))
 if(lg!=''){
  if(sel&c==0){G=G+labs(linetype=Add(lg,'¥n')); G=G+labs(shape=Add(lg,'¥n'))}
  else G=G+labs(color=Add(lg,'¥n'))+labs(fill=Add(lg,'¥n'))
 } else G=G+theme(legend.position = "none") # 凡例を出さない
 G=G+theme(axis.title=IE(lm=='',gB(),element_text(size=f)))
 G=G+theme(axis.title.x=IE(lx=='',gB(),element_text(size=f)))
 G=G+theme(axis.title.y=IE(ly=='',gB(),element_text(size=f)))
 G
}#ラベル (fill)
# gLc=function(G,lm,lx,ly,lg=''){
# G+labs(title=lm,x=Add(lx,'¥n'),y=Add(ly,'¥n'),color=Add(lg,'¥n¥n'))
```

```
# }#ラベル (color)

gLabelSize=function(x=8){
 theme(plot.title=element_text(size=x+6),#title
       axis.title.x=element_text(size=x+4),#x-axis label
       axis.title.y=element_text(size=x+4),#y-axis label
       axis.text.x=element_text(size=x+2),#x-axis tick label
       axis.text.y=element_text(size=x+2),
       plot.caption=element_text(size=x+2)
 )#y-axis tick label
} #Label size

gLg=function(G,l,s=F){
 if(l) G=G+coord_trans(y='log1p'); if(s) G=G+coord_trans(x='log1p'); G
}#対数軸
# gLg=function(G,l){if(l){G+coord_trans(y='log1p')}else G
# }#対数軸

gLin=function(D,a=0){
 library(tidyverse); lx=colnames(D)[1]; colnames(D)[1]='x'
 for(i in 2:NC(D)){D[,i]=as.numeric(D[,i])}
 long_data=D %>% gather(key="G", value="V", -x)
 ggplot(long_data, aes(x=x,y=V,group=G,shape=G,linetype=G))+
  geom_line(linewidth=.5)+geom_point(size =2)+labs(x=NULL,y=NULL)+
  scale_shape_manual(values=1:10)+theme(legend.key.width=unit(1,'cm'))+
  scale_linetype_manual(values=VT('solid,dashed,dotted,dotdash,longdash,twodash'))+
  theme(text=element_text(size=14))+scale_y_continuous(labels=scales::comma)+
  theme(axis.text.x=element_text(angle=a,hjust=.4,vjust=.5))+
  guides(linetype=guide_legend(title=NULL),shape=guide_legend(title = NULL))
} #Line graph (a: x vertical)
#D=DF(x=VT('a,b,c,d'),y1=c(1, 2, 3, 4), y2=c(2, 3, 2, 5)); gLin(D,90)

gLINE=function(D,cl=T,sh=F,lt=F,ln=F,v=F,f=11,lx=NULL,ly=NULL){
 #D:df,cl:color,sh:shape,lt:line-type,ln:letter+number,v=verical-x
 #f:font size,lx:label-x,ly:label-y
 if(v) {colnames(D)=FillUB(colnames(D));a=90; hj=0} else {a=0; hj=0}
 Lg=gCom1(D,ln) #共通要素-1
 Li=VT('solid,dashed,dotted,dotdash,longdash,twodash')
 G=ggplot(Lg, aes(x,y,group=g))+geom_line()+geom_point()
 if(lt) G=G+geom_line(aes(linetype=g))
```

```
 if(sh) G=G+geom_point(aes(shape=g),size=2)
 if(cl) G=G+geom_line(aes(color=g))+geom_point(aes(color=g),size=2.5)
 if(ln) G=G+geom_text(aes(label=i), vjust=-0.7, show.legend=F) #Letter+number
 G=G+labs(x=lx,y=ly) #Label-x, y
 G=G+scale_shape_manual(values=1:NR(D)) #Shape
 G=G+scale_linetype_manual(values=rep(Li,9)) #Linetype
 gCom2(G,f,a,hj,lx,ly) #共通要素-2
} #折れ線グラフ＋記号
# D=DF(x2=c(1,2,3),x1=c(5,4,2)); rownames(D)=VT('bxxxx,ax,c'); D

gLine2=function(
   A=D,x=0,y=0,n=0,lm='',lx='',ly='',lg='',lt=0,la=0,X='',Y='', mn=0, mx=NA,al=1,

u=0,un=1.2,a=0,f=12,c=1,l=F,b=c(0,0),ex=c(.05,.05),ey=c(.2,.2),k=F,ln=F,v=F,t=F,sl=T
){
 #(A:データ,x,y,n:軸,lm,lx,ly,lg:ラベル,lt:レペル文字(1:文字,2:ラベル),
 #la:レペル角度,X,Y:並べ替え,mn:Y 軸最小値,mx:Y 軸最大値,
 #al:alpha(透明度),yr:Y 軸範囲 c(x,y),u:線結合ラベル(0:なし,1:左,2:右,3:左右),
 #un:線結合ラベルの線長,a:ラベル角度,f:フォントサイズ,c:パレット番号,l:対数軸,
 #b:y 軸範囲,ex: X 軸拡張, ey: Y 軸拡張, k:数値,ln:数値ライン,v:縦図,t:転置,sl:凡例
出力
 if(lt>0) k=F; if(NC(A)==1) sg=T else sg=F #  1 行データ
 if(t) {A=t(A)}
 if(v) {A=ReverseDf(A,3)} #  転置 ; 縦図  => 上下逆転

 R=gDf(A,x,y,n,v,X,Y,t,s=v);  W=R[[1]];  x=R[[2]];  y=R[[3]];  n=R[[4]];  X=R[[5]];
Y=R[[6]] #データフレーム+ファクター
 if(sg) W=DF(W,v2=rep('x',NR(W))) #  単列にダミー列 x を追加
 if(c==0&sg) G=ggplot(W,aes(x=v1,y=n,group=v2, label=n)) #  バーなし
 if(c==0&!sg) G=ggplot(W,aes(x=v1,y=n,group=v2, label=v2&': '&n)) #  バーなし
 if(c!=0&sg) G=ggplot(W,aes(x=v1,y=n,group=v2, label=n, color=v2))#  バーなし
 if(c!=0&!sg) G=ggplot(W,aes(x=v1,y=n,group=v2, label=v2&': '&n, color=v2))#  バー
なし
 if(lt>0){ #  レペル文字表記あり
   G=G+geom_point(size=1.5,
show.legend=sl)+geom_line(aes(linetype=v2),show.legend=F)
   if(lt==1)
G=G+geom_text_repel(size=f/4,nudge_x=ifelse(v,-.2,.2),angle=la,direction=ifelse(v,'x','
y'),hjust=.5,min.segment.length=0) #  レペル: 文字
   if(lt==2)
```

```
G=G+geom_text_repel(size=f/4,nudge_x=0,angle=la,segment.alpha=al,direction=ifelse(v,'x','y'),hjust=.5,min.segment.length=0) #  レペル: 文字
   if(lt==3)
G=G+geom_label_repel(size=f/4,nudge_x=ifelse(v,-.2,.2),angle=la,direction=ifelse(v,'x','y'),hjust=.5,min.segment.length=0) #  レペル: ラベル
   if(lt==4)
G=G+geom_label_repel(size=f/4,nudge_x=0,angle=la,direction=ifelse(v,'x','y'),hjust=.5,min.segment.length=0) #  レペル: ラベル
  } else{ #  レペル文字表記なし
   if(c==0)
G=G+geom_line(linetype=1,show.legend=sl,alpha=al)+geom_point(aes(shape=v2),size=1.5, show.legend=sl,alpha=al)#  白黒
   else     G=G+geom_line(linewidth=1,show.legend=sl,alpha=al)+geom_point(size=1.5, show.legend=sl,alpha=al)#  カラー
   #                                                                                  if(c==0)
G=G+geom_smooth(linetype=1,show.legend=sl,alpha=al)+geom_point(aes(shape=v2),size=2.5, show.legend=sl,alpha=al)#  白黒
   #                                                                                  else
G=G+geom_smooth(linewidth=1,show.legend=sl,alpha=al)+geom_point(size=1.5, show.legend=sl,alpha=al)#  カラー
  }
  if(u==ifelse(v,2,1)|u==3)
G=G+geom_label_repel(data=filter(W,v1==X[1]),aes(x=v1,y=n,label=v2,segment.linetype=1),#線左端ラベル
                                    nudge_x=-un,direction=ifelse(v,'x','y'),hjust=0.5,min.segment.length=0,show.legend=F)
  if(u==ifelse(v,1,2)|u==3)
G=G+geom_label_repel(data=filter(W,v1==X[Len(X)]),aes(x=v1,y=n,label=v2,segment.linetype=1),#線右端ラベル

nudge_x=un,direction=ifelse(v,'x','y'),hjust=0.5,min.segment.length=0,show.legend=F)
  G=G+scale_x_discrete(expand=expansion(mult=ex)) #X 軸拡張
  G=G+scale_y_continuous(labels=comma, limits=c(mn,mx)) #y 軸コンマ, 余白(下・上)
  #G=G+scale_y_continuous(labels=comma, limits=c(0,100), expand = expansion(mult = ey)) #y 軸コンマ, 余白(下・上)
  #G=G+scale_y_continuous(expand=expansion(mult=ey)) #y 軸コンマ, 余白(下・上)
  #if(!all(yr==c(0,0))) G=G+ylim(yr) #Y 軸範囲
  G=G+theme(text=element_text(color="black"),
axis.text.x=element_text(color="black")) #  軸の色
  if(v) G=G+theme(axis.text.y=element_text(vjust=.4,hjust=0), legend.position='top') #Y
```

```
軸を左寄りに
 if(v) G=G+theme(legend.position='top')
 if(v)
G=G+guides(shape=guide_legend(reverse=T))+guides(color=guide_legend(reverse=T))
# 縦図で，凡例を逆転
 G=gKb(G,A,A,k,f,w=.9,v,c,ln,stac=F) # 数値表示
 G=gPC(G,c,v,nc=NC(A),sel=T); G=gLg(G,l); G=gE(G,b); G=gV(G,v); G=gA(G,a);
G=gF(G,f); G=gL(G,lm,lx,ly,lg,f,c,sel=T)
 G #数値表示; パレット; L:対数軸; V:縦図; A:横軸名角度; F:フォントサイズ; L:軸
ラベル; G:出力
} #線グラフ

gLineMean=function(D,cl=T,ln=F,b=0,f=12,a=0,w=T,lm='',lx='',ly=''){
 #Line graph with mean (cl:color, ln:line, b: y.breaks by, a=90: vertical x, w:white)
 D=t(D); nc=NC(D); mn=Min(D); mx=Max(D); tm=Sum(D)/sum(!is.na(D)) # max; dotted
line
 D=DF(x=rownames(D),D,m=rep(tm,NR(D)),Media=RowMeans(D))
 Cn=colnames(D)[-1]; Sz=c(rep(1,nc+1),2) #breaks; size of lines
 library(tidyverse); lx=colnames(D)[1]; colnames(D)[1]='x'
 Pal=scales::hue_pal()(nc+2); Pal[nc+(1:2)]=c("black","gray70") #pallete
 Typ=c(rep('solid',nc),'dotted','solid')
 Lng=gather(D,key="var", value="V", -x) # long data
 if(cl) { # Color
  G=ggplot(Lng, aes(x=x,y=V,color=var,group=var,linetype=var))+
   geom_line(aes(linewidth=var),alpha=0.7)+geom_point(aes(color=var),size=2.5)+
   geom_point(data=subset(Lng,var=="Media"),color='black')+
   scale_linewidth_manual(values=Sz,breaks=Cn)+
   scale_color_manual(values=Pal,breaks=Cn)+
   scale_linetype_manual(values=Typ,breaks=Cn)+
   guides(color=guide_legend(title = NULL))
 } else { # Black and white
  G=ggplot(Lng, aes(x=x,y=V,group=var,shape=var,linetype=var))+
   geom_line(aes(linewidth=var))+geom_point(size =2)+
   scale_linewidth_manual(values=Sz/2,breaks=Cn)+
   scale_shape_manual(values=1:10,breaks=Cn)+
   scale_linetype_manual(values=Typ,breaks=Cn)
 }
 if(b==0) G=G+scale_y_continuous(labels=scales::comma,limits=c(mn,mx))
 else
G=G+scale_y_continuous(labels=scales::comma,limits=c(mn,mx),breaks=seq(mn,mx,b))
```

```
 if(ln)                                                    G=G+geom_segment(aes(x=-
Inf,xend=x,y=V,yend=V),linetype="dotted",color="gray30")
 G=G+geom_text_repel(aes(label=var),color="black",size=3,max.overlaps=Inf) #label
 G=G+theme(text=element_text(size=10))+labs(x=NULL,y=NULL)+
  theme(axis.text.x=element_text(angle=a,hjust=.4,vjust=.5))+
  theme(legend.position="none")
 G=G+uTM(w,f,a,tl=F)+uLB(lm,lx,ly); suppressWarnings(G) # suppress Warnings
}

gLineR=function(D,brk=NULL,lx=NULL,ly=NULL,lg=NULL,a=0){
 #if(is.null(brk)) Brk=D[,1]
 D[,3]=factor(D[,3],levels=unique(D[,3]))
 G=ggplot(D,aes(x=D[,1],y=D[,2],color=D[,3]))+geom_line()
 if(is.null(brk)) G=G+scale_x_continuous()
 else G=G+scale_x_continuous(breaks=brk)
 if(a==0) G=G+theme(axis.text.x=element_text(angle=0,hjust=.5,vjust=.5))
 else   G=G+theme(axis.text.x=element_text(angle=90,hjust=1,vjust=.5))
 #G=G+theme(axis.text.x=element_text(angle=a,hjust=1,vjust=.5))
 G+labs(x=lx,y=ly)+scale_color_discrete(name=lg,labels=unique(D[,3]))
}# 線グラフ  rbind data frame of 3 columns: x,y,group, ex:gLineR(D,brk=c(-2.5,0,2.5))

gLines=function(D,vs='',brk=NULL,lx=NULL,ly=NULL,lg=T,y=0,a=0,f=11,w=F){
 D[,1]=as.numeric(D[,1])
 if(vs=='') colnames(D)[1]='x' else colnames(D)=c('x',VT(vs))
 if(is.null(brk)) brk=D[,1]
 # colnames(D)=c('x',VT(vs))
 dLong=gather(D,key='Line',value='Value', -x) # long-format {tidyr}
 dLong$Line=factor(dLong$Line,levels=colnames(D))
 dLong <- dLong[dLong$Value != 0, ]
 if(!w) G=ggplot(dLong,aes(x,Value,color=Line))+
  guides(color=guide_legend(title=NULL))
 if(w) G=ggplot(dLong,aes(x,Value,shape=Line,linetype=Line))+
  scale_shape_manual(values=1:10)+
  scale_linetype_manual(values=VT('solid,dashed,dotted,dotdash,longdash,twodash'))+
  guides(linetype=guide_legend(title = NULL),shape=guide_legend(title = NULL))
 G=G+geom_line(linewidth=.5,alpha=0.8)+geom_point(size=2)
 G=G+scale_x_continuous(breaks=brk)
 G=G+labs(color='',x=lx,y=ly)
 G=G+theme(axis.text.x=element_text(angle=a,hjust=.4,vjust=.5))
 G=G+theme(text=element_text(size=f))+theme(legend.key.width=unit(1,'cm'))
```

```
 if(y==0) G=G+scale_y_continuous(labels=scales::comma)
 else G=G+scale_y_continuous(labels=scales::comma,limits=c(0,y))
 if(lg==F) G=G+theme(legend.position='none'); G
}
# D=DF(x=VT('a,b,c,d'),y1=c(1, 2, 3, 4), y2=c(2, 3, 2, 5))
# D=DF(x=0:3,y1=c(1, 2, 3, 4), y2=c(2, 3, 2, 5))
# xD=DF(x=VT('a,b,c,d'),y1=c(1, 2, 3, 4), y2=c(2, 3, 2, 5))
# gLines(D,y=5,a=90)

gLineU=function(D,f=10,a=0,w=T,m=F,lm=NULL,lx=NULL,ly=NULL,mx=0){
 #f:font,a:angle,w:white,m:mean,lm,lx,ly:label
 D=DF(D)
 if(NC(D)==1) D=t(D); if(any(class(D)=='matrix')) D=DF(CN(D),as.vector(D))
 nr=NR(D); if(mx==0) mx=Max(D[,2]); tm=Sum(D[,2])/sum(!is.na(D[,2])) # max; dotted
line
 D=DF(cat=factor(D[,1],levels=D[,1]), val=D[,2])
 G=ggplot(D, aes(x=cat, y=val, group=1))+
   geom_line(linewidth=1,alpha=0.8)+geom_point()
 if(m) G=G+uSG(1,nr,tm,tm,'gray70',1,3)+uTX(nr,tm,"Media",3,F,-.2)
 G+uSC(F,0,mx)+ggtitle(lm)+xlab(lx)+ylab(ly)+uTM(w,f,a)
} #Line chart of unique vector (df=cat, val, w:white)
# D=DF(x=LETTERS[1:5], v=c(2,5,3,7,6)); gLineU(D)
# D=DF(VT('A,X,Y,Z,B'), c(2,5,3,7,6)); gLineU(D,lm='GGG',lx='T',m=T)

gLinNum=function(D,f=11,a=0){
 Lt=as.character(1:999); nc=NC(D)-1; Lt=Lt[1:nc]
 Cn=colnames(D); colnames(D)=c('x',Lt)
 lx=Cn[1]&' ('&paste(Lt&':'&Cn[-1],collapse=', ')&')'
 dLong=pivot_longer(D,cols=Lt, names_to="g",values_to="y")
 ggplot(dLong,aes(x,y,group=g,label=x))+geom_line(color="black")+
   geom_text(aes(label=g), vjust=-0.5)+
   labs(x=lx,y=NULL)+scale_y_continuous(labels=scales::comma)+
   theme(text=element_text(size=f))+
   theme(axis.text.x=element_text(angle=a,hjust=.4,vjust=.5))
} #線番号つき折れ線グラフ
# D=DF(Libro=c('x1','x2','x3'),abc=c(3,5,2),xyz=c(8,4,3)); gLinNum(D,12,0)

gLn=function(D) ggplot(D,aes(x,y))+geom_line() #Line graph

gLshapeMatrix=function(D,lx='Value',ly='Frequency',lg1='Bar:',
```

```
                lg2='Line:',n='',a=0,f=12,y=0,w=F){
  D=DF(D); Me=rowMeans(D); mx=max(Me); mn=min(Me)
  D1=DF(D,Me); mnt=FM(Monotony(Me),3); ldi=FM(Ldi(Me),3)
  #lx=lx&' (Mnt: '&mnt&', Ldi: '&ldi&', Max: '&mx&', Min: '&mn &') '& n
  lx=lx&' (Mnt: '&mnt&', Ldi: '&ldi&') '& n
  G=gBarsLine(D1,lx,ly,lg1,lg2,y,w); G=gA(G,a); gF(G,f)
  # if(y!=0) G=G+ylim(0, y); G
}#L-shape dist. of matrix in bars-line chart
#(n:comment, a:angle of x, f:font size, y:limit of y axis)

gMap=function(
    D,C,m=1,g=1,gp=.4,gw=40,it=3,fs=12,p=0,r=3,lp=4,
    lg=-3.3,lt=40,z=5.5,gr=T,tx=T,nm=T,ch=T,lb=T,id='',ip=3){
  #D:data,C:coordinate.,m:map:3,g:graph:2,gp:graph-position,gw:graph-width,
  #it:n-of-initial,fs:font-size,p:palette:12,r:round-size,lp:legend pos.,lg:long.,lt:lat.,
  #z:zoom,gr:graph,tx:text,nm:numeric,ch:convex-hull,lb:label,id:id-name,ip:id-pos.
  library(leaflet); library(leaflet.minicharts); library(RColorBrewer)
  E=VlookupRn(D,C,F);m=min(m,3); g=min(g,2); p=min(p,12) #地図データ+地図座標;m,g,p:min

  #基本地図 base map

m=c('Stamen.TerrainBackground','CartoDB.VoyagerNoLabels','CartoDB.PositronNoLabels')[m]
  G=leaflet(options=leafletOptions(zoomControl=F)); G=addProviderTiles(G,m) #地図
  ofs=ifelse(g==2,5,-10) #オフセット
  if(lb) G=addLabelOnlyMarkers(#ラベル
    G,lng=E[,1],lat=E[,2],data=E,label=rownames(E),labelOptions=labelOptions(
      noHide=T,direction='bottom',textOnly=T,offset=c(0,ofs),style=list('font-
size'=fs&'px')))
  G=setView(G,lat=lt,lng=lg,z=z) #セットビュー

  if(p==0) {Pl=VT('red,green,blue,brown,purple,orange,magenta,black')
  }else Pl=brewer.pal(8, gPallete(p)) #パレット palette
  Lp=c('topleft','topright','bottomleft','bottomright') #凡例の位置(<=4)

  if(tx){ #テキスト text
    Init=NULL; n=0; ofs=ifelse(g==2,22,5) #オフセット
    for(i in 3:NC(E)){n=n+1; Init[n]=Left(colnames(E)[i],it)} #イニシャルのリスト
    for(i in 1:NR(E)){ #文字列を地図に表示
```

```
    lab=''; for(j in 3:NC(E)){cn=min(j,8)-2; nk=ifelse(nm,':'&E[i,j],'')
    if(E[i,j]>0) lab=lab&"<span style='color:"&Pl[cn]&"'>"&Init[cn]&"</span>"&nk&",
"
    }; lab=Replace(lab,', $','')
    bgc=ifelse(ch,'#ffffff88','#ffffffaa') #背景白の透明度
    G=addLabelOnlyMarkers(
     G,lng=E[i,'Lng'],lat=E[i,'Lat'],data=E,label=~htmltools::HTML(lab),
     labelOptions=labelOptions(
      noHide=T,direction='top',textOnly=T,offset=c(0,ofs),
      style=list('font-size'=fs&'px','background-color'=bgc,'line-height'=.5)))}
 } #if tx

 if(id!='') G=addControl(G,html=id,position=Lp[ip]) #地図 ID

 if(gr) { #グラフ
  g=c('bar','pie')[g]; lp=Lp[lp] #凡例の位置(<=4)
  if(g=='pie') gw=gw*5/8; gk=ifelse(tx,gp,0) #グラフ幅; グラフ調整位置
  G=addMinicharts(
   #   G,lng=E[,1],lat=E[,2]+gp,type=g,chartdata=E[,3:NC(E)],
   G,lng=E[,1],lat=E[,2]+gk,type=g,chartdata=E[,3:NC(E)],

colorPalette=Pl,width=gw,labelText=rownames(E),legendPosition=lp,transitionTime=0)
 } #if gr

 if(ch){ #凸包線  convex hull line
  r1=(max(E[,'Lng'])-min(E[,'Lng']))/200
  r2=(max(E[,'Lat'])-min(E[,'Lat']))/200 #マージン単位
  for(h in 3:NC(E)){
   H=Grep(E,h,'>='&mean(E[,h])) #列平均を超えるデータを抽出
   n=0;nr=NR(H);M=matrix(0,nr*16,2);rownames(M)=1:(nr*16)
   sg=ifelse(nr==1,3,1) #唯一データの凸包線半径は 3 倍
   for(i in 1:nr){
    Lg=H[i,1]+sin(pi/8*(0:15))*r1*r*sg+ifelse(nr==1,0,h/30) #横座標：経度
    Lt=H[i,2]+cos(pi/8*(0:15))*r2*r*sg+ifelse(nr==1,0,h/30) #縦座標：緯度
    for(j in 1:16){n=n+1; M[n,1]=Lg[j]; M[n,2]=Lt[j]} #経度;緯度
   }; M=M[chull(M[,1], M[,2]),] #chull:凸包線座標
   G=addPolygons(G,data=M,lng=M[,1],lat=M[,2],fill=F,weight=2,color=Pl[h-2])  #凸
包線
  }
 } #if ch
```

```
 if(!gr&&tx){ #凡例
  ht=''; for(i in 3:NC(E)){
   ht1="<td><span style='color: " & Pl[i-2] & ";'>"&Init[i-2]&"</span>:</td>"
   ht2="<td><span style='color: black;'>"&colnames(E)[i]&"</span></td>"
   ht=ht&"<tr>"&ht1&ht2&"</tr>"
  }; ht="<table>"&ht&"</table>"; G=addControl(G,html=ht,position=Lp[lp])
 }
 G#出力
} #言語地図 Linguistic map
# gMap(Dd,Cd,m=1,g=1,gp=.4,gw=60,it=3,fs=12,p=0,r=3,
# lp=4,lg=-3.3,lt=40,z=5.5,gr=T,tx=T,nm=T,ch=T,lb=T,id='ax-001',ip=2)
#

gMapBlank=function(lg=-3.3,lt=40,z=5.5){
 #lg:longitude,lt:latitude,z:zoom
 library(leaflet)

Mp=c('Stamen.TerrainBackground','CartoDB.VoyagerNoLabels','CartoDB.PositronNoLa
bels')#地図(:3)
 G=leaflet(options=leafletOptions(zoomControl=F))
 G=setView(G,lng=lg,lat=lt,zoom=z) #セットビュー
 for(p in Mp) G=addProviderTiles(G,p,group=p)#レイヤーコントロール
 addLayersControl(G,baseGroups=Mp)
} #白地図 blank map
#gMapBlank(lg=-3.3,lt=40,z=5.5) #白地図, スペイン blank map, Spain

Gmark=function(A) 1-A/max(A) # 有標度 (GM: Grade of markedness)
#GM=function(x) {x=x[!is.na(x)]; x[x==0]=1; exp(sum(log(x)/Len(x)))}
G.mean=GM=function(x) {x=x[!is.na(x)]; exp(sum(log(x+1)/Len(x)))-1}
#A=c(NA,1,2,50); A=c(0,1,2,50); psych::geometric.mean(A)
#https://www.wwdmag.com/utility-management/article/10976839/ops-systems-handling-
zeros-in-geometric-mean-calculation

gNET=function(Ed,Nd=0,ly=1,rep=F,sd=1){
 #Ed: from,to,weights; Nd: name,size,type; ly: layout: 1.fr, 2.kk, 3.stress, sd: seed
 if(Nd==0) {N1=Freq(B2,1,3); Nd=cbind(N1,rep('a',NR(N1)))}
 colnames(Nd)=VT('name,size,type'); colnames(Ed)=VT('from,to,weights')
 Uq=unique(c(Ed[,1], Ed[,2])); Nd=filter(Nd, Nd[,1] %in% Uq) # Node
```

```
  Nd[,2]=sqrt(Nd[,2]/sum(Nd[,2])*1000)+2 # Node size
  Ed[,3]=Ed[,3]/sum(Ed[,3])*100+2    # Edge width
  Type=unique(Nd[,3]); Tnum=NULL # Type Number 付加
  for (i in 1:NR(Nd)){Tnum[i]=which(Type==Nd[i,3])}; Nd[,'type']=Tnum
  set.seed(sd); Pt=Nd[,'name'] # Seed, Node name
  Col=VT('cornflowerblue, lightgreen, pink, plum2, coral, tan') # Color
  Co=Cc=Nd[,'type']; for(i in 1:NR(Nd)){Co[i]=Col[Cc[i]]}; names(Co)=Pt # Node color
  Sz=Nd[,'size']; Sz=as.integer(Sz); names(Sz)=Pt # Node size
  Un=unique(c(Ed[,'from'],Ed[,'to'])); Co=Co[Un]; Sz=Sz[Un] # Node color & size
  Lt=VT('fr, kk, stress') # Layout
  ggraph(graph_from_data_frame(Ed), layout = Lt[ly]) +
    geom_edge_arc(arrow = arrow(length=unit(5,'mm')), aes(width = weights),
                  start_cap = circle(4,'mm'), end_cap = circle(4,'mm'),
                  strength = 0.1, color='gray50', alpha = .9, show.legend=F) +
    geom_node_point(color=Co, size=Sz, alpha=0.8) +
    geom_node_text(aes(label = name), repel=rep, force=100) +
    theme_graph(background = "white", plot_margin = margin(20,20,20,20))
} #ネットワーク分析  * Repel

gNet=function(Vt,Ed,sel=0,lx=1,ly=1){ #Vt:Vertex; Ed: Edge; sel:レイアウト; lg:凡例
位置
  #Vt: df(name, type, size); Ed: df(from, to, width)
  par(mar=c(0,0,0,0))
  Uq=unique(c(Ed[,1], Ed[,2]))
  Vt=filter(Vt, Vt[,1] %in% Uq)
  Vt[,3]=sqrt(Vt[,3]/sum(Vt[,3])*1000)
  Ed[,3]=Ed[,3]/sum(Ed[,3])*100
  Type=unique(Vt[,2]); Tnum=NULL # Type Number 付加
  for (i in 1:NR(Vt)){
    Tnum[i]=which(Type==Vt[i,2])
  }; Vt=cbind(Vt,Tnum)
  colnames(Vt)[3]='size'; colnames(Ed)=VT('from,to,weight')
  net=graph.DF(d=Ed, vertices=Vt, directed=F) #グラフオブジェクト-1
  Color = VT('cadetblue1,pink,lightblue') #  色指定
  if(sel==0) {lt=NULL} #レイアウト：なし
  if(sel==1) {lt=layout_nicely} #レイアウト：Nicely
  if(sel==2) {lt=layout_with_fr} #レイアウト：Fruchterman-Reingold
  if(sel==3) {lt=layout_with_kk} #レイアウト：Kamada Kawai
  if(sel==4) {lt=layout_with_dh} #レイアウト：Davidson-Harel
  plot(net, layout=lt, #プロット，レイアウト
```

```
      #vertex.shape = VT('rectangle,rectangle,circle,circle')[VT(net)$Tnum],
      vertex.shape = 'circle',
      vertex.color =Color[VT(net)$Tnum], #頂点の色～Tnum(タイプナンバー)
      vertex.size = VT(net)$size+5, #  ノードのサイズ～size
      vertex.frame.color = 'gray50', #ノードの枠線色：白
      vertex.label = VT(net)$name, #  ラベル: name
      vertex.label.color = 'black', #ラベル色：黒
      edge.color = 'gray50', #エッジの色：グレー
      edge.width = E(net)$weight/2+1, ##  エッジの太さ (幅)：1+weight/2
      arrow.mode=0, #矢印：なし
 )
 legend(x=lx, y=ly, Type, pch=c(22,22,21,21), col='white', #22:四角, 21:丸
       pt.bg=Color, pt.cex=2, cex=.8, bty='n', NC=1) #凡例
}#ネットワーク分析

gNormal=function(A,bn=20,brk=NULL,a=0,lx='Data',ly='Probability'){
 # A:num.vector,bn:bins,brk:breaks,a:angle-x,lx,ly:labels(x,y)
 ggplot()+geom_histogram(aes(x=A,y=after_stat(density)),bins=bn,
                  fill="lightblue",color="black")+
   stat_function(fun=dnorm,args=list(mean=mean(A),sd=sd(A)),color="red")+
   #scale_x_continuous(breaks=brk)+
   labs(x=lx,y=ly)+theme(axis.text.x=element_text(angle=a,hjust=1))
} #Graph of normality of vector A
#A=c(1,2,3,4,4,5,5,5,6,6,6,7,8,9); gNormal(A,9,brk=seq(1,10))
# gNormal=function(A,bn=20,brk=NULL,a=0,lx='Data',ly='Probability'){
# # A:num.vector,bn:bins,brk:breaks,a:angle-x,lx,ly:labels(x,y)
#
ggplot()+geom_histogram(aes(x=A,y=..density..),bins=bn,fill="lightblue",color="black"
)+
#   stat_function(fun=dnorm,args=list(mean=mean(A),sd=sd(A)),color="red")+
#   scale_x_continuous(breaks=brk)+
#   labs(x=lx,y=ly)+theme(axis.text.x=element_text(angle=a,hjust=1))
# } #Graph of normality of vector A

gNormalDist=function(A,brk){
 m=MeanFreqDistD(A); sd=SdFreqDistD(A) #mean, sd
 norm.dist=dnorm(brk,m,sd)*sum(A)
 df=DF(x=brk,data=A,norm.dist)
 gBarLine(df,brk=brk,lx='N. of phoneme',ly='Frequency')
} #Normal dist. in Bar and Line graph A:vector, brk:breaks ex.1:20
```

```
gNormality=function(A){G1=gNormal(A,9); G2=gQQ(A); gBC(G1,G2)}
#gNorm=function(A){G1=gNormal(A,9); G2=gQQ(A); gBC(G1,G2)}

gNormDist.g=function(f,t,e,A=NULL){
 if(is.null(A)) A=0:t
 D=DF(x=A,y=dbinom(A,t,e))
 m=max(D[,2]); s=FM(BinS(f,t,e),3); p=FM(BinR(f,t,e),3)
 gLn(D)+gRb(D,min(A),f,'steelblue')+gRb(D,f,max(A),'red')+
  gTx(t*e,.3*m,'s: '&s,'black',.5)+gVl(t*e,2,'black')+
  gTx(f,.3*m,'p: '&p,'black',0)+gTx(f,.2*m,'f: '&f,'black',0)
} #Normal distribution: greater

gNormDist.l=function(f,t,e,A=NULL){
 if(is.null(A)) A=0:t
 D=DF(x=A,y=dbinom(A,t,e))
 m=max(D[,2]); s=FM(BinS(f,t,e),3); p=FM(BinR(f,t,e),3)
 gLn(D)+gRb(D,f,Inf,'steelblue')+gRb(D,0,f,'red')+
  gTx(t*e,.3*m,'s: '&s,'black',.5)+gTx(f,.3*m,'p: '&p,'black',1)+
  gTx(f,.2*m,'f: '&f,'black',1)+gVl(t*e,2,'black')
} #Normal distribution: less
#gTx=function(x,y,lab,sz=1,color='black',hj=0){

gNormDist.t=function(f,t,e,A=NULL){
 if(is.null(A)) A=0:t
 D=DF(x=A,y=dbinom(A,t,e))
 m=max(D[,2]); s=FM(BinS(f,t,e),3); p=FM(BinR(f,t,e),3)
 p1=pbinom(f,t,e); p2=ifelse(f==0,1,pbinom(f-1,t,e,F))
 p=min(p1,p2); s=FM(1-2*p,3); p=FM(p,3)
 gLn(D)+gRb(D,t-f,f,'steelblue')+gRb(D,0,t-f,'red')+gRb(D,f,Inf,'red')+
  gTx(t*e,.3*m,'s: '&s,'black',.5)+gTx(t-f,.3*m,'p: '&p,'black',1)+
  gTx(f,.3*m,'p: '&p,'black',0)+gTx(f,.2*m,'x: '&f,'black',0)+gVl(t*e,2,'black')
} #Normal distribution: two-sided

gNormDistConform=function(A,brk=.5,lx='x'){
 B=seq(-4.5,4.5,by=brk); Fd=FreqDistV(A,B,T); Bp=c(B,4.6); Ap=NULL
 for(i in 1:Len(B)) Ap[i]=pnorm(Bp[i+1])-pnorm(Bp[i]) #normal dist.
 D=cbind(Fd,Ap); colnames(D)=c('x','Random number','Normal distribution')
 gBarLine(D,lx=lx,ly='Probability')
} #Graph for conformation to standard normal distribution
```

```
gNormFreq=function(A,b=30,a=0,lm='',lx='',ly='',colorF='gray90',colorL='black'){
 h=hist(A, breaks=b); B=h$breaks; B=B[1:Len(B)-1]; C=h$counts # B:階級, C:度数
 N1=dnorm(B,mean(A),sdp(A)) # 正規分布
 df=DF(Y=B, Y1=C, Y2=N1)
 mult=max(df[,2])/max(df[,3]) # 高さを揃えるための乗数
 G=ggplot(df)
 G=G+geom_bar(aes(x=Y, y=Y1),stat="identity", fill=colorF,colour="black") #***
 G=G+geom_line(aes(x=Y-1, y=mult*Y2),stat="identity",color=colorL,size=.5)
 G=G+scale_x_continuous(labels = df$Y, breaks = df$Y)
 G=G+scale_fill_manual(values = c(0:50, "royalblue"))
 G=gA(G,a);G=gL(G,lm,lx,ly);G # a:X 軸角度, lm,lxly:タイトル
} # 数値ベクトル(A)の頻度分布と正規分布

gNormMatrix=function(D,lx='Value',ly='Frequency',lg1='Bar:',lg2='Line:',
                n=1,a=0,f=12,y=0,w=F){
 D=DF(D); nc=NC(D); ird=FM(Normality(D),3)
 A=NULL; for(i in 1:nc) A=c(A,FreqDistVec(D[,i]))
 m=mean(A); md=median(A); sd=sdp(A); t=sum(D[,1:NC(D)])/nc
 D1=DF(D,Norm.dist.=dnorm(1:NR(D),m,sd)*t)
 lx=lx&' (Ird: '&ird&', m:'&FM(m,1)&', sd:'&FM(sd,1)&', md:'&FM(md,1)&') '& n
 G=gBarsLine(D1,lx,ly,lg1,lg2,y,w); G=gA(G,a); gF(G,f)
 #if(y!=0) G=G+ylim(0, y); G
}#Normal dist. of matrix in bars-line chart (n:comment, a:angle of x)

gP=function(G){G+theme_bw()+theme(panel.border=gB())
}#パネル枠消去

gPalette=function(x){
 c('Dark2','Set1','Set2','Set3','Spectral','Accent','Pastel1','Pastel2',
  'YlOrRd','GnBu','BuGn','Greys')[x]
} #色パレット (x=1,2,3...)

gPanel=function(G){
 G+theme(panel.background=gB(),
       panel.grid.major=gB(),panel.grid.minor=gB(),
       panel.spacing=unit(c(0,0,0,0),"cm"),
       axis.ticks=gB(),axis.text.x=gB(),axis.text.y=gB(),
       axis.title.x=gB(),axis.title.y=gB(),
       plot.background=element_rect(fill="transparent",colour=NA),
```

```
      plot.margin=unit(c(-1,-1.2,-1.2,-1.5),"cm"),#t,r,b,l
      legend.position='none')+labs(x=NULL,y=NULL)
}#plot の panel 部分

gPC=function(G,c,v,nc=1,sel=F){ #sel=T 折れ線 (白黒=>黒)
 # if(c>12) return(G)
 if(IsStr(c)){P=Split(c);if(v) P=rev(P[1:nc])} else{P=gPalette(c)} #色パレット
 if(c==0){ #白黒
  # if(sel) G=G+scale_color_grey(1,1)
  if(sel) G=G+scale_colour_manual(values = c("black"))
  else G=G+scale_color_grey(start=ifelse(v,.2,.8),end=ifelse(v,.8,.2))
 }else if(c==1){#デフォルト色
  if(!v) G=G+scale_color_hue()
  if(v) G=G+scale_color_hue(direction=-1,h.start=90)
 }else{#指定色/パレット
  if(IsStr(c)){G=G+scale_color_manual(values=P) #指定色
  }else {G=G+scale_color_brewer(palette=P,direction=ifelse(v,-1,1))} #パレット
 }; G
} #パレット (color)

gPcaBp=function(M=D,lm='',lx='',ly='',s=0,c='V=>blue',a=T,w=F,st=T,f=12,m=1){
 P=prcomp(M,scale=st) #scale=s=T: 標準化(単位が異なるとき)
 E=get_eigenvalue(P) #固有値(分散),分散%,分散累積%:library(factoextra)
 if(lx=='') lx=Add('PCA biplot: Dim.1 (',round(E[1,2],1),' %)') #1 軸ラベル(デフォルト)
 if(ly=='') ly=Add('Dim.2 (',round(E[2,2],1),' %)') #2 軸ラベル(デフォルト)
 V=P$rotation[,1:2]*m; I=P$x[,1:2] #固有ベクトル; 主成分スコア
 gBiplot(V,I,lm,lx,ly,s,c,a,w,f) #バイプロット
} #主成分分析:バイプロット
#gPcaBp(M=D,lm='',lm='',lx='',ly='',s=0,c='',a=T,w=F,f=12,m=1)
#M:数値行列,lm,lx,ly:ラベル,s=[0]:変数+個体/s=1:変数/s=2:個体,
#c:色指定(例:'V=>blue,..'),a:矢印,w:白黒,m:変数 V の乗数

gPcaGp=function(M=D,gr=G,lg='',c='',s=T){
 P=prcomp(M,scale=s) #scale=s=T: 標準化(単位が異なるとき)
 groups=as.factor(gr); if(c=='') c='tomato,steelblue'
 fviz_pca_ind(P,col.ind=groups,palette=Split(c),#グループの色
          addEllipses=T,ellipse.type='confidence',#信頼楕円
          legend.title=lg,repel=T,title='')
} #主成分分析(グループ)
```

```
gPF=function(G,c,v,nc=0){
 # if(c>12) return(G)
 if(IsStr(c)){P=Split(c);if(v) P=rev(P[1:nc])}else{P=gPalette(c)} #色パレット
 if(c==0){ #白黒
  G=G+scale_fill_grey(start=.8,end=.4)+geom_col(color ='white')
 }else if(c==1){#デフォルト色
  if(!v) G=G+scale_fill_hue()
  if(v) G=G+scale_fill_hue(direction=-1,h.start=90)
 }else{#指定色/パレット
  if(IsStr(c)){G=G+scale_fill_manual(values=P) #指定色
  }else {G=G+scale_fill_brewer(palette=P,direction=ifelse(v,-1,1))} #パレット
 }; G} #パレット (fill)

gPlot=function(D,d=0,f=12,s=100,c=T,a=T,l=.5,t=.5,lm='',lx='',ly='',w=T,n=T,dt=T){
 #(D,d=0,f=12,s=100,c=T,a=F,l=.5,t=.5,lm='',lx='',ly='',w=T,n=F)
 # Point graph with diagonal concentration (ver.2024-5-6)
 # D:df,d=0:diag,f:font,s:size-circle,c:color,a=angle-x-90,
 # l:left-margin,t:top-margin,lm,lx,ly:label,w:white,n:number,dt:distance
 Dg=DC(D,d); D=Dg$df; R=Rx=Rnd(Dg$row,2); C=Cx=Rnd(Dg$col,2)
 Rn=names(R); Cn=names(C); mx=Max(D); dc=DECIMAL(D) #names:row; col; max-size
 if(d>0&dt) {if(d==1|d==3) Rx=DisVec(Rx); if(d==2|d==3) Cx=DisVec(Cx)} # distance numeric vec
 else {R[1:NR(D)]=Rnd(Seq(-1,1,NR(D)),2);Rx=R; C[1:NC(D)]=Rnd(Seq(-1,1,NC(D)),2);Cx=C} # equal
 Rx=-Rx; R=-R
 E=M2Long(D); Y=R[E[,1]]; Ra=Rx[E[,1]]; X=C[E[,2]]; Ca=Cx[E[,2]]
 E$d=NA2zero(E$n); E$n=FM(E$n,dc); E$n=ReplA(E$n,'NA=>***') #[E$nis.na(E$n)]="***"
 B=seq(-2,2,0.5);n1=1.1;n2=1.2;n3=1.3;n4=1.4;lf=1+l;tp=1+t #B:breaks, margin
 M=E[E$d==mx,][1,]; mItem='Max:¥n'&M[1]&'¥n'&M[2]
 g='gray'; b='skyblue'; k='gray20'; p='#ff7777';wh='white' # color
 cpos=IE(c,b,'gray40');cneg=IE(c,p,wh) #color:pos; neg
 G=ggplot(E)+
  uRT(-n2,n2,-n2,n2,NA,g,.5)+ #rectangle
  uPT(X,Y,sqrt(abs(E$d/mx)*s),21,ifelse(E$d<0,cneg,cpos),k,.5)+ #point
  uSG(C,C,-n2,n2,g,.2)+uSG(-n2,n2,R,R,g,.2)+ #segment: solid l.
  uSG(0,0,-n2,n2,g,.2,2)+uSG(-n2,n2,0,0,g,.2,2)+ #id. dotted line zero
  uSG(-n4+.03,-n2,Rx,R,g,.2,1)+uSG(n4-.09,n2,Rx,R,g,.2,1)+ #nexus:left+right
```

```
  uSG(Cx,C,n4-.08,n2,g,.2,1)+uSG(Cx,C,-n4+.03,-n2,g,.2,1)+ #nexus:top+bot
  uTX(n3,0,'0',f/3.7,F,1)+uTX(0,-n3,'0',f/3.7,F,.5)+ #zero(0):left+bottom
  uTX(-n4,Rx,Rn,f/3.5,F,1)+uTX(1.33,Rx,FM(R,2),f/3.5,F,0)+ #row:label+num
  uTX(Cx,1.35,Cn,f/3.5,a,IE(a,0,.5))+uTX(Cx,-n4,FM(C,2),f/3.5,T,1)+ #id.:top+bot
  uSC(T,-lf,1.7,B)+uSC(F,-1.7,tp,B) # scale
 if(n){ #number
  for(i in 1:Len(Rx)){ #dotted-line:left-right
   if(Rx[i]!=R[i]&d>0&!dt) G=G+uSG(-n4+.03,n4-.09,Rx[i],Rx[i],k,.2,3)}
  for(i in 1:Len(Cx)){ #dotted-line:top-bottom
   if(Cx[i]!=C[i]&d>0&!dt) G=G+uSG(Cx[i],Cx[i],n4-.08,-n4+.03,k,.2,3)}
  G=G+uTX(Ca,Ra,E$n,f/3.5,c=k) # num in circle
  #G=G+uTX(Ca,Ra,E$d,f/3.7,c=k) # num in circle
 }
 G+uTX(-n4,-n4,mItem,f/3.5,c=k)+ #maxItem
  uPT(n4,-n4,sqrt(s),21,cpos,k,.5)+uTX(n4,-n4,FM(mx,dc),f/3.5,c=k)+
#legend:point+num
  uTM(w=T,f,0,lb=F,lg=T,tl=T)+uLB(lm,lx,ly) # theme.w:white,f:font,lb:grid+label
}

gPoint=function(E=D,x=1,y=2,g=0,lm='',lx='',ly='',lg='',r=F,s=1,w=F,f=12,
          Lx=F,Ly=F,z=F,a=0,p='vh',d='both', wd=10, pt=-1, nd=-1){ #ver.2022-1-7
 #E:,x:x 軸,y:y 軸,g:グループ軸,lm,lx,ly,lg:ラベル,r:行名,s:ポイントサイズ,
 #w: 白黒,f:フォントサイズ,Lx:対数軸(x),Ly:対数軸(y),z:両軸ゼロ開始,
 #a:行名角度,wd:グラフの幅;pt 点の位置;nd:行名の位置
 #p:配置('vh':平面,'v':縦図,'h':横図,d:行名の移動方向('both','x','y'),
 E=DF(E);
 x=Col2n(E,x); y=Col2n(E,y); g=Col2n(E,g) #列名=>列番号
 if(lx==''&x>0) lx=colnames(E)[x] #デフォルトラベル:X 軸
 if(ly==''&y>0) ly=colnames(E)[y] #デフォルトラベル:Y 軸
 if(lg==''&g>0) lg=colnames(E)[g] #デフォルトラベル:凡例
 if(x>0) colnames(E)[x]='vx'; if(y>0) colnames(E)[y]='vy'; if(g>0) colnames(E)[g]='vg'
#列名

 if(pt<0) pt=wd/10; if(nd<0) nd=wd*.3; if (!r) pt=wd/2 #wd:グラフの幅;pt 点の位置;nd:
行名の位置

 if(p=='vh') G=ggplot(E,aes(vx,vy,label=rownames(E))) #平面図
 # if(p=='v') G=ggplot(E,aes(pt,vx,label=rownames(E)))  #縦図
 if(p=='v') G=ggplot(E,aes(pt,vx,label=sprintf('%s (%.1f)',rownames(E), vx)))  #縦図
 # if(p=='h') G=ggplot(E,aes(vx,pt,label=rownames(E)))  #横図
```

```
 # if(p=='h') G=ggplot(E,aes(vx,pt,label=sprintf('%8.1f %-10s', vx,rownames(E)))) #横図
 if(p=='h') G=ggplot(E,aes(vx,pt,label=sprintf('%-20s¥t %8.1f',rownames(E), vx))) #横図
 if(g==0){ #グループ化なし
  G=G+geom_point(shape=16,size=s,color=IE(w,'black','red')) #カラー/白黒
 }else { #グループ化あり
  G=G+geom_point(aes(shape=vg,color=IE(w,NULL,vg)),size=s) #白黒
  n=Len(unique(E[,g])); G=G+scale_shape_manual(name=lg, values=1:n) #ポイントの形
  if(!w) G=G+scale_color_manual(name=lg, values=Cls(n))       #ポイントの色
 }
 if(r){options(ggrepel.max.overlaps=Inf) #行名
  if(p=='vh') { #平面図
   G=G+geom_text_repel(min.segment.length=0,segment.color='gray40',size=f/4,
                direction=d,angle=a)}
  if(p=='v'){ #縦図
   G=G+geom_text_repel(min.segment.length=0,segment.color='gray40',size=f/4,
                direction='y',angle=0,nudge_x=nd,hjust=0)}
  if(p=='h'){ #横図
   G=G+geom_text_repel(min.segment.length=0,segment.color='gray40',size=f/4,
                direction='x',angle=90,nudge_y=nd,hjust=0,vjust=0)}
 }
 if(p=='v') G=G+theme(axis.ticks.x=gB(),axis.text.x=gB())+xlim(0,wd) #X 軸クリア;範囲.縦図
 if(p=='h') G=G+theme(axis.ticks.y=gB(),axis.text.y=gB())+ylim(0,wd) #Y 軸クリア;範囲.横図
 G=gLg(G,Ly,Lx); G=gZ(G,z,z); G=gF(G,f); G=gL(G,lm,lx,ly,lg,f,T); G
 #L:対数軸; Z:ゼロ開始軸;F:フォントサイズ; L:軸ラベル; G:出力
} #ポイント散布図

gPointNum=function(N,w,c){nr=Len(N); R=rep(16,nr)
if(w||c=='') for(i in 1:nr){if(substr(N[i],1,2)=='V:') R[i]=1}; R
} #gBiplot 用ポイント番号

gPower=function(f,t,e=.5,cl=.95,side='t',test='b',B=NULL,lt='Power',
          lx='Frequency',ly='Probability',lc='n',sz=6.5,a=NULL){
 #f:freq.,t:total,e:expected p.,cl:conf.level,A:range,g:breaks,
 #lt,lx,ly: label, sz:label size, a:angle
 #side='t':two-sided,'g':greter,'l':less
```

```
 #test='b':binomial t.
 if(side=='s') side='t'
 if(test=='b'){
  r=f/t
  if(f<t/2) {q1=qbinom(0.001,t,r); q2=qbinom(0.999,t,e); p1=r; p2=e}
  else    {q1=qbinom(0.001,t,e); q2=qbinom(0.999,t,r); p1=e; p2=r}
  A=qbinom(0.001,t,p1):qbinom(0.999,t,p2)
  if(is.null(a)) a=ifelse(Len(B)>=20,90,0)
  H1=dbinom(A,t,r); H0=dbinom(A,t,e) #r: ratio of H1
  if(side=='t') {
    cv1=qbinom((1-cl)/2,t,e) #cv1: lower critical value
    cv2=qbinom((1+cl)/2,t,e) #cv2: upper critical value
    pw1=pbinom(cv1-1,t,r);pw2=pbinom(cv2,t,r,F);b=1-pw1-pw2
  }
  if(side=='g') {cv=qbinom(cl,t,e); pw=pbinom(cv,t,r,F);b=1-pw}
  if(side=='l') {cv=qbinom(1-cl,t,e);pw=pbinom(cv-1,t,r);b=1-pw}
 }
 D=DF(x=rep(A,2),prob=c(H0,H1),Dist=rep(c('H0','H1'),each=Len(A)))
 G=ggplot(D,aes(x=D[,1],y=D[,2],color=D[,3]))+geom_line(linewidth=1)
 G=G+scale_color_manual(values=c('H0'='lightblue','H1'='pink')) #color of lines
 if(is.null(B)) G=G+scale_x_continuous(expand=c(.4,.4)) #espand X axis
 else    G=G+scale_x_continuous(breaks=B,expand=c(.4,.4)) #espand X axis
 if(a==0) G=G+theme(axis.text.x=element_text(angle=0,hjust=.5,vjust=.5))
 else    G=G+theme(axis.text.x=element_text(angle=90,hjust=1,vjust=.5))
 beta1=' Beta¥n '&FM(b,3); beta2='Beta ¥n'&FM(b,3)&' '
 power='Power¥n'&FM(pw,3)
 if(lc=='n') lc='(E:exp.p., R:ratio, C:crit.v.)'
 G=G+labs(title=lt,x=lx,y=ly,caption=lc)
 G=G+geom_hline(yintercept=0,linetype=1,color='gray10')
 G=G+geom_vline(xintercept=t*e,linetype=3,color='blue')
 G=G+geom_vline(xintercept=t*r,linetype=3,color='red')
 m=max(D[,2])
 if(f<t/2) { # left

G=G+geom_text(x=q2,y=.8*m,label='H.0',color='blue',fontface='bold',hjust=0,size=sz/2
)
   G=G+geom_segment(x=q2,xend=t*e,y=.8*m,yend=.8*m, color="gray10",linetype=3)
   G=G+geom_text(x=q2,y=.7*m,label='E: '&FM(e,3),color='blue',hjust=0,size=sz/2)
   G=G+geom_segment(x=q2,xend=t*e,y=.7*m,yend=.7*m, color="gray10",linetype=3)
```

```
G=G+geom_text(x=q1,y=.8*m,label='H.1',color='red',fontface='bold',hjust=1,size=sz/2)
   G=G+geom_segment(x=q1,xend=t*r,y=.8*m,yend=.8*m, color="gray10",linetype=3)
   G=G+geom_text(x=q1,y=.7*m,label='R: '&FM(r,3),color='red',hjust=1,size=sz/2)
   G=G+geom_segment(x=q1,xend=t*r,y=.7*m,yend=.7*m, color="gray10",linetype=3)
  } else{ # right

G=G+geom_text(x=q1,y=.8*m,label='H.0',color='blue',fontface='bold',hjust=1,size=sz/2
)
   G=G+geom_segment(x=q1,xend=t*e,y=.8*m,yend=.8*m, color="gray10",linetype=3)
   G=G+geom_text(x=q1,y=.7*m,label='E: '&FM(e,3),color='blue',hjust=1,size=sz/2)
   G=G+geom_segment(x=q1,xend=t*e,y=.7*m,yend=.7*m, color="gray10",linetype=3)

G=G+geom_text(x=q2,y=.8*m,label='H.1',color='red',fontface='bold',hjust=0,size=sz/2)
   G=G+geom_segment(x=q2,xend=t*r,y=.8*m,yend=.8*m, color="gray10",linetype=3)
   G=G+geom_text(x=q2,y=.7*m,label='R: '&FM(r,3),color='red',hjust=0,size=sz/2)
   G=G+geom_segment(x=q2,xend=t*r,y=.7*m,yend=.7*m, color="gray10",linetype=3)
  }
  if(side=='t') {
   x1=cv1-.5; x2=cv2+.5 #points of critical value
   power1='Power¥n'&FM(pw1,3); power2='Power¥n'&FM(pw2,3)
   G=G+geom_vline(xintercept=x1,linetype=2,color='gray30')
   G=G+geom_vline(xintercept=x2,linetype=2,color='gray30')
   G=G+geom_text(x=x1,y=.6*m,label='-C: '&cv1,color='gray10',hjust=0,size=sz/2)
   G=G+geom_text(x=x2,y=.5*m,label='C: '&cv2&'-',color='gray10',hjust=1,size=sz/2)
   G=G+geom_text(x=x1,y=.3*m,label=power1,color='red',hjust=1.2,size=sz/2)
   G=G+geom_text(x=x2,y=.3*m,label=power2,color='red',hjust=-0.2,size=sz/2)
   if(r<e) G=G+geom_text(x=x1,y=.3*m,label=beta1,color='black',hjust=0,size=sz/2)
   else G=G+geom_text(x=x2,y=.3*m,label=beta2,color='black',hjust=1,size=sz/2)
  }
  if(side=='g') {
   x1=cv+.5 #point of critical value
   G=G+geom_vline(xintercept=x1,linetype=2,color='gray30')
   G=G+geom_text(x=x1,y=.5*m,label='C: '&cv&'-',color='gray10',hjust=1,size=sz/2)
   G=G+geom_text(x=x1,y=.3*m,label=power,color='red',hjust=-0.2,size=sz/2)
   G=G+geom_text(x=x1,y=.3*m,label=beta2,color='black',hjust=1,size=sz/2)
  }
  if(side=='l') {
   x1=cv-.5 #point of critical value
   G=G+geom_vline(xintercept=x1,linetype=2,color='gray30')
   G=G+geom_text(x=x1,y=.5*m,label='-C: '&cv,color='gray10',hjust=0,size=sz/2)
```

```
   G=G+geom_text(x=x1,y=.3*m,label=power,color='red',hjust=1.2,size=sz/2)
   G=G+geom_text(x=x1,y=.3*m,label=beta1,color='black',hjust=0,size=sz/2)
  }
  G+theme(legend.position='none')+gLabelSize(sz)+
   theme(plot.caption=element_text(hjust=.5))
} #Power analysis

gPowerMatrix=function(D,lx='Value',ly='Frequency',lg1='Bar:',lg2='Line:',n='',a=0){
  D=DF(D); nc=NC(D)
  A=NULL; for(i in 1:nc) A=c(A,FreqDistVec(D[,i]))
  Me=rowMeans(D); Dp=Dpower(1:NR(D),Me)
  D2=DF(Me,Dp[[3]]); ird=1-DM(D2,'r')[1,2]
  D1=DF(D,Power.dist.=Dp[[3]])
  lx=lx&' (ird: '&FM(ird,3)&', intercept:'&FM(Dp[[1]],1)&', slope:'&FM(Dp[[2]],1) &')
'& n
  G=gBarsLine(D1,lx,ly,lg1,lg2); gA(G,a)
}#Power dist. of matrix in bars-line chart (n:comment, a:angle of x)

gQQ=function(A) { #A: numeric vector ex. A=c(5.3, 4.1, 4.5, 2.3, 2.6)
  #https://qiita.com/TSeri/items/e0228f877ccb22f5dbc9
  As=sort(A); Pt=(1:Len(As)-0.5)/Len(As) #percentile
  Xn=qnorm(Pt); D=DF(Theoretical=As, Observed=Xn)
  y=quantile(As,c(0.25,0.75),type=7); z=qnorm(c(0.25,0.75))#Q1/Q3 in normal dist.
  slope=diff(y)/diff(z); inte=y[1]-slope*z[1]
  ggplot(D,aes(y=Theoretical,x=Observed))+
   geom_point(shape=1)+geom_abline(intercept=inte,slope=slope,
                          color="red",linetype="dashed")+
   xlab("Theoretical quantiles")+ylab("Observed quantiles")
} #QQ plot ex:
# A=c(5.3, 4.1, 3.1, 2.3, 2.3,7.1); gQQ(A)
# qqnorm(A); qqline(A, col="red")

Gram2=function(D, sel=F){
  dd=NULL
  for(i in 1:Len(D)){
   str='#' & D[i,'Fonema'] & '#'; len=Len(str)-1
   for(j in 1:len){
    rt=Mid(str,j,1) & Mid(str,j+1,1)
    if(is.null(dd[rt]) || is.na(dd[rt])) {dd[rt]=0}
    dd[rt]=dd[rt]+D[i,'Frec']
```

```
  }}
 if(sel) sort(dd, T) else dd[order(names(dd))]
}# ２文字連続 (2 gramas) Ar: 文字ベクトル, sel=T:names でソート

gRb=function(D,x1,x2,color){
 geom_ribbon(data=subset(D,x>=x1&x<=x2),aes(ymin=0,ymax=y),fill=color,alpha=.4)
} #ribbon

Grep=function(D,col=1,re,ic=T,iv=F,fx=F,p=T){
 # General grep. col:column,re:regex,ic:ignore-case,iv:invert,fx:fix,p:print
 library(stringr); D=DF(D)
 if(str_detect(re,'[<>=]¥¥.?¥¥d')){ #数値 : iv.'=4','>=4'
  fd=FindRE(re,'¥¥.?¥¥d'); op=Left(re,fd-1); nm=as.numeric(Mid(re,fd))
  if(op=='=') A=which(ifelse(D[,col]==nm,T,F))
  if(op=='<') A=which(ifelse(D[,col]<nm,T,F))
  if(op=='>') A=which(ifelse(D[,col]>nm,T,F))
  if(op=='<='|op=='=<') A=which(ifelse(D[,col]<=nm,T,F))
  if(op=='>='|op=='=>') A=which(ifelse(D[,col]>=nm,T,F))
 }else if(col==0){
  if(fx&&iv) A=which(RN(D)!=re)
  else if(fx) A=which(rownames(D)==re)
  else A=grep(re, RN(D),ic,invert=iv,fixed=fx,perl=T)
 }else{ #letter: iv.'abc'
  if(fx&&iv) A=which(D[,col]!=re)
  else if(fx) A=which(D[,col]==re)
  else A=grep(re,D[,col],ic,invert=iv,fixed=fx,perl=T)
 }
 if(NC(D)==1) {print(L(D[A,1])); return(D[A,1])}
 if(p) print(L(D[A,])); D[A,]
} #Grep(D,'mag','<5') iv:exclude, fx:literal

GREP=function(D,str,sep1=',',sep2=':',p=T){
 # Grep multiple. str=col:regex,p:print. ex.str='1:^LE$,3:a¥¥.1[2-5]00$'
 Ss=Sep(str,sep1)
 for(i in 1:Len(Ss)){
  S=Sep(Ss[i],sep2)
  co=as.numeric(S[1]); re=S[2]
  ic=ifelse(is.na(S[3]), F, ifelse(S[3]=='T',T,F))
  iv=ifelse(is.na(S[4]), F, ifelse(S[4]=='T',T,F))
  fx=ifelse(is.na(S[5]), F, ifelse(S[5]=='T',T,F))
```

```
   D=Grep(D,co,re,ic,iv,fx,p)
  }; D
}

gRepColor=function(A=D,c){
  for (i in 1:Len(A)){A[i]=gReplaceColor(A[i],c)}; A
} #配列 A の全要素を c='V=>blue,...'で置換(不一致は black)

gReplaceColor=function(str,c){
  P=Split(c); rep='black'
  for (i in 1:Len(P)){
    p=Split(P[i],'=>'); if(is.na(p[2])){p[2]=''}
    if(str_detect(str,Add('^',p[1]))){rep=p[2]} #語頭一致
  }

rep=ReplaceStr(rep,'^b$=>#039,^c$=>#c30,^g$=>#360,^o$=>#f60,^p$=>#c0c,^r$=>#f1
1') #文字変換
  rep=str_replace_all(rep,'^#(.)(.)(.)$','#¥¥1¥¥1¥¥2¥¥2¥¥3¥¥3') #ex.#123=>#112233
  rep
} #文字列 str を r='p1=>r1,p2=>r2'で置換; ic=T:大小文字区別なし; ini:語頭一致

gSave=function(G,f='@.png',w=600,h=0,r=2/3,d=600,s=T){
  #Save-graph. G:graph obj,f:file-name,w:width,h:height,d:dpi,s:show
  if(h==0) h=w*r
  ggsave(plot=G,filename=f,width=w*.2646,height=h*.2646,units='mm',dpi=d)
  if(s) if(interactive()) utils::browseURL(f) # show
}
#gSave(p=G,f='x.jpg',w=300,h=200,d=600)
#p:グラフオブジェクト,f:ファイル名,w:幅(cm),h:高さ(cm),d:dpi
#ggsave("cairo.png", type = "cairo")

gScale=function(E=D,lm='',lx='',ly='',lg='',f=12,Lx=F,Ly=F,z=F,a=90,na=90,
            p='h',d='both', wd=10,nd=-1){
  #E:1 列データ,lm,lx,ly,lg:ラベル,f:フォントサイズ,Lx:対数軸(x),Ly:対数軸(y),
  #z:両軸ゼロ開始,a:文字角度,na:数値角度,wd:グラフの幅;nd:行名の位置
  #p:配置('v':縦図,'h':横図,d:行名の移動方向('both','x','y'),
  E=cbind(E,EquiDis(E[,1],  wd));  colnames(E)=VT('vx,equi');  pt=wd/10;  if(nd<0)
nd=wd*.3 #列名; wd:グラフの幅;pt 点の位置;nd:行名の位置
  if(p=='h') G=ggplot(E,aes(vx,pt)); if(p=='v') G=ggplot(E,aes(pt,vx))   #横図; 縦図
  if(p=='h'){ #横図
```

```
  ps=ifelse(a==0, .05, 0); pk=ifelse(a==0, .85, .95); hj=ifelse(a==0, .5, 0);
hk=ifelse(a==0, .5, 1)
  G=G+geom_text(aes(x=equi, y=nd+ps, label=rownames(E)), hjust=hj, size=f/4,
color='gray20', angle=a) # 文字
  G=G+geom_text(aes(x=equi, y=pk, label=sprintf('%.3f', vx)), hjust=hk, size=f/4,
color='gray20', angle=na) # 数値
  G=G+theme(axis.ticks.y=gB(), axis.text.y=gB())+xlim(0,wd)+ylim(0,1) #Y 軸クリア;
範囲.横図
  G=G+geom_segment(x=0, y=pt, xend=wd, yend=pt, color='gray15', linetype=3,
linewidth=.5) # スケール (横線)
  G=G+geom_segment(data=E, aes(x=vx, y=pt, xend=equi+.01, yend=nd-.02),
color='gray50', linetype=1, linewidth=.5) # 連結線
  # for(i in 1: NR(E)){
  # G=G+geom_segment(x=E[i,1], y=pt, xend=E[i,2]+.01, yend=nd-.02, color='gray50',
linetype=1, linewidth=.5) # 連結線
  # }
 }
 if(p=='v'){ #縦図
  G=G+geom_text(aes(y=equi, x=nd, label=rownames(E)), hjust=0, size=f/4,
color='gray20', angle=a) # 文字
  G=G+geom_text(aes(y=equi, x=.95, label=sprintf('%.3f', vx)), hjust=1, size=f/4,
color='gray20', angle=na) # 数値
  G=G+theme(axis.ticks.x=gB(), axis.text.x=gB())+xlim(0,1)+ylim(0,wd) #X 軸クリア;
範囲.縦図
  G=G+geom_segment(x=pt, y=0, xend=pt, yend=wd, color='gray15', linetype=3,
linewidth=.5) # スケール (縦線)
  G=G+geom_segment(data=E, aes(x=pt, y=vx, xend=nd-.02, yend=equi+.01),
color='gray50', linetype=1, linewidth=.5) # 連結線
  # for(i in 1: NR(E)){
  # G=G+geom_segment(y=E[i,1], x=pt, yend=E[i,2]+.01, xend=nd-.02, color='gray50',
linetype=1, linewidth=.5) # 連結線
  # }
 }
 G=G+geom_point(shape=16,size=1.5,color='black') #ポイントのサイズ/カラー/白黒
 G=G+theme(plot.margin = unit(c(2,2,2,2), "mm")) # プロットマージン t, r, b, l
 G=gLg(G,Ly,Lx); G=gZ(G,z,z); G=gF(G,f); G=gL(G,lm,lx,ly,lg,f,T); G
 #L:対数軸; Z:ゼロ開始軸;F:フォントサイズ; L:軸ラベル; G:出力
}

GSd=function(A) exp(SDp(log(A))) #幾何標準偏差
```

```
GSdz=function(A) exp(SDp(log(A+1))) #幾何標準偏差(+1)

gSecurity=function(f,t,e=.5,cl=.95,side='t',test='b',B=NULL,
              a=NULL,lt='Security',lx='Frequency',ly='Probability',lc='n',sz=6.5){
 #f:freq.,t:total,e:expected p.,cl:conf.level,B:breaks (seq),
 #a:angle,lt,lxmly:label,sz:label size
 #side='s':selective,t':two-sided,'g':greter,'l':less
 #test='b':binomial t.
 if(side=='s') side='t'
 # if(is.null(A)) A=qbinom(0.001,t,e):qbinom(0.999,t,e)
 # if(b==0) B=A else B=seq(min(A),max(A),b)
 q1=qbinom(0.001,t,e); q2=qbinom(0.999,t,e); A=q1:q2
 #if(is.null(A)) A=q1:q2; if(b==0) B=A else B=seq(q1,q2,b)
 if(is.null(a)) a=ifelse(Len(B)>=20,90,0)
 if(test=='b'){
  if(side=='t') {
   pb1=(1-cl)/2;cv1=qbinom(pb1,t,e) #cv1: lower critical value
   pb2=(1+cl)/2;cv2=qbinom(pb2,t,e) #cv2: upper critical value
   p1=pbinom(f,t,e); p2=ifelse(f==0,1,pbinom(f-1,t,e,F))
   p=2*min(p1,p2,0.5)
  }
  if(side=='g') {pb=cl; cv=qbinom(pb,t,e); p=ifelse(f==0,1,pbinom(f-1,t,e,F))}
  if(side=='l') {pb=1-cl; cv=qbinom(pb,t,e);p=pbinom(f,t,e)}
  r=f/t; H0=dbinom(A,t,e) #r: ratio of H1
 }
 s=1-p; p=FM(p,3); s=FM(s,3)
 D=DF(x=A,prob=H0)
 G=ggplot(D,aes(x=D[,1],y=D[,2]))+geom_line(linewidth=1,color='lightblue')
 if(is.null(B)) G=G+scale_x_continuous(expand=c(.4,.4)) #espand X axis
 else     G=G+scale_x_continuous(breaks=B,expand=c(.4,.4)) #espand X axis
 if(a==0) G=G+theme(axis.text.x=element_text(angle=0,hjust=.5,vjust=.5))
 else    G=G+theme(axis.text.x=element_text(angle=90,hjust=1,vjust=.5))
 if(lc=='n') lc='(E:Exp.p., C:crit.v., p:prob., F:freq., S:sec., R:risk)'
 G=G+labs(title=lt,x=lx,y=ly,caption=lc)
 G=G+geom_hline(yintercept=0,linetype=1,color='gray10')
 m=max(D[,2])
 G=G+geom_text(x=t*e,y=.8*m,label='H.0',color='blue',fontface='bold',size=sz/2)
 G=G+geom_text(x=t*e,y=.7*m,label='E: '&FM(e,3),color='blue',size=sz/2)
 if(side=='t') {
```

```
 x1=cv1-.5; x2=cv2+.5 #points of critical value
 G=G+geom_vline(xintercept=x1,linetype=2,color='gray30')
 G=G+geom_vline(xintercept=x2,linetype=2,color='gray30')
 G=G+geom_text(x=q1,y=.9*m,label='C: '&cv1,color='gray10',hjust=1,size=sz/2)
 G=G+geom_text(x=q1,y=.8*m,label='p: '&pb1,color='gray10',hjust=1,size=sz/2)
 G=G+geom_text(x=q2,y=.9*m,label='C: '&cv2,color='gray10',hjust=0,size=sz/2)
 G=G+geom_text(x=q2,y=.8*m,label='p: '&pb2,color='gray10',hjust=0,size=sz/2)
 G=G+geom_segment(x=q1,xend=x1,y=.9*m,yend=.9*m, color="gray10",linetype=3)
 G=G+geom_segment(x=q1,xend=x1,y=.8*m,yend=.8*m, color="gray10",linetype=3)
 G=G+geom_segment(x=q2,xend=x2,y=.9*m,yend=.9*m, color="gray10",linetype=3)
 G=G+geom_segment(x=q2,xend=x2,y=.8*m,yend=.8*m, color="gray10",linetype=3)
}
if(side=='g') {
 x2=cv+.5 #point of critical value
 G=G+geom_vline(xintercept=x2,linetype=2,color='gray30')
 G=G+geom_text(x=q2,y=.9*m,label='C: '&cv,color='gray10',hjust=0,size=sz/2)
 G=G+geom_text(x=q2,y=.8*m,label='p: '&pb,color='gray10',hjust=0,size=sz/2)
 G=G+geom_segment(x=q2,xend=x2,y=.9*m,yend=.9*m, color="gray10",linetype=3)
 G=G+geom_segment(x=q2,xend=x2,y=.8*m,yend=.8*m, color="gray10",linetype=3)
}
if(side=='l') {
 x1=cv-.5 #point of critical value
 G=G+geom_vline(xintercept=x1,linetype=2,color='gray30')
 G=G+geom_text(x=q1,y=.9*m,label='C: '&cv,color='gray10',hjust=1,size=sz/2)
 G=G+geom_text(x=q1,y=.8*m,label='p: '&pb,color='gray10',hjust=1,size=sz/2)
 G=G+geom_segment(x=q1,xend=x1,y=.9*m,yend=.9*m, color="gray10",linetype=3)
 G=G+geom_segment(x=q1,xend=x1,y=.8*m,yend=.8*m, color="gray10",linetype=3)
}
G=G+geom_vline(xintercept=f,linetype=1,color='red')
G=G+geom_text(x=f,y=.4*m,label=' F:'&f,color='red',hjust=0,size=sz/2)
if(f<t/2) {
 G=G+geom_text(x=q1,y=.2*m,label='S: '&s,color='blue',hjust=1,size=sz/2)
 G=G+geom_text(x=q1,y=.1*m,label='R: '&p,color='blue',hjust=1,size=sz/2)
 G=G+geom_segment(x=q1,xend=f,y=.2*m,yend=.2*m, color="gray10",linetype=3)
 G=G+geom_segment(x=q1,xend=f,y=.1*m,yend=.1*m, color="gray10",linetype=3)
}
else{
 G=G+geom_text(x=q2,y=.2*m,label='S: '&s,color='blue',hjust=0,size=sz/2)
 G=G+geom_text(x=q2,y=.1*m,label='R: '&p,color='blue',hjust=0,size=sz/2)
 G=G+geom_segment(x=q2,xend=f,y=.2*m,yend=.2*m, color="gray10",linetype=3)
```

```
  G=G+geom_segment(x=q2,xend=f,y=.1*m,yend=.1*m, color="gray10",linetype=3)
 }
 G+theme(legend.position='none')+gLabelSize(sz)+
  theme(plot.caption=element_text(hjust=.5))
} # Graph of security
#gSecurity(40,100,side='t')

gSquare=function(A=D,a=0,d=0,dx=1,dy=1,f=12,nl=0,lm='',lx='',ly='',lg='',m=3,t=F,mx
=0, s=1/2,ba=T,po=T,hl=T,vl=T,sp=T){
 # v:縦図,a:X 軸名角度,d:小数桁,dx,dy: X,Y 軸ドッジ段数,f:フォント, nl: 数値角度,
lm, lx, ly, lg:ラベル,
 #m:分析 1:行, 2:列, 3:行列,t: 転置,mx: 最大値(0: データ最大値), s:累乗数(1,
1/2),ba:バー,po:ポイント,hl:横線, vl:縦線,sp:スペイン式
 if(t) A=t(A); X=A # 転置 ; X:元データ
 for(i in 1:NC(A)) {A=ReplaceC(A,i,'/.*=>;.*:=>')};
 A=AsNum(A) # 数文字を取り出し数値化
 Rm=Rnd(rowMeans(A),1); Cm=Rnd(colMeans(A),1)
 if(m==1) {Mx=apply(A,1,max); A=cbind(A,M=Rm); X=cbind(X,M=Rm)} # 平均: 行
 if(m==2) {Mx=apply(A,2,max); A=rbind(A,M=Cm); X=rbind(X,M=Cm)} # 平均: 列
 if(m==3) {A=cbind(A,M=Rm); X=cbind(X,M=Rm);
A=rbind(A,M=Rnd(colMeans(A),1)); X=rbind(X,M=Rnd(colMeans(A),1))} # 平均: 行
列
 nr=NR(A); nc=NC(A); Rn=rownames(A); Cn=colnames(A); W=M2D(X,T);
D=M2D(A,T); gray='gray10'
 As1=DF(Rn,nr:1); D[,1]=ReplaceAso(D[,1],As1) # 行名を番号に
 As2=DF(Cn,1:nc); D[,2]=ReplaceAso(D[,2],As2) # 列名を番号に
 mx=ifelse(mx==0, max(D[,3]), mx); Sz=(D[,3]/mx)^s; Na=Nb=NULL # 四角の大きさ
を s 乗する
 df=DF(w1=W[,2], w2=W[,1], v1=D[,2], v2=D[,1], n=W[,3], Size=Sz, nx=D[,2]+Sz,
ny=D[,1]+Sz)
 for(i in 1:NR(df)){# 縦線用データ作成
  x=df[i,3]; if(df[i,4]!=1) y=df[i,4]-1 else y=df[i,4]
  Na[i]=df[df$v1==x & df$v2==y,]['nx'] # 縦線の開始点
  Nb[i]=df[df$v1==x & df$v2==y,]['ny'] # 縦線の終了点
 }
 Na=as.numeric(Na); Nb=as.numeric(Nb); df=cbind(df,na=Na,nb=Nb)

 if(vl & hl==F) {df[,'ny']=df[,'v2']; df[,'nb']=ifelse(df[,'v2']==1,1,df[,'v2']-1)} # 縦線の
み
 if(hl & vl==F) {df[,'nx']=df[,'v1']; df[,'na']=ifelse(df[,'v1']==1,1,df[,'v1']-1)} # 縦線の
```

み

```
 G=ggplot(df)+theme(panel.grid=gB(),
panel.background=element_rect(fill='gray95'),axis.ticks=gB())
 E=M2D(X,F);  E[,1]=ReplaceAso(E[,1],As1);  E[,2]=ReplaceAso(E[,2],As2);
E=DF(v1=E[,2], v2=E[,1]) # E:タイル用データ
 G=G+geom_tile(data=E,aes(x=v1, y=v2),fill='gray95',color='white',alpha=0.9,lwd=1) #
離散軸 =>タイル
 if(ba)  G=G+geom_rect(aes(xmin=v1-.5,  xmax=v1+Size-.5,  ymin=v2-.5,
ymax=v2+Size-.5), fill=gray, color='white', alpha=.2) # 四角
 if (nl==0) G=G+geom_text(aes(x=v1+.5-.5, y=v2+.2-.5, label=FM(n,d,sel=sp)),
hjust=.5, size=f/4, color='gray20', angle=0) # 数値 nl==0
 else G=G+geom_text(aes(x=v1+.5-.5, y=v2+.7-.5, label=FM(n,d,sel=sp)), hjust=1,
size=f/4, color='gray20', angle=90) # 数値 nl==90
 G=G+scale_x_discrete(limits=factor(1:nc), labels=Cn,guide=guide_axis(n.dodge=dx),
expand=expansion(mult=c(.01,.01)),position='top') # X 軸ラベル exp(左・右)
 G=G+scale_y_discrete(limits=factor(1:nr),  labels=rev(Rn),
guide=guide_axis(n.dodge=dy), expand=expansion(mult=c(.02,.02))) # Y 軸ラベル
exp(下・上)
 G=G+theme(axis.text.x=element_text(angle=a,  vjust=ifelse(a==0,.5,0),
hjust=ifelse(a==0,.5,0))) # X 軸ラベル
 G=G+theme(axis.text.y=element_text(vjust=.5,hjust=0, color='gray20')) # Y 軸の調整
 df=df[complete.cases(df),] # NA がある行を除去
 if(po) G=G+geom_point(aes(x=nx-.5, y=ny-.5, group=v1), color='black', size=1,
alpha=1.0) # ポイント
 if(hl) G=G+geom_line(aes(x=nx-.5, y=ny-.5, group=v2), color=gray, alpha=.3) # 横方
向線
 if(vl) G=G+geom_segment(data=df,aes(x=nx-.5, y=ny-.5, xend=na-.5, yend=nb-.5),
color=gray, linetype=4, alpha=.3) # 縦方向線
 if(m==1|m==3) G=G+geom_vline(xintercept=nc-.5, color='gray20', linewidth=.5,
alpha=1) # 縦区切り線
 if(m==2|m==3) G=G+geom_hline(yintercept=2-.5, color='gray20', linewidth=.5,
alpha=1) # 横区切り線
 if(m==1|m==3)  {w=(nr:1)+(as.numeric(A[,nc])/mx)^s;  Dc=DF(x1=rep(1,nr),
x2=rep(nc+1,nr), y1=w, y2=w)} # 列平均データ
 if(m==1|m==3)  G=G+geom_segment(data=Dc,  aes(x=x1-.5,  y=y1-.5,
xend=x2-.5,yend=y2-.5),color=gray, linetype=3, alpha=.5) # 平均横線プロット
 if(m==2|m==3)  {w=(1:nc)+(as.numeric(A[nr,])/mx)^s;  Dc=DF(x1=w,  x2=w,
y1=rep(1,nc), y2=rep(nr+1,nc))} # 列平均データ***
 if(m==2|m==3)  G=G+geom_segment(data=Dc,  aes(x=x1-.5,  y=y1-.5,
```

```
xend=x2-.5,yend=y2-.5),color=gray, linetype=3, alpha=.5) # 平均縦線プロット
 G=gF(G,f); G=gL(G,lm,lx,ly,lg,f); G+theme(plot.margin=margin(t=2, r=5, b=2, l=5,
"mm"))+coord_cartesian(clip = "off")
} # 四角グラフ Square graph

GsubD=function(s,r,D){
 for(i in 1:NC(D)){D[,i]=gsub(s,r,D[,i])}; D
} #gsub を DF で実行
#D=DF(N=V('a,b,d'), A=V('x,a,y')); GsubD('a','z',D)

gSz=function(sz) update_geom_defaults("text",list(size=sz)) #Font size

gT=function(G,X,Y){ #軸タイトル
 G+theme(line=gB(),axis.ticks=gB())
 if(Len(X)==1) G=G+theme(axis.title.y=gB(),axis.text.y=gB())
 if(Len(Y)==1) G=G+theme(axis.title.x=gB(),axis.text.x=gB()); G
}

gTile=function(D,E=NULL,d=0,c=T,a=F,dx=1,dy=1,f=10,mx=0,
           lm='',lx='',ly='',lg='',w=T){
 #E:output df,d:diagonal=0:none/1:row/2:col/3:both,c:color,a:angle-x,
 #dx,dy:dodge,f:font,lm,lx,ly,lg:label,mx:max-size,w:white
 if(is.null(E)) E=FM(D) else{rownames(E)=RN(D);colnames(E)=CN(D)}
 D=Diagonal(D,d)$df; D=D[NR(D):1,]; E=E[RN(D),CN(D)]; D=NA2zero(D)
 Rn=RN(D); Cn=CN(D); D=M2Long(D); E=M2Long(E); E$n[is.na(E$n)]='<N>'
 Z=abs(NA2zero(D[,5]));if(mx==0) mx=Max(Z); S=sqrt(Z/mx)#size of tile
 wh='white';cpos=IE(c,'skyblue','gray40');cneg=IE(c,'#ff7777',wh) #color:pos; neg
 ggplot(D, aes(x=c, y=r))+
  geom_tile(width=1, height=1,fill=wh,color='gray90')+ #tile:frame
  geom_tile(aes(fill=n),width=S,height=S,color=IE(c,wh,'gray'))+ #tile:data
  uSFG2(l=cneg,m=wh,h=cpos)+ #scale_fill_gradient2: low, mid, high
  uTX(D$c,D$r,E$n,f/3.7,a)+uSD(T,Cn,dx)+uSD(F,Rn,dy)+ #text+scale_discrete
  uTM(w,f,a,lb=T,lg=F,tl=T)+uMG(5)+uAX(a)+uLB(lm,lx,ly)
#theme+margin+axis+label
} # Tile graph: gradient
#D=DF(a=c(1,2,3,4),b=c(3,8,11,20),c=c(4,9,10,15)); D; gTile(D,d=3,c=T)

gTile2=function(D,E=NULL,d=0,c=F,a=F,dx=1,dy=1,f=13,mx=0,
           lm='',lx='',ly='',lg=''){
 #E:output df,d:diagonal=0:none/1:row/2:col/3:both,c:color,a:angle-x,
```

```
 #dx,dy:dodge,f:font,lm,lx,ly,lg:label,mx:max-size
 if(is.null(E)) E=D else{rownames(E)=RN(D);colnames(E)=CN(D)}
 D=Diagonal(D,d)$df; D=D[NR(D):1,]; E=E[RN(D),CN(D)]; D=NA2zero(D)
 Rn=RN(D);Cn=CN(D);D=M2Long(D);E=M2Long(E); E$n[is.na(E$n)]='<N>'
 Z=abs(NA2zero(D[,5]));if(mx==0) mx=Max(Z);S=(Z/mx)^(1/1)/2#四角の大きさ
 W=DF(v1=D[,4],v2=D[,3],n=D[,5],e=E[,5],sz=S) #e:ラベル
 if(c){fp='skyblue';fn='pink'} else{fp='gray90';fn='white'}#fp:positive,fn:nega
 W$e[is.na(W$n)]='<N>'; W$fl=fp; W$fl[W$n<0]=fn
 G=ggplot(W)+geom_tile(aes(x=v1,y=v2),fill='white',color='gray95',alpha=0.9,lwd=1)+
  uRT(W$v1-W$sz,W$v1+W$sz,W$v2-W$sz,W$v2+W$sz,W$fl,'gray80',.5)+
  uTX(W$v1,W$v2,W$e,f/4,a)
 G=G+uSD(T,Cn,dx)+uSD(F,Rn,dy) #scale_discrete: limit,label,dodge
 G=G+uAX(a);# axis x-y
 G=G+theme(panel.grid=gB(),axis.ticks=gB()) # no grid,ticks
 G=gF(G,f); G=gL(G,lm,lx,ly,lg,f); G+uMG(5)#font, label, margin
} # Tile graph: square
#D=DF(a=c(1,2,3,4),b=c(3,8,11,20),c=c(4,9,10,15)); D; gTileDC2(D,d=3)

gTx=function(x,y,lab,color='black',hj=0){
 geom_text(x=x,y=y,label=lab,color=color,hjust=hj)}

gV=function(G,v){if(v) G+coord_flip() else G}#縦図

gVl=function(x,lt,cr,al=1)        geom_vline(xintercept=x,linetype=lt,color=cr,alpha=al)
#Vline

gZ=function(G,z,s=F){if(z) G+expand_limits(y=0) else G}#ゼロ開始軸

#### H ####

HM=function(A) Len(A)/sum(1/A) #harmonic mean HM(c(40,100))

#### I ####

ID=function(Vt){
 Vt=sort(Vt); len=Len(Vt); Vt[1]*(1/Vt[2]-sum(1/Vt[3:len]))
} # Index of directionality 方向性指標 (Vt: vector numerico)

IE=function(c,x,y) if(c) x else y #like ifelse
```

```
IF=function(c,a,x) ifelse(c,x,ifelse(!c,a,NULL)) #if (c) a <- x

Impute=function(X,f=mean,s=1){ #f=mean, median, s=1:行,2:列,3:全
 #X=AsNum(X);
 W=X; Id=which(is.na(X), arr.ind=T)
 if(s==1|s==2) {
  for(i in 1:NR(Id)){
   if(s==1) W[Id[i,1],Id[i,2]]=f(X[Id[i,1],], na.rm=T)
   if(s==2) W[Id[i,1],Id[i,2]]=f(X[,Id[i,2]], na.rm=T)
  }
 }else W[Id]=median(X, na.rm=T); W
} #欠損値補完 Imputation of missing value by mean/median

ImputeN=function(X,s=1){ #f=mean, median, s=1:行,2:列,3:全
 X=AsNum(X); nr=NR(X); nc=NC(X); W=X; Id=which(is.na(X), arr.ind=T)
 for(i in 1:NR(Id)){
  r=Id[i,1]; c=Id[i,2]; cc=cr=2
  if(c==1) {r1=0; cr=cr-1} else if(is.na(X[r,c-1])) {r1=0; cr=cr-1} else r1=X[r,c-1]
  if(c==nc) {r2=0; cr=cr-1} else if(is.na(X[r,c+1])) {r2=0; cr=cr-1} else r2=X[r,c+1]
  if(r==1) {c1=0; cc=cc-1} else if(is.na(X[r-1,c])) {c1=0; cc=cc-1} else c1=X[r-1,c]
  if(r==nr) {c2=0; cc=cc-1} else if(is.na(X[r+1,c])) {c2=0; cc=cc-1} else c2=X[r+1,c]
  if(s==1) W[r,c]=(r1+r2)/cr
  if(s==2) W[r,c]=(c1+c2)/cc
  if(s==3) W[r,c]=(c1+c2+r1+r2)/(cc+cr)
 }; W
} #欠損値補完: 隣接値 Impute missing data by neighborhood

Index=function(A,B){R=NULL;for(i in 1:Len(A))R=c(R,which(B==A[i]));R}
#A=c(8,7); B=c(1,5,8,3,7,8); Index(A,B) #index of A in B: 3 6 7

Ineq=function(Vt){
 m=max(Vt); s=sum(Vt); n=Len(Vt); 1-(s-m)/(m*(n-1))
} # Inequality 不平等性 (Vt: 数値ベクトル)

Info=function(A, sel=F){ #A: 数値ベクトル(配列) sel=T: relative, F: absolute
 s=sum(A); r=0; len=Len(A); if(len==1) return(0)
 for(i in 1:len){
  p=A[i]/s; r=r-p*log2(p)
 }; if (sel) r/log2(len) else r
} # Information (statistic)
```

```
IniSch=function(Str,Ini){
 R=rep('N',Len(Str))
 for(i in 1:Len(Str)){for(j in 1:Len(Ini)){
  if(str_detect(Str[i],Add('^',Ini[j]))){R[i]=Ini[j]}}}; R #語頭一致
} #語頭探索 initial search (Str:対象文字ベクトル, Ini:探索文字ベクトル)

Init=function(str,A){A[grepl('^'&str,A)][1]}
#Init('A',c('Name','Age','Gen')) #=>'Age'

Initial=function(A) {
 A1=substr(A,1,1); A2=table(A1)
 B2=rep(0,Len(A2)); names(B2)=names(A2)
 for(i in 1:Len(A1)){
  x=A1[i]; if(A2[x]>1) {B2[x]=B2[x]+1; A1[i]=x&B2[x]}
 }; A1
} #語頭文字 a1, a2, b, c, c2
#A=c("app", "ba", "ore", "av", "blu"); Initial(A)

InitPos=function(S, B){
 W=sapply('^'&S, function(x) grep(x,B)[1]); W[is.na(W)]=0; W
} # 語頭が一致する要素の位置 S: サーチ配列, B: ベース配列(基準)

InsertBlank=function(V,re='^@') {
 L=list(); n=1
 for(line in V) {
  if (grepl(re, line)) {L[[n]]="";n=n + 1}
  L[[n]]=line; n=n + 1
 }; unlist(L)}
#V=c("Line 1","@Line 2", "Line 3"); InsertBlank(V)

Intersec=function(D,b=0){ # Intersections of df(A,B,...)
 R=NULL; if(b>0) D=log(D,b)
 for(i in 1:(NC(D)-1)){for(j in (i+1):NC(D)){
  A=D[,i];B=D[,j]; X=1:NR(D); C=which(diff(sign(A-B))!=0) #C:cross
  It=lapply(C,function(i){ #It:intersections
   x1=X[i]; x2=X[i+1]; a1=A[i]; a2=A[i+1]; b1=B[i]; b2=B[i+1]
   s1=(a2-a1)/(x2-x1); s2=(b2-b1)/(x2-x1) #s1,s2:slope
   i1=a1-s1*x1; i2=b1-s2*x1; X=(i2-i1)/(s1-s2); Y=s1*X+i1 #i1,i2:intercept
   DF(x=X,y=Y)}); R=rbind(R,do.call(rbind,It))}}
```

```
 if(b>0) R[,2]=b^R[,2]
 R}
# D=DF(A=c(3,7,11,13,17,5,2,1),B=c(25,20,15,10,5,3,3,3));D
# Intersec(D)

IP=function(f='',S=NULL,t=T,rn=F,cn=T){
 Right=function(s,n){nc=nchar(s); x=nc-n+1; substr(s,x,nc)}
 if(f=='') D=IpCopy(rn,cn,t) #Clipboard
 else if(Right(f,4)=='xlsx') D=IpExcel(f,S) #Excel file
 else if(t) D=read.csv(f, sep='¥t',fileEncoding='UTF-8',na.strings="") #txt (csv)
 else D=readLines(f,encoding='UTF-8') #txt file (lines)
 D=DF(D)
 if(rn==T) {rownames(D)=D[,1]; D=D[,-1]} #with row names
 if(cn==F) {D=rbind(CN(D),D); colnames(D)=1:NC(D)} #with no col names
 for(i in 1:NC(D)) if(all(IsNumeric(D[,i]))) D[,i]=as.numeric(D[,i])
 colnames(D)=ReplA(colnames(D),'X¥¥d+¥¥.=>')
 if(NC(D)==1) D=D[,1]
 print(L(D)); D
} #S: Excel sheet, t: tab separated value, rn:row name, cn:col name
# Input Ip(): clipboard, f='x.xlsx': Excel, f='x.txt': txt file, rn:rowname, cn:colname
# D=IP('Inma/correl.txt',rn=T); L(D)
# D=IP('DQ/DQ-Tx.xlsx','Tx'); L(D) # 5 sec
# D=IP(); L(D)

IpCopy=function(rn=F,cn=T,t=T){
 win=Sys.info()[1]=="Windows"
 if(win) {
  if(t) D=read.table(text=readClipboard(),sep="¥t",header=T, fill=T,quote = "¥b")
  else {D=readClipboard(); return(D[-1])} # text
 }else D=read.table(pipe('pbpaste'),header=T)
 D=DF(D)
 if(rn==T) {rownames(D)=D[,1]; D=D[,-1]} #行名あり
 if(cn==F) {D=rbind(CN(D),D); colnames(D)=1:NC(D)} #列名なし
 for(i in 1:NC(D)){
  if(all(IsNumeric(D[,i]))) D[,i]=as.numeric(D[,i])
 }; D
} #IpCopy()

IpExcel=function(f,S){
 PathExcel=function(path, sheet=NULL, rn=F,cn=T){
```

```
  library(readxl); temp=tempfile(fileext=".xlsx")
  cmd=paste0("powershell -command ¥"Copy-Item '",gsub("/","¥¥¥¥",path),
        "' -Destination '",temp,"'¥"")
  error_code=system(cmd)
  D=read_xlsx(path=temp, sheet=sheet)
  D=DF(D)
  if(rn==T) {rownames(D)=D[,1]; D=D[,-1]} #with RN
  if(cn==F) {D=rbind(CN(D),D); colnames(D)=1:NC(D)} #without CN
  D
 } # Path to Excel file
 if(!is.null(S)) print(S[1])
 D=PathExcel(f,S[1],rn=F) # INPUT 40 sec
 for(s in S[-1]){
  print(s); E=PathExcel(f,s,rn=F) # INPUT 40 sec
  colnames(E)=CN(D); D=rbind(D, E)
 }; D
} #Input Excel file (f:book name, S:sheet name)

Ipj=function(fn='clipboard'){
 con=file(fn,encoding='UTF-8'); on.exit(close(con))
 ln=readLines(con); nr=Len(ln); nc=Len(Split(ln[1],'¥t'))
 mt=Split(ln,'¥t'); mm=matrix(0,nr,nc)
 k=0; for(i in 1:nr){for(j in 1:nc){k=k+1; mm[i,j]=mt[k]}}
 dd=mm[-1,-1]; R=as.numeric(dd); R=matrix(R,NR(dd))
 rownames(R)=mm[-1,1]; colnames(R)=mm[1,-1]; R
}#データ入力 (fn: 日本語 tsv)

Ipm=function(fn=''){
 if(fn=='') E=read.table(pipe('pbpaste'),header=T) #コピーデータ MAC
 if(fn==1){E=read.table(file.choose(),header=T,sep='¥t',encoding='UTF-8') #ファイル
選択
 }else {E=read.table(fn,header=T,sep='¥t',encoding='UTF-8')} #ファイル指定
 if(IsStrM(E[,-1])){ #データフレーム
  return(E)
 }else{ #数値行列
  R=as.numeric(as.matrix(E[,-1])); R=matrix(R,NR(E)) #行列化
  colnames(R)=CN(E[,-1]); rownames(R)=E[,1]; return(R)
 }
} #データ入力(MAC) Ip():コピーデータ, Ip(1):ファイル選択, Ip('x.txt'):ファイル指
定
```

```
IpWord=function(D){
 #install.packages("officer") #read_docx
 library(officer); library(dplyr)
 content=docx_summary(read_docx(D))
 filter(content, content_type=="paragraph")$text
} #IpWord("Inma/QA.docx")

IsD=function(E=D)'data.frame'%in%class(E) #DF 判定

IsIn=function(x, C){x %in% R
} # x が配列 C に存在: x in C =>T

IsJp=function(C){T %in% str_detect(C,'¥¥p{Hiragana}|¥¥p{Katakana}|¥¥p{Han}')
} #配列 C|str に日本語が存在

IsJpD=function(E=D){
 flg=F
 for(i in 1:min(NR(E),5)){
  for(j in 1:min(NC(E),5)){
   if(IsJp(E[i,j])) {flg=T; break}
  }}; flg
} #D:df,mt に日本語が存在

IsM=function(E=D){'matrix' %in% class(E)
} #matrix 判定

IsN=function(E=D){!IsM(E)&!IsD(E)&!IsT(E)
} #数値(スカラー)判定

IsNum=function(x){all(x!='') & all(gsub('(¥¥d+|[0-9.,]+| +)','',x)=='')}
#数値判定('1.2'=>T)

IsNumA=function(A){
 all(A!='') & all(gsub('(¥¥d+|[0-9.,]+| +)','',A)=='')
} #数値判定 A(ベクトル)
# A=c(1,2,3); IsNumA(A))
# A=VT('25, 30, 22, 28'); IsNumA(A)

IsNumCol=function(D){
```

```
 A=NULL; for(i in 1:NC(D)){A[i]=IsNumA(D[,i])}; which(A)
} #数値列の番号ベクトル
#D=DF(K=VT('a,b,c'), A=c(2,3,7)); IsNumCol(D)

IsNumD=function(D){
 all(D!='') & all(GsubD('(¥¥d+|[0-9.,]+| +)','',D)=='')
} #数値判定 D('1.2'=>T)
# D=DF(N=c(1,2,3), A=c(2,3,7)); IsNumD(D)
# D=DF(N=VT('1,2,3'), A=VT('2,3,7')); IsNumD(D)

IsNumeric=function(str) !is.na(suppressWarnings(as.numeric(str)))
#数値判定(文字型を含む, ex:'123')

IsStr=function(x){!IsNum(x)
} #文字判定

IsStrA=function(A){f=F; for (i in A){if(IsStr(i)){f=T; break}}; f
} #文字判定 (配列)

IsStrM=function(X){f=F; for (i in 1:NR(X)){ for (j in 1:NC(X)){
 if(IsStr(X[i,j])){f=T; break}
}; if(f){break} }; f
} #文字判定 (行列)

IsT=function(E=D){'table' %in% class(E)
} #table 判定

#### J ####

Join=function(A,s=','){paste(A,collapse=s)} #配列要素を s で繋ぐ

JoinC=function(df,x,sep=',') do.call(paste,c(df[x],sep=sep))
#df の col 列を sep で結合して文字ベクトルを返す

JP=function() Sys.setlocale("LC_ALL", 'Japanese_Japan.932') #日本語文字設定

JustD=function(R=D, z=F){ #v.2021-12026
 X=Trim(N2S(R))
 for(i in 1:NC(X)){intmx=0; decmx=0
 for(j in 1:NR(X)){s=X[j,i]
```

```
 if(IsNum(s)&Detect(s,'¥¥.')) {
  intx=nchar(Extract(s,' *(¥¥d+)¥¥.'))
  decx=nchar(Extract(s,'¥¥.(¥¥d+)$'))
 }else{intx=nchar(s); decx=0}
 if(intx>intmx) {intmx=intx}
 if(decx>decmx) {decmx=decx}
 }
 for(j in 1:NR(X)){s=X[j,i]
 if(IsNum(s)&Detect(s,'¥¥.')) {
  intx=nchar(Extract(s,' *(¥¥d+)¥¥.'))
  decx=nchar(Extract(s,'¥¥.(¥¥d+)$'))
  if(z) X[j,i]=Add(RepStr(' ',intmx-intx),s,RepStr('0',decmx-decx))
  if(!z) X[j,i]=Add(RepStr(' ',intmx-intx),s,RepStr(' ',decmx-decx))
 }
 if(IsNum(s)&!Detect(s,'¥¥.')) {
  intx=nchar(s)
  if(z) X[j,i]=Add(RepStr(' ',intmx-intx),s,' ',RepStr('0',decmx))
  if(!z) X[j,i]=Add(RepStr(' ',intmx-intx),s,RepStr(' ',decmx))
 }
 }
 }; noquote(X)
} #小数点揃え  justification by decimal point

JustR=function(X){
 for(i in 1:NC(X)){
  X[,i]=as.character(X[,i]); X[is.na(X)]='NA'
  m=max(nchar(X[,i]),nchar(colnames(X)[i]))
  X[,i]=sprintf('%'&m&'s', X[,i])
  colnames(X)[i]=sprintf('%'&m&'s', colnames(X)[i])
 }; noquote(X)
} #小数数値行列を右揃え

JustRrownames=function(X){
 rownames(X)=as.character(rownames(X))
 m=max(nchar(rownames(X)))
 rownames(X)=sprintf('%'&m&'s', rownames(X)); X
} #行名を右揃え

#### K ####
```

```
Kurt.r=function(A){n=Len(A); return(Kurt(A)*(n-1)/(n*n-3*n+3))}
#相対尖度 Relative Kurtosis

Kurt=function(A) Mean((A-Mean(A))^4)/(SDp(A)^4) #尖度

Kwic=function(D,re,cs=F,ct=50){
 #D[,1]: Tx, D[,2~]: Parameter, re:正規表現, cs:大小文字区別, ct:文脈文字数
 A=K=P=I=NULL; n=0; nr=NR(D) #stringr
 for(i in 1:nr){
  print(i&' / '&nr)
  tx=D[i,1]; Lc=ReLocate(tx,re,cs); if(Len(Lc)==0) next
  for(j in 1:NR(Lc)){
   p1=Lc[j,1]; p2=Lc[j,2]; n=n+1
   ant=Right(Left(tx,p1-1),ct)
   A[n]=ifelse(nchar(ant)>ct-10, CutLeft(ant), ant)
   K[n]=Mid(tx,p1,p2-p1+1)
   pos=Left(Mid(tx,p2+1),ct)
   P[n]=ifelse(nchar(pos)>ct-10, CutRight(pos), pos)
   #I=rbind(I,D[i,-1])
   I[n]=D[i,2] #ID
  } #j
 } #i
 if(ct==0) DF(I,K) else DF(I,A,K,P)
} # KWIC コンコーダンス

Kwic2Tex=function(D,col_i,col_k){
 library(dplyr); D=DF(I=D[,col_i],K=D[,col_k])
 D%>%group_by(I)%>%summarise(K=paste(K,collapse=" "))%>%ungroup()
} #Kwic から Text へ
# D=cbind(Id=c("x","x","y","y","y","y"),Kw=c("a","b","c","d","e","f"))
# Kwic2Tex(D,1,2) #=>cbind(I=c("x","y"), K=c("a b", "c d e f"))
# Kwic2Tex=function(D,col_kw,col_id){
# as.vector(tapply(D[,col_kw],D[,col_id],function(x) paste(x,collapse=" ")))
# } #KWIC から text へ
# # D=cbind(Id=c("x","x","y","y","y","y"),Kw=c("a","b","c","d","e","f"))
# # Kwic2Tex(D,2,1) #=>"a b", "c d e f"

KwicAll=function(D) {
 Kw=lapply(seq_len(NR(D)),function(i) {
  tx=gsub("(¥¥W)"," ¥¥1 ",D[i,2]); tx=trimws(gsub("¥¥s+"," ",tx))
```

```
   W=unlist(strsplit(tx, "¥¥s+"))
   DF(
    id=rep(D[i,1],Len(W)),
    ant=c("",head(W, -1)),kw =W,pos=c(tail(W, -1),"")
   )
  })
  do.call(rbind, Kw)
} #KWIC-all words
#D=DF(id=c(1,2,3),text = c("x y","xx yyy z","(¿dd?)")); D; KwicAll(D)

#### L ####

L=function(D,r=3,l=0,t=F,cn=F,n=F,cl=F){
  #r:num of rows, l:limit,t:tail, cn:col.num, n: row/col names, cl:class
  if (Len(D)==0) return('None')
  if(is.vector(D)){
   cat(' # Class:', class(D), ' / Length:',format(Len(D),big.mark=","))
  } else{ # data frame
   cat('# Name:', deparse(substitute(D)),' / Class:', class(D))
   if(cn) colnames(D)=1:NC(D) & '.' & CN(D)
   if(!is.null(NR(D))&!is.null(NC(D))){
    cat(' / Rows:',format(NR(D),big.mark=","),'/ Cols:', NC(D))
    if(n){
     cat('¥n#Row names:', 1:min(NR(D),3)&'.'&RN(D)[1:min(NR(D),3)],
        '...',NR(D)&'.'&RN(D)[NR(D)])
     cat('¥n#Col names:', 1:NC(D)&'.'&CN(D)&'.'&class(D[]))
    }
    if(cl){
     A=sapply(D, class); Ps=paste(names(A)&': '&A, collapse = ", ")
     cat('¥n#Col class:', Ps)
    }
   }
  }
  cat('¥n¥n')
  if(!t) D=head(D,r) else D=tail(D,r)
  if (l==0) return(D)
  D[]=lapply(D,function(x)ifelse(is.character(x)& nchar(x)>l,substr(x,1,l)&"..",x));D
} #Look

L2M=function(df=D,t=F){
```

```
 R=NULL
 for(i in 2:NC(D)){
  X=xtabs(~df[,1]+df[,i])
  if(t) colnames(X)=paste0(CN(df)[i],'.',CN(X))
  R=cbind(R,X)
 }; R
} #文字行列(D:ex.santander.txt)=>数値行列

Ldi=function(A=D){n=Len(A); mx=max(A); (mx*n - sum(A)) / (mx*(n - 1))}
#L 字分布係数 (L-shaped distribution index)

Left=function(str,num){
 substr(str, 1, num)
} #文字列左 izquierda de secuencia de letras

LeftAr=function(A,len=10){
 B=sapply(A,function(x)Left(x,len));names(B)=NULL;B
} # 配列 A の要素の右側(文字数:len)
#A=c("abcdefg","123456"); LeftAr(A,3) #"abc" "123"

Len=function(x){
 if(class(x)=='data.frame'|class(x)=='matrix') {
  if(NR(x)==1) NC(x) else NR(x)
 } else length(x)
} # lengthod df/vt/scalar

Library=function(){
 library(BSDA);library(clipr);library(data.table);library(dplyr);
 library(knitr);library(ggplot2);library(ggrepel);library(ggtext);
 library(gplots);library(grid);library(gridExtra);library(lattice);
 library(leaflet);library(magrittr);library(maptools);library(MASS);
 library(patchwork);library(pheatmap);library(psych);library(pwr);
 library(RColorBrewer);library(reshape2);library(scales);library(slanter);
 library(stats);library(stringr);library(stringi);library(stringdist);
 library(tidyr);library(tidyverse);library(vcd);library(viridis);
 library(combinat)
}

Linea=function(l='-',n=5){
 a=paste(rep(l,n), sep = "", collapse = ""); cat(paste(a, "¥n"))
```

```
} #線 Línea

List=function(D,s1=' ', s2=', '){
 if(NC(D)==1) D=Move(D)
 W1=D[,1] & s1 & D[,2]; Join(W1,s2)&'.'
} # 1 列+2 列をコンマで繋いでリストにする

List2Df=function(Lt){
 df=NULL; for(i in 1:Len(Lt)){
  df=rbind(df,DF(Lt[[i]], names(Lt)[i]))
 }; df
} #List to DF

ListFunction=function(){
 D=IP(t=F,rn=F,cn=F); D=D[-1]
 E=Repl(D,'^([a-z0-9.]+=function)=>@¥¥1:T,^####=>@####')
 E=paste(E, collapse="¥n"); E=Repl(E,"¥n(?!@)=>
")
 E<- unlist(strsplit(E, "¥n"))
 E=Repl(E,"#### ([A-Z]) ####=>¥¥1 ####,=function=>=function, => ")
 E=sort(E); E=Repl(E,"=function=>=function,@(.) ####=>@#### ¥¥1 ####")
 E=unlist(strsplit(E,"
")); E=InsertBlank(E); E=Repl(E,"^@=>")
 Copy(E,rn=F,cn=F)}
# List of functions. 1. Copy functions(F.R), 2. ListFunction(), 3.Paste

ListTotal=function(F1){
 li=List(F1)
 tt='. Total (' & NR(F1) & ' lemas, ' & sum(F1[,'frec']) & ' formas).'
 C(li&tt,F,F)
} # 頻度データ (Freq) => リスト=> ペースト

ListTotalGm=function(F1){
 F3=F2=F1
 F2[,2]=Rnd(1-F2[,2]/max(F2[,2]),3) # 有標度 (GM)
 F3[,2]=F1[,2]&' ('&F2[,2]&')'
 li=List(F3)
 tt=', Total (' & NR(F1) & ' lemas, ' & sum(F1[,'frec']) & ' formas).'
 C(li&tt,F,F)
} # 頻度データ (Freq) => リスト＋計 ＋計 (Gm) Grado de marcacion => ペースト
```

```
ListWordVal=function(D){
 Lt=NULL
 for(i in CN(D)){
  E=Grep(D,i,'>.99'); s='¥r¥n['&i&'] '; E=SortC(E,i,T)
  if(NR(E)>0) for(j in 1:NR(E))s=s&RN(E)[j]&' ('&Fm(E[j,i],3)&'), '
  Lt[[i]]=ReplaceStr(s,', $=>.')
 }; Lt
}

Llenar=function(Ar,f=' ',s=2){ # f:埋める文字, s=1:前に埋める; =2:後に埋める
 Nc=nchar(Ar); m=max(Nc); Dc=m-Nc; Wr=Ar
 for(i in 1:Len(Ar)){
  if(s==1) Wr[i]=Concat(rep(f, Dc[i]),'') & Ar[i]
  if(s==2) Wr[i]=Ar[i] & Concat(rep(f, Dc[i]),'')
 }; Wr
} #空白(など)を埋める

LLR=function(a,b,c,d){
 df=matrix(c(a,b,c,d),2,2,T)
 if(df[1,1]==0){return(0)} else{2*sum(df*(log(df/Exp(df))))}
} # 対数尤度比(2x2) (LLR(2x2): Log Likelihood Ratio)

LLRdf=function(df){
 R=df; Rs=RowSums(df); Cs=ColSums(df); t=sum(df)
 for(i in 1:NR(df)){for(j in 1:NC(df)){
  a=df[i,j]; b=Cs[j]-a; c=Rs[i]-a; d=t-a-b-c
  R[i,j]=LLR(a,b,c,d)#log(0)=>log(1)
 }}; R
} #対数尤度比（データフレーム）

Log1=function(x, b=10) log(x+1, b) # 1 プラス対数  logarithm of 1 plus with base:b

Log9=function(A) {A=log(A); (A-min(A))/(max(A)-min(A))*9}
# A to log [0,9] ex.: A=c(100,50,20,5,2,1); Log9(A)

LookUp=function(D1, D2, C1=1, C2=1) {
 if(Len(C1)==1) D1x=D1[,C1] else D1x=do.call(paste,c(D1[,C1],sep='-'))
 if(Len(C1)==1) D2x=D2[,C2] else D2x=do.call(paste,c(D2[,C2],sep='-'))
 D1=cbind(v1=D1x,D1)
```

```
 CN2=names(D2)[-C2]
 D2=DF(v2=D2x,D2[,-C2])
 names(D2)=c('v2',CN2)
 D2=distinct(D2, v2, .keep_all=T)
 library(dplyr); R=left_join(D1,D2,by=c("v1"="v2"))
 R[,-1]
} #D1 の列 C1 と D2 の C2 が一致すれば D2 のデータを繋ぐ

LS=function(D,s=3){
 Mx=AP(D,s,Max); Mn=AP(D,s,Min); MV(MV(D,Mn,'s'),Mx-Mn)
} #限定得点(s=1:行, 2:列, 3:全)

Lyneal2Data=function(D){
 A=Sch(D,'ID::',1,1); ln=Len(A); A=D[,1]; M=matrix(0,Len(A),2)
 for(i in 1:Len(A)){
  Sp=Sep(A[i],'::'); M[i,1]=Sp[1]; M[i,2]=Sp[2]
 }; Un=unique(M[,1]); R=matrix(0,ln,Len(Un)); n=0
 for(i in 1:NR(M)){
  w=Where(M[i,1],Un); if(M[i,1]=='ID') n=n+1; R[n,w]=M[i,2]
 }; colnames(R)=Un; R[,c(8,1:7)]
} #Lyneal data to data for Kwic

Lyneal2Df=function(A){
 Lyn2D=function(A,IR){
  lx=Len(A); ly=Len(IR)
  for(i in 1:ly){
   S=unlist(strsplit(IR[i],"::")); x=as.numeric(S[1]); a=S[2]
   if(i<ly) {S=unlist(strsplit(IR[i+1],"::")); y=as.numeric(S[1])} else y=lx
   A[x:y]=a
  }; A
 } #A=1:10; IR=c('3::a','5::b'); Lyn2D(A,IR)
 G=Grep(A,1,"^##"); G=SplitA(G,"::"); U=unique(G[,1]); D=A
 for(i in Len(U):1){
  u=U[i]; G1=Grep(G,1,u); I=FindIndex(A,u); R=ReplA(A[I],u&'=>')
  D=cbind(Lyn2D(A,I&R),D)
 }; R=FindIndex(A,"^##"); D=D[-R,]
 D=DF(D)
 rownames(D)=1:NR(D); colnames(D)=c(ReplA(U,'^##=>'),'Tx'); D
} #LYNEAL 形式の文字ベクトル(##Folio::1r, ##Cap::1)=>DF, Lyneal2Df(A)
```

```
#### M ####

M.mean=function(V){ # Majority mean. V:vt
 n=Len(V); w=floor((n+1)/2); e=floor((n+2)/2); M=NULL
 for(i in 1:e){W=V[i:(i+w-1)]; M[i]=Mean(W)}; Mean(M)}
#V=c(1,2,4,5,55); M.mean(V) # 9.111111

M2D=function(X=D,rm=F){
 X[is.na(X)] = ""
 if(NC(X)==1){ #ベクトル
  n=NR(X); R=matrix(0,n,2)
  R=DF(v1=RN(X),n=X[,1])
  rownames(R)=1:n
 }else{ #行列
  n=NR(X); p=NC(X); np=n*p; R=matrix(0,np,3); k=0
  for (i in 1:n){ for (j in 1:p){
   if(rm && X[i,j]=='') next else k=k+1
   rn=IE(is.null(RN(X)),'*',RN(X)[i])
   cn=IE(is.null(CN(X)),'*',CN(X)[j])
   R[k,1]=rn; R[k,2]=cn; R[k,3]=X[i,j]
  }}
  rownames(R)=1:np; colnames(R)=c('v1','v2','n'); R=DF(R)
  #R[,3]=as.numeric(R[,3])
  if(IsNum(R[,3])[1]) R[,3]=as.numeric(R[,3])
  R=R[1:k,]
 }; R
} #Matrix=>data frame

M2Dn=function(X=D){
 n=NR(X); p=NC(X); np=n*p; R=matrix(0,np,3); k=0
 for (i in 1:n){ for (j in 1:p){ k=k+1
 R[k,1]=i; R[k,2]=j; R[k,3]=X[i,j]
 }}; rownames(R)=1:np; colnames(R)=c('v1','v2','n'); DF(R)
} #Matrix=>data frame (numeric)

M2M=function(M=D,R=NULL,C=NULL){
 M=as.matrix(M)
 if(is.null(R)||R==0) R=1:NR(M) #R=NULL or R=1 ならは全行
 if(is.null(C)||C==0) C=1:NC(M) #C=NULL or C=1 ならは全列
 W=as.matrix(M[R,C])
```

```
 if(Len(R)>1 & Len(C)==1) colnames(W)=CN(M)[C]
 if(Len(R)==1 & Len(C)>1){colnames(W)=RN(M)[R]; W=t(W)}
 if(Len(R)==1 & Len(C)==1){
  rownames(W)=RN(M)[R]; colnames(W)=CN(M)[C]
 }; W
} #行列 M の要素 R 行(複数), C 列(複数)

M2S=function(X=D){
 B=rbind(as.character(CN(X)),X)  #列名=>表頭
 B=cbind(c('*',RN(X)),B)#行名=>表側
 str=''; for(i in 1:NR(B)){for(j in 1:NC(B)){
  if(j==1) str=Add(str,B[i,j]) else str=Add(str,'¥t',B[i,j])
  # }; str=Add(str,'¥r¥n')}; Encoding(str)='UTF-8'; str
 }; str=Add(str,'¥n')}; Encoding(str)='UTF-8'; str
} #行列=>文字列(TSV)

MakeRef=function(D){
 Ft=function(E){
  library(dplyr) #for count, distinct
  nc=NC(E); E=count(E,E[,1:nc]) #UniqSum
  A=c(rep(F,nc-1),T); E=Sort(E,1:nc,A)
  E=distinct(E,E[,1:nc], .keep_all=T)
  E=SortM(E,nc+1,F)
 }; Li=list(); Col=list(1:5,1:4,2:5,2:4,1:3,3:5,2:3,3:4,3); n=NC(D)
 for(i in 1:9){print(paste(i,'/ 9')); Li[[i]]=Ft(D[,c(Col[[i]],6:n)])}; Li
} # Reference data

MakeTb=function(Mt=D,Vt=Ps,sel=1,m=100){
 Vt=DF(Vt); sel2=1; if(NC(Vt)>1) sel2=2
 for(i in 1:NR(Mt)){for(j in 1:NC(Mt)){
  if(sel==1) {
   if(sel2==1) Mt[i,j]=Mt[i,j]/Vt[i,1]*m # 相対頻度 (m=100:パーセント)
   if(sel2==2) Mt[i,j]=Mt[i,j]/Vt[i,j]*m # 相対頻度 (m=100:パーセント) mx.mx
  }
  if(sel==2) {
   if(sel2==1) Mt[i,j]=BinE(Mt[i,j],Vt[i,1])*m # 確率頻度
   if(sel2==2) Mt[i,j]=BinE(Mt[i,j],Vt[i,j])*m # 確率頻度 mx.mx
  }
 }}; Mt
} # テーブル作成 (Mt: 行列 Vt: 1 列行列 sel=1: 相対頻度, =2: 確率頻度, m : 乗
```

数)

```
Match=function(re,tx,ic=T,fx=F) grepl(re,tx,ic,perl=T,fixed=fx)
# Match by regex, re:regex,tx:text (include vt),ic=ignore-cas,fx:fixed
#Match=function(r,str){regexpr(r,str)[1]>0} #パタンマッチ=>T/F

MatchRows=function(D,col,Str) which(D[, col] %in% Str)
#特定の文字列と一致する行の番号を取得 Str:c('X','Y')

Matrix=function(A,r,c){M=matrix(A,r,c,T);rownames(M)='r'&1:r;colnames(M)='c'&1:c;
M}

MATRIX=function(n,r,c){
 M=DF(matrix(0,r,c)); rownames(M)='r'&1:r; colnames(M)='c'&1:c ;M
} #data frame of matrix form

Max=function(...) max(...,na.rm=T) #NaN を除く

MaxCol=function(D){ #Max in col
 res=lapply(1:ncol(D), function(i) {
  V=D[,i]; max_row=which.max(V)
  list(col=i, row=max_row, val=V[max_row])
 }); do.call(rbind,lapply(res,as.data.frame))}
#D=DF(A=c(1,5,3),B=c(4,2,6),C=c(7,0,9)); D; MaxCol(D)

MaxDf=function(D) which(D==max(D),arr.ind=T) #Max in df
#MaxDf(D)

McaCd=function(D){
 MC=mca(D); CS=MC$cs; R=MC$d #CS: カラムスコア (2 軸) R:相関係数
 Rnd(D(XR=CS[,1]*R[1],YR=CS[,2]*R[2]),3) #出力
} #多重対応分析 2 軸の座標

McaEv=function(D){
 nf=1; for (i in 1:NC(D)){nf=nf*(Len(unique(D[,i]))-1)}
 MC=mca(D,nf); R=MC$d; E=R^2; P=E/sum(E); C=cumsum(P)
 #R:相関係数,E:固有値,P:寄与率,C:累積寄与率
 D(E=Rnd(E,3),R=Rnd(R,3),P=perc(P),C=perc(C)) #出力
} #多重対応分析 R:相関係数,E:固有値,P:寄与率,C:累積寄与率
```

```
Mdv=function(A) {mean(abs(A-mean(A)))} # 平均偏差 Mean deviation

Mean=function(D) mean(unlist(D),na.rm=T) #NaN を除く

MeanFreqDistD=function(D){
 D=DF(D)
 nr=NR(D); nc=NC(D); M=NULL
 for(i in 1:nc) M[i]=sum(1:nr*D[,i])/sum(D[,i]) #M: mean vector
 M
} #Mean of Freq. dist. in DF

MeanMedianContrast=function(A){
 me=mean(A,na.rm=T); md=median(A,na.rm=T); (me-md)/(me+md)
} #平均値:中央値の対照値 Mean median contrast

Median=function(D) median(unlist(D),na.rm=T) #NaN を除く

Memory=function(D){
 n=0; Obj=NULL; Siz=NULL
 for (obj in D) {
  siz=object.size(get(obj)); n=n+1; Obj[n]=obj; Siz[n]=round(siz/1024,0)
 }; D=DF(Obj,Siz); D=SortC(D,2,T); rownames(D)=1:NR(D); D
} #全オブジェクトのメモリ: Memory(ls())

Merge=function(D,E,k) merge(D,E,by=1:k,all.x=T) # 複数キー(1:k)で結合
# D=DF(a=c("A","B","C"),b=c(1, 2, 3),v1=c(10, 20, 30)); D
# E=DF(x=c("X","C","A"),y=c(2, 3, 1),v2=c(200, 350, 110)); E
# Merge(D,E,2)

MERGE=function(D,E,k){
 print("1/3"); M=merge(D,E,by=1:k,all.x=T) #merge
 print("2/3"); W=unique(which(is.na(M), arr.ind=T)[,1]) #position of NA
 print("3/3"); M1=M[-W,]; M1=DuplicateDel(M1,1:NC(D))
 M2=M[W,][,1:NC(D)]; list(M1, M2)
} # Merge => list
# D=DF(a=c("A","B","C"),b=c(1,2,3),c=c(1,2,9),v1=c(10, 20, 30)); D
# E=DF(x=c("X","C","A"),y=c(2,3,1),z=c(2,3,8),v2=c(200, 350, 110)); E
# M=MERGE(D,E,2); M[[1]]; M[[2]]

MetaFunc1=function(Ft,a1){
```

```
 W=NULL; n=0; for(i in a1) {n=n+1; W[n]=Ft(i)}; W
} #メタ関数-1 (s=1:zero based vector)

MetaFunc2=function(Ft,a1,a2){
 W=NULL; n=0; for(i in a1) {n=n+1; W[n]=Ft(i,a2)}; W
} #メタ関数-2 (s=1:zero based vector)

MetaFunc3=function(Ft,a1,a2,a3){
 W=NULL; n=0; for(i in a1) {n=n+1; W[n]=Ft(i,a2,a3)}; W
} #メタ関数-3 (s=1:zero based vector)

MG=function(f,b) 1-log(f)/log(b) #Markedness grade
#MI=function(f,n,x,y) log2(f*n/x/y) #  相互情報量(2x2) (MI(2x2): Mutual information)

Mid=function(A) (Max(A)+Min(A))/2#ミッドレンジ

Mid=function(str,ini,num=0){
 if(num==0) num=nchar(str) else num=ini+num-1
 substr(str, ini, num)
} #文字列中  medio de secuencia de letras

MIdf=function(df){
 R=df; Rs=RowSums(df); Cs=ColSums(df); n=Sum(df)
 for(i in 1:NR(df)){for(j in 1:NC(df)){
  f=df[i,j]; x=Cs[j]; y=Rs[i]
  R[i,j]=log2(f*n/x/y) #log(0)=>log(1)
 }}; R
} #相互情報量（データフレーム）

Min=function(...) min(...,na.rm=T) #NaN を除く

MMC=function(V){m=Mean(V); md=Median(V); (m-md)/(m+md)}
# Mean median contrast

Mode=function(A){F1=table(A); as.numeric(names(F1)[which.max(F1)])} #最頻値

Monotony=function(A){
 a=d=0; for(i in 2:Len(A)){
  if(A[i]>A[i-1]) a=a+A[i]-A[i-1] else d=d+A[i-1]-A[i]
 }; (a-d)/(a+d)
```

```
} #Monotony [-1, 1]

Mosteller=function(D){
 for(i in 1:1000){
  X=D; D=MV(D,Rsums(D),'d')/NR(D); D=MV(D,Csums(D),'d')/NC(D)
  #X=D; D=D/RowSums(D)/NR(D); D=t(t(D)/ColSums(D))/NC(D)
  if(sum((D-X)^2)<10^-10) break
 }; D
} # モステラーの標準化

Move=function(D,m=T){
 if(m){
  D=DF(RN(D),D)
  if(all(IsNum(D[,1]))) D[,1]=as.numeric(D[,1])
  rownames(D)=1:NR(D); colnames(D)[1]='x'
 }else{
  rownames(D)=D[,1]; D=D[,-1]
 }; D
} #Move cols to (m=T) right, (m=F) left

MoveX2Y=function(D,re='[[:punct:]]+$'){
 X=ifelse(Detect(D[,1],'^[[:punct:]]+$')==F, gsub(re,"",D[,1]), D[,1])
 #Y=ifelse(Detect(D[,1],re), ExtractRe(D[,1],re)&' '&D[,2], D[,2])
 Y=ifelse(Detect(D[,1],re)&Detect(D[,1],'^[[:punct:]]+$')==F,     ExtractRe(D[,1],re)&'
'&D[,2], D[,2])
 D[,1]=X; D[,2]=Y; D
} #2 列の df の 1 列の文字列を re で取り出して 2 列の文頭に移動

MS=function(X){
 for(i in 1:1000){
  X=RS(X,1); X=RS(X,2)
  if(var(RowSums(X)) < 10^-9 & var(RowSums(X)) < 10^-9) break
 }; X/sum(X)
} # モステラーの標準化  Mosteller's standardization

MultiSum=function(D, g, ss){
 #Un=sort(unique(D[,g]))
 if(g==0) Un=sort(rownames(D)) else Un=sort(unique(D[,g]))
 Un=Un[Un != ""]; Sm=NULL
 for(i in 1:Len(Un)){
```

```
   #Gr=Grep(D,g,'^'&Un[i]&'$',fx=T); Gr=Gr[,ss]
   Gr=Grep(D,g,Un[i],lt=T); Gr=Gr[,ss]
   Cs=ColSums(Gr,na.rm=T); Sm=rbind(Sm,Cs)
  }; rownames(Sm)=Un; NA2zero(Sm)
} # 複数列集計 D:データフレーム, g:グループ列, ss: 集計対象列(複数可),

MV=function(X,Y,sel='d'){
  fx=is.atomic(X)&&Len(X)==1&&!is.matrix(X) # is.scalar.X
  fy=is.atomic(Y)&&Len(Y)==1&&!is.matrix(Y) # is.scalar.Y
  if(!fx) X=as.matrix(X); if(!fy) Y=as.matrix(Y)
  if(!fx&&NR(X)==1) X=matrix(as.numeric(rep(X,NR(Y))),NR(Y),byrow=T)
  if(!fx&&NC(X)==1) X=matrix(as.numeric(rep(X,NC(Y))),NR(X),byrow=F)
  if(!fy&&NR(Y)==1) Y=matrix(as.numeric(rep(Y,NR(X))),NR(X),byrow=T)
  if(!fy&&NC(Y)==1) Y=matrix(as.numeric(rep(Y,NC(X))),NR(Y),byrow=F)
  if(sel=='a') return (X+Y); if(sel=='s') return (X-Y)
  if(sel=='m') return (X*Y); if(sel=='d') return (X/Y)
} #行列・ベクトル・スカラーの四則演算

MX=function(f,mx) log(f)/log(mx) #ratio by max

MxRn=function(D,B,bs){
  B=SortC(B,2,T); P1=B[,1]; D=SortDO(D,P1)
  Rns=rownames(D)
  for(i in 1:Len(Rns)) Rns[i]=FM(MX(Sch(B,1,2,Rns[i]),bs),3)&':'&Rns[i]
  rownames(D)=Rns; D
} #Markedness grade + rowname

#### N ####

N.cat=function(D,n,Ct){
  mx=max(D[,n]); M=Matrix(0,mx,Len(Ct))
  for(i in 1:NR(D)){k=0; for(j in Ct){
    k=k+1; a=D[i,n]; M[a,k]=M[a,k]+D[i,j]}}
  rownames(M)=1:mx; colnames(M)=colnames(D)[Ct]; NA2zero(M)
} # Num-categories cross, N.cat(D,3,5:14)

N.mean=function(A){
  if(Len(A)==1) return(A)
  A=unlist(DF(A)); N=A; for(i in 1:Len(A)) N[i]=Norm(A[i],Mean(A),Varp(A))
  Sum(A*N)/Sum(N)
```

```
} #Normal mean

N2Col=function(d=D,x){ifelse(IsStr(x),FN(x,CN(d)),CN(d)[x])
} #列番号=>列名

N2S=function(X=D){
 R=mapply(X, FUN=as.character); R=matrix(R,NR(X))
 rownames(R)=RN(X); colnames(R)=CN(X); R
} #numeric Mt=>string Mt

NA2Blank=function(D) {D[is.na(D)]=""; D}

Na2Str=function(A,str=""){A[is.na(A)]=str; A}
#<na> to string: vt

Na2StrD=function(D,str="＊") {
 library(dplyr); mutate_all(D, ~ ifelse(is.na(.), str, .))}
#<na> to string: df. rapid
NC=ncol; NR=nrow
# variable 2 string s:T "[...]"

NA2zero=function(df) {df[is.na(df)]=0; df} #from NA to zero (0)

NFM=function(D){
 X=D; Rs=RowSums(D); Cs=ColSums(D)
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  X[i,j]=D[i,j]*2/(Rs[i]+Cs[j])
 }}; X
} #分数平均による標準化 Normalization by Fractional Mean

Nlex=function(L,sel=0){ # L: Lemas; sel: seleccionar
 D=DF(table(L)) # Frecuencia
 d=NR(D); if(d==1) return (0)
 nlex=sum(1/D[,2]) # sum(1/Frecuencia)
 ifelse(sel==0, nlex, nlex/d) # devolver
} #Novedad léxica

NonConSec=function(A) {
 diffs=diff(A); which(diffs>1)+1
} # 非連続な位置のインデックス find_non_consecutiv
```

```
Norm=function(x,m,v,s=F){#x:頻度, m:平均, v:分散, s=0:密度, 1:累積
 if(s==F) dnorm(x,m,sqrt(v)) else pnorm(x+.5,m,sqrt(v))
} #正規分布確率

Normality=function(D) {
 D=DF(D); nc=NC(D); nr=NR(D)
 A=NULL; for(i in 1:nc) A=c(A,FreqDistVec(D[,i]))
 m=mean(A); sd=SDp(A); t=sum(D[,1:nc])/nc; B=dnorm(1:nr,m,sd)*t
 D2=matrix(0,nr*nc,2); n=0
 for(i in 1:nr){for(j in 1:nc){
  n=n+1; D2[n,1]=D[i,j]; D2[n,2]=B[i]}}; 1-DM(D2,'r')[1,2]
}#Normality of matrix by relative distance [0,1]

NormalityA=function(A) {
 m=MeanFreqDistD(A); sd=SdFreqDistD(A)
 D2=DF(A/sum(A),dnorm(1:Len(A),m,sd))
 1-DM(D2,'r')[1,2]
} #Normality of vector by relativw distance [0,1]

Normalize=function(X,A,m=10^5){ #X:行列, A：ベクトル
 t(t(X)/A*m)
} #正規化頻度
Normal_significance=function(v,A,side='g',cl=.99,r=3){
 #v:value,A:vector,side:l/g,cl:conv.level,r:Rnd
 m=mean(A); n=Len(A); sd=sd(A); mx=max(A); mn=min(A); rg=mx-mn
 #m:mean; n:sample size; sd:st.dev; mx:max; mn:min; rg:range
 if(side=='l') {p=pnorm(v+.5,m,sd); bl=mn; bu=qnorm(cl,m,sd); em=bu-m} #lower side
 if(side=='g') {p=1-pnorm(v+.5,m,sd); bl=qnorm(1-cl,m,sd); bu=mx; em=m-bl} #upper
side
 R=Rnd(c(v,m,sd,n,mn,mx,rg,1-p,p,bl,bu,em,em*2,em*2/rg,cl),r)
 names(R)=c('v:value','mean','st. dev.','size','min','max','range','security','p-value',
         'lower-bound','upper-bound','error-margin','width','width/range','conf.level'); R
} # Normal distribution test
# set.seed(0); v=35; A=Rnd(rnorm(30,50,10),0); side='l'; cl=.95; r=3
# set.seed(0); v=65; A=Rnd(rnorm(30,50,10),0); side='g'; cl=.95; r=3
# Normal_significance(v,A,side,cl,r)

NormD=function(x,m,sd)  (1/(sd*sqrt(2*pi)))*exp(-((x-m)^2)/(2*sd^2))  #Normal  dist.
density
```

```
NormDistConform=function(A,brk=.5){
 B=seq(-4.5,4.5,by=brk); Fd=FreqDistV(A,B,T); Bp=c(B,4.6); Ap=NULL
 for(i in 1:Len(B)) Ap[i]=pnorm(Bp[i+1])-pnorm(Bp[i]) #normal dist.
 D=cbind(Fd,Ap); colnames(D)=c('x','Random number','Normal distribution')
 cat("Mean of difference:", sum(abs(D[,2]-D[,3]))/NR(D),'¥n')
} #Conformation to standard normal distribution

NormS=function(x,n,e){#x:頻度, n:全数, e:期待確率
 pnorm(x-.5,n*e,sqrt(n*e*(1-e)))
} #正規分布有意率

NS=function(D,E,e=0){
 # Normalized score. D:df,E:population df, e:exponent
 #if(e==0) {for(i in 1:20) if(DigitUp(Max(D/E*10^i))>DigitUp(Max(D))) {e=i-1;
break}}
 if(e==0) e=EX(D,E); print('exponent: '&e); D/E*10^e
}

NS2=function(D,E,x=1,y=2){
 Rnd(NS(PV(D,x,y), PV(E,x,y)),1)
} # Normalized Score, 2 dimensions (D: object df, E: base df, Col: 3 cols, d: digit)

NumberCol=function(D){
 names(D)=ReplA(names(D),'^¥¥d+¥¥.=>')
 names(D)=(1:NC(D))&'.'&names(D); D
} #Numbering colum name

NumForm=function(x,sel=1){
 if(sel==1) w=number(x, big.mark=' ', decimal.mark=',')# スペイン式
 if(sel==2) w=number(x, big.mark=',', decimal.mark='.')# 日本式
 w
} #数値の 3 桁, 小数桁の書式

NumText=function(D,nc){
 nr=NR(D); m=ceiling(nr/nc)*nc
 X=DF(A=rep(0,m-nr), B=rep('*',m-nr))
 names(X)=names(D); X=rbind(D,X)
 A=matrix(X[,1], NC=nc, byrow=T)
 B=matrix(X[,2], NC=nc, byrow=T)
```

```
  W=matrix(NR=NR(A)*2, NC=NC(A))
  W[seq(1, NR(W), by=2), ]=A
  W[seq(2, NR(W), by=2), ]=B
  W
} #Number and text
#D=DF(A=1:13, B=LETTERS[1:13]); NumText(D,8)

#### O ####

OER=function(D) D/Esp(D) #Observed-to-expected ratio

Off=function() dev.off() # window off

OneCol=function(Df,c){
  D=Df[,c]; names(D)=1:NR(Df); D=DF(D);colnames(D)=CN(Df)[c];D
} # Df の 1 列を Df 形式で抽出

OP=function(D,f='',S='test',rn=T,cn=T,n=0){
  Right=function(s,n){nc=nchar(s); x=nc-n+1; substr(s,x,nc)}
  if(n==0) print(D) else print(L(D,n))
  if(f=='') OpCopy(D,rn,cn) # Clipboard
  else if(Right(f,4)=='xlsx') OpExcel(D,f,S,rn,cn) #Excel file
  else OpText(D,f,rn,cn) # Text file
} #Output OP():Clipboard, Op(D): df, rn: row-names, cn: col-names
# OP(D,'a.txt')=Op(D,'a'), Op(D,1)=Op(D,'1')

OpCopy=function(D,rn=T,cn=T) {#rn: row-names, cn: col-names
  D=DF(D)
  if(cn) {D=rbind(CN(D),D);rownames(D)[1]='*'}
  if(rn) D=cbind(RN(D),D)
  D=apply(D,1,paste,collapse='¥t')
  writeClipboard(as.character(D),format=13)
} #Output to clipboard

OpExcel=function(D,f,S,rn=T,cn=T){
  if(class(D)=='data.frame') D=list(D)
  library(openxlsx); len=Len(S); n=0
  if(file.exists(f)) {
    print('Loading...'); wb=loadWorkbook(f); SH=getSheetNames(f)
    for(sh in S){
```

```
    n=n+1; print(n&'/'&len&': '&sh)
    if (!(sh %in% SH)) addWorksheet(wb,sheetName=sh)
    writeData(wb,sheet=sh,x=D[[n]], rowNames=rn, colNames=cn)
   }
  } else {
   wb=createWorkbook()
   for(sh in S){
    n=n+1; print(n&'/'&len&': '&sh)
    addWorksheet(wb,sheetName=sh)
    writeData(wb,sheet=sh,x=D[[n]], rowNames=rn, colNames=cn)
   }
  }; print('Saving...'); saveWorkbook(wb,f=f,overwrite=T); print('Finish!')
} #Output to Excel D: (list/df), f: file name (string), S: sheet name (vector)

Opj=function(X=D,f=''){
 if(f!=1&f!='1'&f!=''&!Match('¥¥.txt',f)) f=Add(f,'.txt') #ファイル名に'.txt'を付加
 if(f==1|f=='1') f=file.choose() #ファイル選択
 if(f!='') { #ファイル名指定
  B=rbind(CN(X),X)   #列名=>表頭
  B=cbind(c('*',RN(X)),B)#行名=>表側
  readr::write_tsv(DF(B),f,col_names=F) #行列(TSV)出力
 } else{ #クリップボード
  str=Trim(M2S(X)) #行列=>文字列(TSV)=>トリム
  writeClipboard(str,format=13)} #str:文字列(TSV)出力
 if(f=='') f='Copy'; Dt(X,d=Add('File: ',f,' /')) #データ表示
} #テキストファイル(TSV)出力 Op():コピー, Op(X):データ指定, Op(D,1):データ選択
#例: Op(f='a.txt'), Op(D,'a.txt')=Op(D,'a'), Op(D,1)=Op(D,'1')

Opm=function(X=D,fn='c'){
 if(mode(X)=='numeric'){ #数値行列
  R=rbind(CN(X),X); R=cbind(c('*',RN(X)),R)#行列に表頭・表側を追加
 }else {R=X} #文字を含むデータフレーム
 if(fn=='c'){write.table(R,file=fn,sep='¥t',quote=F,row.names=F,col.names=F)
 }else  {write.table(R,file=pipe('pbcopy'),sep='¥t',quote=F,row.names=F,col.names=F)}
#行列出力
} #テキストファイル出力 MAC

Ops=function(X,Y,fileN='clipboard'){
 A=rbind(CN(X),X); A=cbind(c('*',RN(X)),A) #行列に表頭・表側を加える
```

```
 B=rbind(CN(Y),Y); B=cbind(c('*',RN(Y)),B) #行列に表頭・表側を加える
 C=DF(A,rep('',NR(Y)+1),B)
 write.table(C,file=fileN,sep='¥t',quote=F,row.names=F,col.names=F) #行列出力
} #2 表の連結を出力

OpText=function(D,f,rn=T,cn=T) {#rn: row-names, cn: col-names
 D=DF(D)
 if(cn) {D=rbind(CN(D),D);rownames(D)[1]='*'}
 write.table(D,f,row.names=rn,col.names=F,sep="¥t",quote=F,fileEncoding='UTF-8')
} #Output to text file

Orden=function(df,col=1,dec=NULL,ren=1,fx='',tx='',sp='',del=''){
 #col: columna (0: colnum or CN , ex:'Lema,CG'),dec=1:descendente (ex:'0,1'),ren=1:renumerar
 if(fx=='') fx='áàâéèêëíìïóòôúùüý'; if(tx=='') tx='aaaeeeeiiiooouuuy'
 if(sp=='') sp='ñ:nzz,ç:czz'; if(del=='') del='[_<>]'
 col=VT(col); len=Len(col) #ベクトル化, 長さ V col; Contar col
 R=Df=DF(df); if (NC(R)==1) col=c(1) #ベクトルデータ Datos en vector
 if(is.character(col)) col=match(col, CN(df)) #文字型列名を数値化 Numeralizar letras
 if(is.null(dec)) {dec=col*0} else {dec=VT(dec)} #降順 Ascendente/descendente
 Spec=Sep(sp,',') #特殊文字ベクトル化 V letra especial
 for(i in 1:len) { #アクセント/特殊文字/除去文字 Acento, letra especial, letra a eliminar
  if(col[i]==0){Sr=RN(R)} else{Sr=R[,col[i]]} #0:行名/1-:列ソート Ordenar rótulo / columna
  if(is.character(Sr)) { #文字ソート=>置換
   Sr=ifelse(str_detect(Sr,"[[:upper:]]"), Sr&' 1', Sr&' 0') # $$ Sr に大文字があれば#を付加
   Sr=tolower(Sr) #小文字に変換
   for(j in 1:nchar(fx)){ #アクセント Acento
    fa='(.*)' & substr(fx,j,j) & '(.*)' #アクセント from / Acento origen
    k=j; if(j<10) {k='0'&j}
    ta='¥¥1' & substr(tx,j,j) &'¥¥2' & k #アクセント to / Acento destino
    Sr=ifelse(str_detect(Sr,fa), Sr&'@', Sr) # $$ Sr が fa に一致すれば@を付加
    Sr=gsub(fa,ta,Sr,T) #置換
   }
   for(j in 1:Len(Spec)){#特殊文字 Letra especial (ex: ñ,ç)
    Sp=VT(Spec[j],':'); Sr=gsub(Sp[1],Sp[2],Sr,T)
   }
   Gr=grepl(del, Sr); Tr=NULL #除去文字 Letra eliminada (ex: del='[_<>]')
```

```
    for(j in 1:Len(Sr)){
     if(Gr[j]) Tr[j]=Sr[j] else Tr[j]=''
    }
    Sr=gsub(del,'',Sr,T) & ' ' & Tr
   }
   if(col[i]==0){R[,1]=Sr; col[1]=1} else{R[,col[i]]=Sr} # 格納(行名/その他)
Almacenar(rótulo de fila/otros)
  }
  if(len==1) Sf=Df[order(R[,col[1]]), ]
  if(len==2) Sf=Df[order(R[,col[1]], R[,col[2]]), ]
  if(len==3) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]]), ]
  if(len==4) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]], R[,col[4]]), ]
  if(len==5) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]], R[,col[4]], R[,col[5]]), ]
  if(len==6) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]], R[,col[4]], R[,col[5]],
R[,col[6]]), ]
  if(len>6) stop("¡Número de columnas debe ser menos de 7!")
  if(ren==1) {rownames(Sf)=NULL} #行名連番 Numerar fila
  return(Sf) #返す Devolver
} #数値/スペイン語ソート Ordenar letra española/número

Ordenar=function(df,col=1,dec=NULL,ren=1,fx='',tx='',sp='',del=''){
  #col: columna (0: colnum or CN , ex:'Lema,CG'),dec=1:descendente
(ex:'0,1'),ren=1:renumerar
  if(fx=='') fx='áàâéèêëíìïóòôúùüý'
  if(tx=='') tx='aaaeeeeiiiooouuuy'
  if(sp=='') sp='ñ:nzz,ç:czz'
  if(del=='') del='[_<>]'
  col=VT(col); len=Len(col) #ベクトル化, 長さ V col; Contar col
  R=Df=DF(df); if (NC(R)==1) col=c(1) #ベクトルデータ Datos en vector
  if(is.character(col)) col=match(col, CN(df)) #文字型列名を数値化 Numeralizar letras
  if(is.null(dec)) {dec=col*0} else {dec=VT(dec)} #降順 Ascendente/descendente
  Spec=Sep(sp,',') #特殊文字ベクトル化 V letra especial
  for(i in 1:len) { #アクセント/特殊文字/除去文字 Acento, letra especial, letra a
eliminar
   if(col[i]==0){Sr=RN(R)} else{Sr=R[,col[i]]} #行名/列ソート Ordenar rótulo /
columna
   if(is.character(Sr)) { #文字ソート=>置換
    for(j in 1:nchar(fx)){ #アクセント Acento
     fa='(.*?)' & substr(fx,j,j) & '(.*?)' #アクセント from / Acento origen
     k=j; if(j<10) {k='0'&j}
```

```
    ta='¥¥1' & substr(tx,j,j) &'¥¥2 ' & k #アクセント to / Acento destino
    Sr=gsub(fa,ta,Sr,T) #置換 Sustituir
   }
   for(j in 1:Len(Spec)){#特殊文字 Letra especial (ex: ñ,ç)
    Sp=VT(Spec[j],':'); Sr=gsub(Sp[1],Sp[2],Sr,T)
   }
   Gr=grepl(del, Sr); Tr=NULL #除去文字 Letra eliminada (ex: del='[_<>]')
   for(j in 1:Len(Sr)){
    if(Gr[j]) Tr[j]=Sr[j] else Tr[j]=''
   }
   Sr=gsub(del,'',Sr,T) & ' ' & Tr

   Uv=str_count(Sr, regex('[A-ZÁÉÍÓÚÜ]', F)) # 大文字の数
   Uv=ifelse(Uv>9, i, Uv)
   Sr=tolower(Sr) & ' ' & Uv
  }
  if(col[i]==0){R[,1]=Sr; col[1]=1} else{R[,col[i]]=Sr} # 格納(行名/その他)
Almacenar(rótulo de fila/otros)
 }
 if(len==1) Sf=Df[order(R[,col[1]]), ]
 if(len==2) Sf=Df[order(R[,col[1]], R[,col[2]]), ]
 if(len==3) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]]), ]
 if(len==4) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]], R[,col[4]]), ]
 if(len==5) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]], R[,col[4]], R[,col[5]]), ]
 if(len==6) Sf=Df[order(R[,col[1]], R[,col[2]], R[,col[3]], R[,col[4]], R[,col[5]],
R[,col[6]]), ]
 if(len>6) stop("¡Número de columnas debe ser menos de 7!")
 if(ren==1) {rownames(Sf)=NULL} #行名連番 Numerar fila
 return(Sf) #返す Devolver
} #数値/スペイン語ソート Ordenar letra española/número
# stri_trans_general(str = 'üéâäàåçêëèïîì', id = "Latin-ASCII")
# Order=function(A,d=F){
# order(A,decreasing=d)
# } #順番, d=T: decreasing

Order=function(A,d) { #Spanish or numeric
 is.num=all(!is.na(suppressWarnings(as.numeric(A))))
 if(is.num) {d=ifelse(d,-1,1); A=as.numeric(A); Od=order(d*A)}
 else {library(stringi)
  Od=stri_order(A,locale="es_ES",decreasing=d,strength=4,uppercase_first=F)
```

```
  }; Od
} # Each order array of Spanish words (d=T: descending)

ORDER=function(A,d){ #Spanish or numeric
  Nm=IsNumeric(A); W1=which(Nm); W2=which(!Nm) #index
  O1=Order(A[Nm],d); O2=Order(A[!Nm],d); c(W1[O1], W2[O2]) #num,char
} # All order array of Spanish words (d=T: descending)

Otro=function(D,col='Lema',str='ahora,así,mismo',otr='otro'){                    #Ex:
col='Lema',str='ahora,así,mismo'
  V=D[,col]; Str=VT(str); E=ifelse(V %in% Str, V, otr); D[,col]=E; D
} #指定語以外を otro とする

Output=function(df,f=''){
  if(f=='') f=file.choose() #ファイル選択
  write.table(df,f,row.names=F,sep="¥t",quote=F,fileEncoding='UTF-8')
} #テキストファイル(TSV)出力

#### P ####

Pareto=function(A){
  A=sort(A,decreasing=T); n=Len(A); c=sum(cumsum(A))
  m=sum(cumsum(rep(mean(A),n))); s=n * sum(A); (c - m) / (s - m)
} #パレート係数  (Pareto index)

Part=function(D,rn=0,cn=0){
  if(all(rn==0)) rn=1:NR(D); if(all(cn==0)) cn=1:NC(D)
  if(is.numeric(rn)) Rn=RN(D)[rn] else RN=rn
  if(is.numeric(cn)) Cn=CN(D)[cn] else CN=cn
  R=DF(D[rn,cn]); rownames(R)=Rn; colnames(R)=Cn; R
} #部分行列  partical matrix
# D=DF(Libro=c('x1','x2','x3'),a=c(3,5,2),b=c(8,4,3)); D
# Part(D,2:3,V('a,b'))

Paste=function(rn=F, cn=T){ #rn=T:  行名あり, cn=T:  列名あり
  r=readClipboard(format=13) #utf-8
  R=strsplit(r,'¥t'); nr=Len(R); nc=Len(R[[1]]); M=matrix(0,nr,nc) #行列
  for(i in 1:nr){for(j in 1:nc){M[i,j]=R[[i]][j]}} #行列要素
  df=DF(M)
  if(cn) {coln=df[1,]; df=DF(df[-1,]); colnames(df)=coln;}
```

```
 if(rn) {rownames(df)=df[,1]; df=df[,-1]}
 else {rownames(df)=1:NR(df)}
 # for(i in 1:nc){
 # if(all(IsNum(df[,i]))){df[,i]=as.numeric(df[,i])}
 # }
 df #データフレーム
}# クリップボードからペースト

PasteV=function(){ #rn=T: 行名あり, cn=T: 列名あり
 R=readClipboard(format=13); as.numeric(unlist(strsplit(R,'¥t')))
}# クリップボードからペースト (数値ベクトル)

Pbinom=function(x,n,p) ifelse (x==0,0,pbinom(x-1,n,p)) # pbinom with n==0

PcaEv=function(M=D,s=T){
 P=prcomp(M,scale=s) #scale=s=T: 標準化(単位が異なるとき)
 E=get_eigenvalue(P) #固有値(分散),分散%,分散累積%:library(factoextra)
 E[,1]=Rnd(E[,1],4); E[,2]=Rnd(E[,2],1); E[,3]=Rnd(E[,3],1) #小数桁
 colnames(E)=c('Ev','V%','V%(cum)'); E
} #主成分分析:固有値(分散),分散%,分散累積%

Perc=function(X){sprintf('%1.1f%%',X*100)
} #パーセント (0.0123 > 12.3%)

Percent=function(D,s=1,v=F,d=1){
 if(!v) {
  if(s==1) A=RowSums(D)
  if(s==2) A=ColSums(D)
  if(s==3) A=sum(D)
 }; if(s==1|s==3) D=D/A else D=t((t(D)/A))
 Rnd(D*100,d)
 #DF(lapply(Rnd(D,d), function(x) paste0(x,"%")))
} #パーセント(D:df, s=1:行,2:列,3:全, v=T: vt

PerfectMatch=function(str,rx='(¥¥d+|[0-9]+)') str_replace_all(str,rx,'')==''#完全一致(数値)

PF=function(f,t,c=0.99,m=1000){#f:freq,t:total,m:multiplier,c:confidence
 Rnd(BinE(f,t,c)*m,0)
} #確率頻度 Probabilistic frequency
```

```
PFS=function(X=D,s=1,d=3){
 if(s==2) X=t(X); Sh=apply(X,1,sum); Sv=apply(X,2,sum) #行和; 列和
 for (i in 1:Len(Sh)){for (j in 1:Len(Sv)){
  X[i,j]=BinE(X[i,j],Sh[i],0.99)
 }}; if(s==2) X=t(X); Rnd(X,d)
} #確率得点 (s=1:行 ; 2:列)

PhonemeSp=function(Ar){
 A=tolower(Ar); Ar # 小文字に変換
 for (i in 1:Len(A)){
  if(Right(A[i],5)=='mente' && A[i]!='mente' && A[i]!='demente' &&
A[i]!='vehemente') {
   A[i]=PhoSp(Left(A[i],nchar(A[i])-5)) & ".'men.te"
  }else{
   A[i]=PhoSp(A[i])
  }
 }; A
} #スペイン語音素 Ar: 文字列ベクトル, V('paz,inyecto,...')

PhoSp=function(str){
 str=ReplaceStr(str,'ch=>C, c([eiéí])=>z¥¥1, c=>k, x=>ks, g([eiéí])=>x¥¥1') # 子音-1
 str=ReplaceStr(str,'gu([eiéí])=>g¥¥1, gü([eiéí])=>gu¥¥1, ([nsl])r=>¥¥1R') # 子
音-2
 str=ReplaceStr(str,'hu(@v)=>w¥¥1, h=>, j=>x, ll=>L, qu=>k,^r=>R, v=>b') # 子音-3
 str=ReplaceStr(str,'(@v)(@c[lr]?@v)=>¥¥1.¥¥2',F,F,T) # VC[lr]?V=>V.C[lr]?V
 str=ReplaceStr(str,'(@v@c)(@c[lr]?@v)=>¥¥1.¥¥2',F,F,T) #
VCC[lr]?V=>VC.C[lr]?V
 str=ReplaceStr(str,'(@v@c@c)(@c[lr]?@v)=>¥¥1.¥¥2',F,F,T) #
VCCC[lr]?V=>VCC.C[lr]?V
 str=ReplaceStr(str,"([aeoíú])([aeoíú])=>¥¥1.¥¥2") # 母音分立
 str=ReplaceStr(str,'i(@v)=>y¥¥1, u(@v)=>w¥¥1, (@v)i=>¥¥1y, (@v)u=>¥¥1w') #二重
母音
 # アクセント記号
 if(FindRE(str,'[áéíóú]') > 0){
  str=ReplaceStr(str,"(¥¥.)([^'.]*[áéíóú])=>¥¥1'¥¥2") # アクセント記号つきの語
  str=ReplaceStr(str,"á=>a,é=>e,í=>i,ó=>o,ú=>u") # アクセント記号を除去
 } else{
  str=ReplaceStr(str,"(¥¥.)([^'.]*[^aeiouns]$)=>¥¥1'¥¥2") # 語末子音$, ...C=>'...C
  str=ReplaceStr(str,"(¥¥.)?([^.]*¥¥.[^.]+[aeiouns]$)=>¥¥1'¥¥2") # 語末母音
```

```
+ns$ ... ...V=>'... ...V
   str=ReplaceStr(str,"(^[^.']+$)=>'¥¥1")          # 単音節語にアクセント記号(')
  }
  str
} #PhonemeSp のサブルーチン
Paren = function(X, Y) {
  M = '(' & Y & ')'; M = matrix(M, NR=NR(X)); W=NULL; A=NULL
  for(i in 1:NC(X)){
    A[2*i-1]=CN(X)[i]; A[2*i]='.'; W=cbind(W, X[,i], M[,i])
  }; colnames(W)=A; noquote(RightJust(W))
}

Pivot=function(D,x,y='',f='',sel=F){ #x 軸, y 軸, f 軸(freq) ex:Pivot(Fr,'Lema','Per','frec')
  if(y=='' & f=='') {R=xtabs(~D[,x], D); R=DF(R); colnames(R)[1]=x}
  if(y=='' & f!='') {R=xtabs(D[,f]~D[,x],D); R=DF(R); colnames(R)[1]=x}
  if(y!='' & f=='') {R=xtabs(~D[,x]+D[,y],D);R=DF(R)}
  if(y!='' & f!='') {R=xtabs(D[,f]~D[,x]+D[,y],D);R=DF(R)}
  #rownames(R)=1:NR(R)
  if(sel) {rownames(R)=x&'.'&rownames(R); colnames(R)=y&'.'&colnames(R)}
  Fac2Cha(R)
} #Pivot table

PivotM=function(D,x,y='',f=''){ #x 軸, y 軸, f 軸(freq) ex:Pivot(Fr,'Lema','Per','frec')
  Cns=colnames(D)[x]; nam=paste(colnames(D)[x],collapse='::')
  A=JoinC(D,x,'::'); E=DF(nam=A,D); col=x; x='nam'
  if(y=='' & f=='') {X=xtabs(~E[,x], E); X=DF(X); colnames(X)[1]=x}
  if(y=='' & f!='') {X=xtabs(E[,f]~E[,x],E); X=DF(X); colnames(X)[1]=x}
  if(y!='' & f=='') {X=xtabs(~E[,x]+E[,y],E);X=DF(X)}
  if(y!='' & f!='') {X=xtabs(E[,f]~E[,x]+E[,y],E);X=DF(X)}
  df=SplitA(as.vector(X[,1]),'::'); colnames(df)=Cns; E=DF(df,freq=X[,-1])
  AsNumC(E)
} #Pivot table multiple x: multiple ex:1:10

PoisD=function(x,L) exp(-L+log(L)*x-sum(log(1:x))) #poisson individual 対数

PoisP=function(x,L){p=0; for(i in 1:x) p=p+PoisD(i,L); p} #poisson cumulative

PoisTest=function(x,ld=1,side='g',cl=.99,r=5){
  #x:number of events,b=base,ld=hypothesized number,side:l/g/t; r=Rnd
  Test=poisson.test(x,1,ld,side,cl); a=1-cl #Exact Poisson test
```

```
 if(side=='l') {p=ppois(x,ld); ci=Test$conf.int[1:2]} #'l' lower side
 if(side=='g') {p=1-ppois(x-1,ld); ci=Test$conf.int[1:2]} #'g' upper side
 if(side=='t') {p=Test$p.value; ci=c(qchisq(a/2, 2*x)/2, qchisq(1-a/2, 2*(x+1))/2)} #'t'
two sided
 R=Rnd(c(x,ld,1-p,p,ci[1],ci[2],ci[2]-ci[1]),r)
 names(R)=c('event','lambda','security','p-value','lower-bound','upper-bound','width'); R
} # Poisson test
# x=11; ld=8; side='g'; cl=.95; r=5 #x:observed count, em:expected mean
# poisson.test(x,1,ld,side,cl) #Exact Poisson test
# PoisTest(x,ld,side,cl,r)

Power=function(f,t,e=.5,cl=.95,side='g'){
 r=f/t #f: freq, t:total, e:exp.probability, cl:conf.level, side:g,l,t
 if(side=='g') {c=qbinom(cl,t,e); pw=pbinom(c,t,r,F)}
 if(side=='l') {c=qbinom(1-cl,t,e); pw=pbinom(c-1,t,r)}
 if(side=='t') {
  c1=qbinom((1-cl)/2,t,e); c2=qbinom((1+cl)/2,t,e)
  pw=pbinom(c1-1,t,r)+pbinom(c2,t,r,F)
 }; pw
} #Power in binomial distribution

PrintM=function(M){
 M[M==0]=''; M=gsub('0¥¥.','.',M); M=DF(M); noquote(M)
} #Print matrix without 0, 0., quote

PropTest1=function(f,t,r0=.5,side='t',cl=.95,r=3){
 Pt=prop.test(f,t,r0,side,cl)
 chi=Pt$statistic; p=Pt$p.value; Ci=Pt$conf.int[1:2]
 es=f/t/r0; r1=f/t #effect size (risk ratio); sample proportion
 if(side=='t'){
  cv1=qbinom((1-cl)/2,t,r0); cv2=qbinom((1+cl)/2,t,r0)
  pw=pbinom(cv1-1,t,r1)+1-pbinom(cv2,t,r1); b=1-pw
 }
 if(side=='g'){cv=qbinom(cl,t,r0); b=pbinom(cv,t,r1); pw=1-b}
 if(side=='l'){cv=qbinom(1-cl,t,r0); b=pbinom(cv-1,n1,r1); pw=1-b}
 R=Rnd(c(r1,r0,r1-r0,chi,1-p,p,Ci[1],Ci[2],Ci[2]-Ci[1],b,pw),r)
 s1='sample ratio,null-ratio,diff,chi^2,security,p-value,'
 s2='lower.b,upper.b,width,beta,power'; names(R)=VT(s1&s2); R
}
#f=13; t=24; r0=.35; side='t'; cl=.95; r=4; PropTest1(f,t,r0,side,cl,r)
```

```
PRS=function(D,s=1){
 n=NR(D); p=NC(D); Rs=RowSums(D); Cs=ColSums(D)
 if(s==1) (p-1)*D/((p-2)*D+Rs)
 else if(s==2) (n-1)*D/t(t((n-2)*D)+Cs)
 else (n*p-1)*D/((n*p-2)*D+sum(D))
} # 卓立相対得点(Prominent Relative Score, s=1: 行, 2:列, 3:全)

PS=function(X=D,s=1) X*RS(X,s) #比例得点 (s=1:行 ; 2:列; 3:全)

PV=function(D,x,y=0,f=0,sort=T){ #x 軸, y 軸, f 軸(freq) ex:PV(Fr,'Lema','Per','frec')
 if(y==0 & f==0) {
  X=xtabs(~D[,x], D); X=DF(X);Rns=X[,1];X=X[,-1]
  X=DF(X);rownames(X)=Rns;colnames(X)[1]=colnames(D)[x]
  return(t(X))
 }
 if(y==0 & f>0) {
  X=xtabs(D[,f]~D[,x],D);X=DF(X);Rns=X[,1];X=X[,-1]
  X=DF(X);rownames(X)=Rns;colnames(X)[1]=colnames(D)[x]
  return(t(X))
 }
 if(y>0 & f==0) {X=xtabs(~D[,x]+D[,y],D);X=DF(X)}
 if(y>0 & f>0) {X=xtabs(D[,f]~D[,x]+D[,y],D);X=DF(X)}
 #Fac2Cha(X)
 X=Fac2Cha(X); if(!sort) X=X[unique(D[,x]),]; X
} #Pivot table

PV3=function(D,x=1,y=2,z=3,f=0,s=F){
 if(f==0) D=cbind(D[,c(x,y,z)], f=rep(1,NR(D))) else D=D[,c(x,y,z,f)]
 colnames(D)=VT('p1,p2,p3,f'); Tb=xtabs(f~p1+p2+p3, D)
 if(s) P=ftable(Tb,row.vars="p1",col.vars=c("p2","p3"))
 else P=ftable(Tb,row.vars=c("p1","p2"),col.vars="p3")
 DF(as.matrix(P))
} #3 次元ピボットテーブル D:p1,p2,p3,f=0 (freq なし), sel=T:横長

PVm=function(D,V1,V2=0,n=0,w=T){ #D:df,V1:V1, V2:V2, n:num, wl:wide/long
 if(n==0) N=rep(1,NR(D)) else N=D[,n]
 if(Any(V2==0)) R=DF(CombineCol(D,V1,':'), V=rep('x',NR(D)), N)
 else     R=DF(CombineCol(D,V1,':'), CombineCol(D,V2,':'), N)
 R=stats::xtabs(R[,3]~R[,1]+R[,2],R) # library(stats)
```

```
 E=T2D(R); E=Fac2Cha(E)
 if(w) return(E) # w=T: Wide
 E=DF(R); E=Fac2Cha(E)
 if(Any(V2==0)) E=DF(SplitA(E[,1],':'), E[,3])
 else     E=DF(SplitA(E[,1],':'), SplitA(E[,2],':'), E[,3])
 colnames(E)=c('v'&(1:(NC(E)-1)),'f'); E # wl=F: Long
} # Pivot by multiple cols. ex: PVm(Obj,1:2,3,T)

PX=function(D,s='',d='r') 1-DM(D,s,d) #近接(Proximity)
#s='l':限定化/'s':標準化, d='m':1-平均距離/'r':1-規定距離,

PX2=function(A,B,s='',d='r') PX(DF(A,B),s,d)[1,2] #近接(Proximity), 2 ベクトル
#s='l':限定化/'s':標準化, d='m':1-平均距離/'r':1-規定距離,

#### Q ####

Q2df=function(X){
 R=as.numeric(X); R=matrix(R,NR(X));
 rownames(R)=RN(X); colnames(R)=CN(X); DF(R)
} #quote => df

Q2M=function(X){
 R=as.numeric(X); R=matrix(R,NR(X)); rownames(R)=RN(X); colnames(R)=CN(X); R}
#quote => df

QT1=function(A=D) quantile(A,na.rm=T)[2] #first quartile (na remove)

QT2=function(A=D) quantile(A,na.rm=T)[3] #second quartile (na remove)

QT3=function(A=D) quantile(A,na.rm=T)[4] #third quartile (na remove)

#### R ####

RA=function() rm(list=ls(envir=globalenv()),envir=globalenv())
#Remove all clearing work space RA()

Rank=function(X,s=1,d=T,met='min'){#sel=1:行, 2:列, 3:全; d=T:降順
 if(d) X=-X
 if(s==3){Vc=c(as.matrix(X)); Rk=rank(Vc,ties.method=met)
 W=matrix(Rk, nr=NR(X)); rownames(W)=rownames(X); colnames(W)=colnames(X)
```

```
 } else W=apply(X,s,function(X){rank(X,ties.method=met)})
 if(s==1) W=t(W); W #横(sel==1)→転置  met:'first','min','average'
} #Rank score (s=1:row ;  2:col/3:all) d:descending

Ranking=function(A) rank(-A,ties.method="min") #最大値をトップとするランク

RBIND=function(...) {
 Li=list(...)
 for (i in seq_along(Li)) {colnames(Li[[i]])=CN(Li[[1]])}
 do.call(rbind, Li)
} #ファイルを連結: 列名を最初のデータに合わせる, RBIND(D1,D2,D3)

RBindExcel=function(b,S){
 D=IpExcel(b&".xlsx",S[1],rn=F); print(S[1]) # INPUT 40 sec
 for(s in S[-1]){
  E=IpExcel(b&".xlsx",s,rn=F) # INPUT 40 sec
  colnames(E)=CN(D); D=rbind(D, E); print(s)
 }; D
} #Excel ファイルを連結して df にする  b:book name, S:sheet, ex:
#RBind('CODEA/A',V('A1,A2,A3'))

RCsum=function(X,s=3){
 if(s==1) cbind(X,sum=RowSums(X))
 else if(s==1) rbind(X,sum=ColSums(X))
 else {X=cbind(X,sum=RowSums(X)); rbind(X,sum=ColSums(X))} #  行和・列和
} #  行列＋行和(s=1)＋列和(s=2)＋全和(s=3)
Real_significance=function(v,A,side='g',cl=.99,r=3){
 #v:value,A:vector,side:l/g,cl:conv.level,r:Rnd
 m=mean(A); md=median(A); n=Len(A); sd=sd(A); mx=max(A); mn=min(A); rg=mx-mn
 #m:mean; md:median; n:sample size; sd:st.dev; mx:max; mn:min; rg:range
 if(side=='l') {p=sum(A<=v)/n; bl=mn; bu=quantile(A,cl); em=bu-md} #lower side
 if(side=='g') {p=sum(A>=v)/n; bl=quantile(A,1-cl); bu=mx; em=md-bl} #upper side
 R=Rnd(c(v,m,md,v-md,(v-md)/m,n,mn,mx,rg,1-p,p,bl,bu,em,em*2,em*2/rg,cl),r)
 names(R)=c('v:value','mean','md:median','v-md','(v-
md)/m','size','min','max','range','security','p-value',
          'lower-bound','upper-bound','error-margin','width','width/range','conf.level'); R
}# Real significance
# set.seed(0); v=35; A=Rnd(rnorm(30,50,10),0); side='l'; cl=.95; r=3
# set.seed(0); v=65; A=Rnd(rnorm(30,50,10),0); side='g'; cl=.95; r=3
# Real_significance(v,A,side,cl,r)
```

```
RE=function(re){
 re=gsub('&','#@+#',re)
 re=gsub('-','@+',re)
 re=gsub('#','¥¥¥¥b',re)
 re=gsub('@v','[aeiouáéíóúüy]',re)
 re=gsub('@c','[bcdfghjklmnpqrstvwxzçñ]',re)
 re=gsub('@','¥¥¥¥w',re)
 re
} #正規表現再定義

ReExtract=function(tx,re,cs=F) {
 library(stringr); cs=ifelse(cs,'','(?i)')
 str_extract_all(tx, cs&RE(re))[[1]]
}#tx="así año Ana";re="#a-";ReExtract(tx,re,F) #tx 内の re マッチ文字

ReLocate=function(tx,re,cs=F) {
 library(stringr); cs=ifelse(cs,'','(?i)')
 str_locate_all(tx, cs&RE(re))[[1]]
}#tx="así año Ana";re="#a-";ReLocate(tx,re,T) # tx 内の re 位置

RemoveAc=function(str) {
 #https://stackoverflow.com/questions/39148759/remove-accents-from-a-dataframe-column-in-r
 if(!is.character(str)) str=as.character(str)
 # od="áéíóúÁÉÍÓÚüÜàèìòùÀÈÌÒÙâêîôûÂÊÎÔÛäëïöÄËÏÖ"
 # od=stri_enc_toutf8(od)
 # nw="aeiouAEIOUuUaeiouAEIOUaeiouAEIOUaeioAEIO"
 #
 # od=str_split_1('áéíóúÁÉÍÓÚüÜàèìòùÀÈÌÒÙâêîôûÂÊÎÔÛäëïöÄËÏÖ', '')
 # nw=str_split_1('aeiouAEIOUuUaeiouAEIOUaeiouAEIOUaeioAEIO', '')
 # #stri_replace_all_fixed(x_stringi, pattern = c("'", " "), replacement = c("", "_"), vectorize_all = FALSE)
 # stri_replace_all_fixed(str, od, nw, vectorize_all=F)

 # stringi::stri_trans_char(str, od, nw)
 od="áéíóúÁÉÍÓÚüÜï"
 nw="aeiouAEIOUuUi"
 # od="áéíóúÁÉÍÓÚüÜàèìòùÀÈÌÒÙâêîôûÂÊÎÔÛäëïöÄËÏÖ"
 # nw="aeiouAEIOUuUaeiouAEIOUaeiouAEIOUaeioAEIO"
```

```
  chartr(od, nw, str)
} # アクセント記号を除去 (高速)

RemoveAll=function(A) Replace(A,'[^A-Za-zÀ-ÖØ-ɋǍ-ɋΆ-Фɯ-lᴀ-лȷ ぁ-ゖー ァ-ロ 一-
龥々〆]','')
#Remove [^A-Za-zÀ-ÖØ-ɋǍ-ɋΆ-Фɯ-lᴀ-лȷ ぁ-ゖー ァ-ロ 一-龥々〆]

RemoveNA=function(D) D[complete.cases(D), ]

RemoveNullA=function(A) A[nzchar(A) & !is.na(A)]
#Remove null and NA form a letter vector

Rep=function(s, n) paste0(rep(s, n),collapse='') #文字 s の n 個の連続

RepC=function(A=D,r){matrix(rep(A,r),Len(A))} #列繰り返し(A:配列, r:列数)

Repl=function(x,str,sep1=',',sep2=':'){
  # Replace. str:regex,p:print. ex.str='a=>A:F,[x-z]=>@:T'
  #s=>r:i:f s:search,r:replace,i:ignore-case(F),f:fixed(F)
  Ss=Sep(str,sep1,trim=F) # separate by ','
  for(i in 1:Len(Ss)){
    S=Sep(Ss[i],'(=>'&'|'&sep2&')',trim=F) # separate by '(=>|:)
    if(is.na(S[2])) S[2]=''
    ic=IE(is.na(S[3]), F, IE(S[3]=='T',T,F))
    iv=IE(is.na(S[4]), F, IE(S[4]=='T',T,F))
    fx=IE(is.na(S[5]), F, IE(S[5]=='T',T,F))
    x=gsub(S[1],S[2],x,S[3],perl=T,S[4])
  }; x
}

ReplA=function(A,r,ic=F,sep=';'){
  P=Split(r,sep)
  for (i in 1:Len(P)){
    p=Split(P[i],'=>'); if(is.na(p[2])){p[2]=''}
    A=gsub(p[1],p[2],A,ignore.case=ic,perl=T)
  }; A
} #配列 A の全要素を r='p1=>r1;p2=>r2'で置換; ic=T:大小文字区別なし (高速)
# ReplA=function(A=D,r,ic=F,ini=F,tw=F){
# for (i in 1:Len(A)){A[i]=ReplaceStr(A[i],r,ic,ini,tw)}; A
# } #配列 A の全要素を r='p1=>r1;p2=>r2'で置換; ic=T:大小文字区別なし; ini:語頭
```

一致

```
Replace=function(Ar, sch, rep, exc=F){
 if (exc) gsub("^(?!" & sch & "$).*", rep, Ar, perl=T)
 else gsub(sch, rep, Ar)
} # 置換(配列)sch(RE)=>rep, exc=T:～以外を置換

ReplaceAll=function(Df,r){
 for(i in 1:NC(Df)){Df=ReplaceCol(Df,i,r)}; Df
} # Df 全要素を r='sch=>rep' で置換

ReplaceAso=function(A,B,na=0){
 Aso=B[,2]; names(Aso)=B[,1]; W=Aso[A]; W[is.na(W)]=na; names(W)=NULL; W
} #置換(連想配列): A: 文字ベクトル, B:2 列データフレーム, na:デフォルト NA=0

ReplaceC=function(X,col,str,ic=T){
 Sr=Sep(str,';'); W=X[,col]
 for(i in 1:Len(Sr)){
  St=Sep(Sr[i],'=>'); sch=St[1]; rep=St[2]; if(is.na(rep)) rep=''
  W=gsub(sch,rep,W, ignore.case=ic)
 }; X[,col]=W; X
} #置換カラム col: colum number, str: 'C1=>; S=>ss'

ReplaceCj=function(D,str,ic=T){
 Cr=Sep(str,':'); col=as.numeric(Cr[1]); st2=Cr[2]; Sr=Sep(st2,';')
 W=D[,col]
 for(i in 1:Len(Sr)){
  St=Sep(Sr[i],'=>'); sch=St[1]; rep=St[2]; if(is.na(rep)) rep=''
  W=gsub(sch,rep,W, ignore.case=ic)
 }; D[,col]=W; D
} #置換カラム
# D=DF(x2=c(1,2,3),x1=c(5,4,2)); rownames(D)=V('bxxxx,ax,c'); D
# ReplaceCj(D,'1:2=>5;3=>9')

ReplaceCol=function(d=D,c,r){
 P=Split(r,',+'); if(IsNum(c)) c=CN(d)[c]
 for(i in 1:Len(P)){
  p=Split(P[i],'=>'); if(is.na(p[2])) p[2]=''
  d[c]=lapply(d[c],gsub,pattern=p[1],replacement=p[2])
 }; d
```

```
} #D の c 列を r で置換(例:r='0=>v,1=>s')

ReplaceStr=function(str,r,ic=F,ini=F,tw=F){
 r=gsub('@v','[aeiouáéíóúü]',r,ignore.case=T)
 r=gsub('@c','[^aeiou.]',r,ignore.case=T)

 P=Split(r,'; *'); for (i in 1:Len(P)){
  p=Split(P[i],'=>'); if(is.na(p[2])){p[2]=''}
  # if(ini & str_detect(str,Add('^',p[1]))){str=p[2] #語頭一致
  if(ini & str_detect(str,'^'&p[1])){str=p[2] #語頭一致
  }else {
   str=gsub(p[1],p[2],str,ignore.case=ic)
   if(tw) str=gsub(p[1],p[2],str,ignore.case=ic)
   if(tw) str=gsub(p[1],p[2],str,ignore.case=ic)
  }
 }; str
} #文字列 str を r='p1=>r1;p2=>r2'で置換; ic=T:大小文字区別なし; ini=T:語頭一致;
tw=T:2 回変換

ReplaceV=function(Sv,r,ic=T,tw=F){
 Rv=Split(r,';')
 for (i in 1:Len(Rv)){
  p=Split(Rv[i],'=>'); if(is.na(p[2])){p[2]=''}
  Sv=gsub(p[1],p[2],Sv,ignore.case=ic)
  if(tw) Sv=gsub(p[1],p[2],Sv,ignore.case=ic)
 }; Sv
} #Sv: 文字ベクトルを r='p1=>r1;p2=>r2'で置換; ic=T:大小文字区別なし; tw=T:2 回
変換

RepR=function(A=D,r){t(RepC(A,r))}       #行繰り返し(A:配列, r:行数)

RepStr=function(s,t){paste0(rep(s,t),collapse ='')
} #同文字連続(s:文字, t:回数)

Rescale=function(A,s=F){
 if(!s) (A-Min(A))/(Max(A)-Min(A)) #[0,1]
 else (A-Min(A))/(Max(A)-Min(A))*2-1 #[-1,1]
} # Resclale vec to range [0,1]/[-1,1] s=F:[0,1]/T:[-1,1]
# A=c(3,9,22,99); Rescale(A,T)
```

```
RevDF=function(D,s=0){
 nr=NR(D); nc=NC(D); if(s==0) R=D else if(s==1) R=D[nr:1,]
 else if(s==2) R=D[,nc:1] else R=D[nr:1,nc:1]; R
} # Reverse data frame. s=0:none/1:row/2:col/3:row+col

Reverse=function(A) {
 A=sapply(strsplit(A, ""),function(x)paste(rev(x),collapse=""))
 A=gsub("([A-ZÁÉÍÓÚÜÑ])",'#¥¥1',A); gsub('([áéíóúü])','¥¥1@',A,T)
} # vt.A の各要素の文字列を逆順にする
# ReverseVt=function(A) {
# sapply(strsplit(A, ""),function(x)paste(rev(x),collapse=""))
# } # vt.A の各要素の文字列を逆順にする

ReverseDf=function(D,sel=1){ #sel=1: 行, 2: 列, 3: 行列
 if(sel==1|sel==3) {Cn=CN(D); Rn=RN(D); D=DF(D[NR(D):1,]); colnames(D)=Cn;
rownames(D)=rev(Rn)}
 if(sel==2|sel==3) {Cn=CN(D); Rn=RN(D); D=DF(D[,NC(D):1]); colnames(D)=rev(Cn);
rownames(D)=Rn}
 D
}# データフレームを逆転

ReverseStr=function(str){
 paste(rev(strsplit(str, "")[[1]]), collapse = "")
}# 文字列をリバース

Right=function(s,n){nc=nchar(s); x=nc-n+1; substr(s,x,nc)}
#文字列右 derecha de secuencia de letras

RightAr=function(A,len=10){
 B=sapply(A,function(x)Right(x,len));names(B)=NULL;B
}# 配列 A の要素の右側(文字数:len)
#A=c("abcdefg","123456"); RightAr(A,3) #"efg" "456"

RightJust=function(X){
 M=X
 for(i in 1:NC(X)){
  Nx=nchar(M[,i]); m=max(Nx)
  # if (m-nchar(CN(M)[i])-2>-1){
  # colnames(M)[i]=Concat(rep(' ', m-nchar(CN(M)[i])),'') & CN(M)[i]
  # }
```

```
   for(j in 1:NR(X)){
    M[j,i]=Concat(rep(' ', m-Nx[j]),'') & M[j,i]
   }
  }
  M
} #行列右揃え

Rmd=function(fn){
 rmarkdown::render(fn)
} #R Markdown Rmd => Html

RN=function(D,A=NULL) if(is.null(A))rownames(D) else{rownames(D)=A;D}
# RN=function(X=D,N=0){if(is.null(RN(X))) return(NULL)
# if(N[1]==0) N=1:NR(X); R=N
# for(i in 1:Len(N)){R[i]=RN(X)[i]}; R
# } #行名(1 列でも可) cf Cn
# RnSeq=function(D){rownames(D)=1:NR(D); D} #行名を連番に変換

RND=function(D,d=0) {
 for(i in 1:NC(D)) if(IsNum(D[,i])) D[,i]=Rnd(D[,i],d); D
}

Rnd=function(x,d=0) round(x+1/10^10,d) # Round (d:decimal) cf round(2.5)=>2

Rng=function(A=D) Max(A)-Min(A) #range

Round=function(X,d=3){ #X: データ, d:小数点以下桁数  Round(2,1): 2.0 (no quote)
 # W=format(Rnd(X,d),nsmall=d); W=gsub('^0¥¥.',' .',W); noquote(W)
 W=format(Rnd(X,d),nsmall=d); W=gsub('^0¥¥.',' .',W); noquote(W)
} #小数点以下桁数で丸める  Redondear decimales

RowColJoint=function(X){
 nr=NR(X); nc=NC(X); W=matrix(0,nr*nc,nr+nc); n=0
 rownames(W)=1:(nr*nc); colnames(W)=c(rownames(X),colnames(X))
 for(i in 1:nr){for(j in 1:nc){n=n+1; W[n,i]=W[n,nr+j]=X[i,j]}}; W
} #行列接合得点  Row and column joint score

RowGMs=function(D) apply(D,1,function(x) (GM(x)))

RowMeans.T=function(O,A) NS(RowSums(O),RowSums(A)) #fraction mean-row
```

```
RowMeans=function(D) rowMeans(D,na.rm=T) #NaN を除く行平均
#RowMeans=function(D,d=1) Rnd(rowMeans(D,na.rm=T),d) #NaN を除く行平均

RowMedians=function(D) apply(D,1,function(x) (median(x,na.rm=T)))

RowSums=function(D,d=0) rowSums(D,na.rm=T) #NaN を除く行和

RS=function(D,s=1,v=F){
 if(!v) {
  if(s==1) A=RowSums(D)
  if(s==2) A=ColSums(D)
  if(s==3) A=Sum(D)
 }; if(s==1|s==3) D=D/A else D=t((t(D)/A)); D
} #relative score(D:df, s=1:row,2:col,3:all, v=T: vector

#### S ####

S2A=function(str){
 s=gsub(',.*','',str)
 IE(IsNum(s),Spl(str),Split(str))
} #文字列=>配列  string to array ex.'2,3,5'=>c(2,3,5); 'a,b,c'=>c('a','b','c')

S2N=function(X=D){
 R=as.numeric(X); R=matrix(R,NR(X))
 # R=mapply(X, FUN=as.numeric)
 rownames(R)=RN(X); colnames(R)=CN(X); R
} #string Mt=>numeric Mt

Same=function(A,B){
 n=Len(A); C=numeric(n); st=Sys.time()
 for (i in 1:n) {
  idx=which(A[i]==B)[1]; print(i&'/'&n)
  C[i]=ifelse(!is.na(idx), idx, 0)
 }; print("Time: "&round(as.numeric(Sys.time()-st),1)&' sec.'); C
} #Same form index 同形インデックス
#A=c("abc", "de", "f"); B=c("de", "abc"); Same(A, B)

Same2Seq=function(A){
 len=Len(A); n=1; B=rep(0,len); B[1]=1
```

```
 for(i in 2:len){
  if(A[i]!=A[i-1]) n=0; n=n+1; B[i]=n
 }; B
} #同じ文字が続くとき連続する数値とする
#A=c('a','a','a','b','b'); Same2Seq(A) # => 1,2,3,1,2

SameMat=function(D,E,d,e,Cd,Ce){
 n=NR(D); C=numeric(n); st=Sys.time()
 for (i in 1:n) {
  idx=which(D[i,d]==E[,e])[1]; print(i&'/'&n)
  D[i,Cd]=E[idx,Ce]
 }; D[is.na(D)]=0
 print("Time: "&round(as.numeric(Sys.time()-st),1)&' sec.'); D
} #Same form natrix D の c 列 E の e 列と同形ならば D の Cd 列<=E の Ce 列, if not=>0
# D=DF(A=V('abc,de,x'), B=V('x,y,z'), C=V('1,2,3'))
# E=DF(A=V('de,abc'), B=V('b1,b2'), C=V('5,6'))
# SameMat(D,E,1,1,2:3,2:3)

SameVec=function(A,B){ fl=T; for (i in 1:Len(A)){if(A[i] !=B[i]){fl=F; break}}; fl} #
ベクトル同一判定

Sample=function(...) sample(...,replace=T) # random-sample replace=T

Sch=function(D,rex,x=1,y=1){
 A=D[,x]; B=which(grepl(rex,A)); D[B,y]
} #Search D:df, rex:regex, x:col for search, y:col for return
#Sch=function(df,x=1,y,s){A=df[,x]; w=which(A==s); df[w,y]}
#Search df, x:col for search, y:col for return, s:element for sch

Sci=function(s=F) if(s) options(scipen=0) else options(scipen=999)
# Sci(T): scientific notation / Sci(F): NO s.n.

SD=function(A) sd(A,na.rm =T) #standard dev

SdFreqDistD=function(D){
 D=DF(D); nr=NR(D); nc=NC(D); S=NULL
 for(i in 1:nc){
  m=sum(1:nr*D[,i])/sum(D[,i]) #m: mean
  v=sum((1:nr-m)^2*D[,i])/sum(D[,i]) #v:variance
  S[i]=sqrt(v) #S: st.dev. vector
```

```
  }; S
} #St. dev. of Freq. dist. in DF

SDp.r=function(A) {n=Len(A); SD(A)/Mean(A)/sqrt(n)}
#relative unbiased standard dev.
# SDp=function(A) {n=Len(A); sqrt((n-1)/n)*sd(A)} #sd: unbiased standard dev.
# sdpr=function(A) {n=Len(A); sd(A) #unbiased standard dev.

SDp=function(A) {n=Len(A); sqrt((n-1)/n)*SD(A)}
#SDp; population standard dev. / sd: unbiased standard dev.

Security.score=function(M,s1=1,s2=0,r=3,S=NULL){
  Rs=RowSums(M); Cs=ColSums(M); n=sum(M); nr=NR(M); nc=NC(M);R=M
  if(s2==0){ # 1/n.of.cells
    if(s1==1) for(i in 1:nr){for(j in 1:nc)R[i,j]=BinS(M[i,j],Rs[i],1/nc)} #row
    if(s1==2) for(i in 1:nr){for(j in 1:nc)R[i,j]=BinS(M[i,j],Cs[j],1/nr)} #col
    if(s1==3) for(i in 1:nr){for(j in 1:nc)R[i,j]=BinS(M[i,j],n,1/(nr*nc))} #all
  }else if(s2==1) {
    if(s1==1) for(i in 1:nr){for(j in 1:nc)R[i,j]=BinS(M[i,j],Rs[i],Cs[j]/n)} #row
    if(s1==2) for(i in 1:nr){for(j in 1:nc)R[i,j]=BinS(M[i,j],Cs[j],Rs[i]/n)} #col
  } else{ # Sum
    for(i in 1:nr){for(j in 1:nc) R[i,j]=BinS(M[i,j],Rs[i],S[j]/sum(S))}
  }; Rnd(R,r)
} # Security score #M:mat, s1=1:row,2:col,3:total, s2=0:n. of cells, 1:ALL, 2:Sum
# A=c(10,19,14,7,12,11,7,10,0,1,0,0,1,12,1,0,1,2,3,3)
# M=Matrix(A,4,5,T); M
# Security.score(M,sel=1) #M:matrix, sel=1:row,2:col,3:total

SelectCol=function(D,re,ic=T,p=T,f=F,iv=F) {
  #Select cols by regex. re:regex,ic:ignore-case,p=perl,f:fixed,iv:invert
  D[,grep(re,CN(D),ic,p,fixed=f,invert=iv)]}

SelectRow=function(D,re,ic=T,p=T,f=F,iv=F) {
  #Select rows by regex. re:regex,ic:ignore-case,p=perl,f:fixed,iv:invert
  D[grep(re,RN(D),ic,p,fixed=f,invert=iv),]}

Selpower=function(f,t,e=0.5,cl=.95){
  s=ifelse(f<t/2,'l','g');m=ifelse(f<t/2,-1,1);Power(f,t,e,cl,s)*m
} # Selective power (plus/minus)
```

```
Selrisk=function(f,t,e=0.5){
 s=ifelse(f<t/2,'l','g');m=ifelse(f<t/2,-1,1);BinR(f,t,e,s)*m
} # Selective risk (plus/minus)

Selsecurity=function(f,t,e=0.5){
 s=ifelse(f<t/2,'l','g');m=ifelse(f<t/2,-1,1);BinS(f,t,e,s)*m
} # Selective security (plus/minus)

Sep=function(str,sep=',',trim=T){
 r=unlist(strsplit(str,sep)) # strsplit
 if(trim) r=gsub('(^[ ]+|[ ]+$)','',r); r
} #スプリット  Separar secuencia de letras

Sepa=function(str,sep=',',trim=T){
 r=unlist(str_split(str,sep)) # str_split: stringr (x: ñ)
 #r=unlist(strsplit(str,sep)) # strsplit
 if(trim) r=gsub('(^[ ]+|[ ]+$)','',r); r
} #スプリット  Separar secuencia de letras
#F2=T3[order(T3$LM,T3$CG,T3$Lex,T3$Num,T3$Forma), ]; L(F2) #ソート

Seq=function(f=-1,t=1,len=10) seq(f,t,length.out=len) # seq.number

SF=function(f,t,s=.95,b=10^3){
 #Secure frequency. f:frequency,t:total,s:security,b:base
 if(t==0) return(0); e=BinE(f,t,s); BinF(b,e,s)}

SFS=function(D,E,s=.95,e=NULL){
 #D:frequency-df, E:total-df, s=security, b:base
 D=DF(D); E=DF(E)
 if(is.null(e)) e=EX(D,E); print('exponent: '&e); b=10^e
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  if(is.na(D[i,j])) D[i,j]=NA else D[i,j]=SF(D[i,j],E[i,j],s,b)
 }}; D} #Secure frequency score

Sign=function(D,E){# Significance marking by E
 R=D
 for(i in 1:NR(D)){for(j in 1:NC(D)){
  e=E[i,j]; d=D[i,j]
  if(is.na(d)) {R[i,j]='＊'; next}
  if(e<=0.01)     R[i,j]='＝ ' & d
```

```
   if(e>0.01&e<=0.05) R[i,j]='－ '& d
   if(e>=0.99)     R[i,j]='＃ '& d
   if(e>=0.95&e<0.99) R[i,j]='＋ '& d
  }}; R
}

Signx=function(D,s=3,p=T){
  # Significance marking bin=0.01 =>"--0.01", 0.95=>"+0,95"
  #s=1:row/2:col/3:all, p=T:equal probability/F:expected p.
  R=D; if(p) B=BinM(D,s) else B=BinA(D,s)
  for(i in 1:NR(D)){for(j in 1:NC(D)){
   b=B[i,j]; d=D[i,j]; if(is.na(d)) next
   if(b<=0.01)     R[i,j]='-- ' & d
   if(b>0.01&b<=0.05) R[i,j]='- '& d
   if(b>=0.99)     R[i,j]='++ '& d
   if(b>=0.95&b<0.99) R[i,j]='+ '& d
  }}; R
}
#D=DF(x1=c(10,21,32),x2=c(52,43,25)); Sign(D,1); BinM(D,1)

Similar=function(A,B){
  library(stringdist); n=Len(A); C=numeric(n); st=Sys.time()
  for (i in 1:n) {
   Dis=stringdistmatrix(A[i], B); w=which.min(Dis); print(i&'/'&n)
   C[i]=ifelse(Dis[w]==nchar(A[i])|Dis[w]==nchar(B[w]),0,w)
  }; print("Time: "&round(as.numeric(Sys.time()-st),1)&' sec.'); C
} #Similar form index 類似形インデックス(for)

SimilarMat=function(A,D){
  library(stringdist); n=Len(A); nc=NC(D); st=Sys.time()
  R=DF(matrix(rep(0, n*nc), NC = nc)); R[,1]=A
  colnames(R)=CN(D)
  for (i in 1:n) {
   Dis=stringdistmatrix(A[i], D[,1]); w=which.min(Dis); print(i&'/'&n)
   mx=max(nchar(A[i]), nchar(D[w,1]))
   if(Dis[w]<mx) R[i,2:nc]=D[w,2:nc]
  }; print("Time: "&round(as.numeric(Sys.time()-st),1)&' sec.'); R
} #Similar form matrix: A 列の要素と D の 1 列と比べ最類似形の D を代入,不一致
=>0
```

```
SimpleSum=function(df, col){
 X=xtabs(~df[,col], df); X=DF(X); X=Ordenar(X,1)
 colnames(X)=c(col,'frec'); X
} #単集計 suma simple

Skew.e=function(A){Mean((A-Mean(A))^3)/(SDp(A)^3)} #歪度 Excel SKEW.P

Skew.r=function(A){n=Len(A); Skew.e(A)*sqrt(n-1)/(n-2)} #相対歪度 relative SKEW

Skew=function(A){t=Sum(((A-Mean(A))/SD(A))^3); n=Len(A); t*n/(n-1)/(n-2)}

Smooth=function(X,n=1,s=1){
 if(s==2) X=t(X); nr=NR(X); nc=NC(X); W=X
 for(h in 1:n){
  X=W; for(i in 1:nr){for(j in 1:nc){
   if(j==1)   W[i,j]=(X[i,1]+X[i,j]+X[i,j+1])/3
   else if(j==nc) W[i,j]=(X[i,j-1]+X[i,j]+X[i,nc])/3
   else     W[i,j]=(X[i,j-1]+X[i,j]+X[i,j+1])/3
  }}}; if(s==2) t(W) else W
} #平滑化得点 n:回数, s=1:行, 2:縦

SN=function(V){for(i in 1:Len(V)){V[i]=Add(i,'.',V[i])}; V} #連番.要素

SORT=function(D, K=1, A=NULL, rn=T) {
 D=DF(D); if(is.null(A)) A=rep(T,Len(K))
 for(i in Len(K):1) {
  if(K[i]==0) D=D[order(row.names(D)), ]
  #else D=D[order(D[,K[i]],!A[i]),]
  #else D=D[Order(D[,K[i]],!A[i]),]
  else D=D[ORDER(D[,K[i]],!A[i]),] #文字 and 数値
 }; if(rn) row.names(D)=NULL; D
} #複数キーK で D をソート, ex.K:c(2,1); A=T:昇順, F:降順
#SORT(D,c(2,1,c(T,F)) #行名でソート
# Sort=function(M=D,r=NULL,c=NULL,d=F,n=F){
# if(!is.null(c)) {c=rev(c); for(i in 1:Len(c)) M=SortC(M,c[i],d,n)}
# if(!is.null(r)) {r=rev(r); for(i in 1:Len(r)) M=SortR(M,r[i],d,n)}; M
# } #行列ソート
# # Sort(M=D,r=NULL,c=NULL,d=F) D:データ行列,r:ソートキー番号(行),c:r:ソートキー番号(列),d:降順
```

```
Sort=function(D, K=1, Dc=NULL, rn=T) {
 #D: df/vec, K:key, Dc:ascending/descending; rn:row number
 Order=function(A,d) { #Spanish or numeric
  is.num=all(!is.na(suppressWarnings(as.numeric(A))))
  if(is.num) {d=ifelse(d,-1,1); A=as.numeric(A); Od=order(d*A)}
  else {library(stringi)
   Od=stri_order(A,locale="es_ES",decreasing=d,strength=4,uppercase_first=F)
  }; Od
 } # Each order array of Spanish words (d=T: descending)
 ORDER=function(A,d){ #Spanish or numeric
  Nm=IsNumeric(A); W1=which(Nm); W2=which(!Nm) #index
  O1=Order(A[Nm],d); O2=Order(A[!Nm],d); c(W1[O1], W2[O2]) #num,char
 } # All order array of Spanish words (d=T: descending)

 D=DF(D); if(is.null(Dc)) Dc=rep(F,Len(K))
 for(i in Len(K):1) {
  if(K[i]==0) A=row.names(D) else A=D[,K[i]] # object vec
  D=D[ORDER(A,Dc[i]),] #numeric and char
 }; if(rn) row.names(D)=NULL; D #row num; output
} #Multiple key sort (Spanish), ex.K:c(2,1); Dc=c(F,T), F:ascend, T:descend
# A=c('10', '2', 'a', '1', 'x', 'b'); SORT(A)
# A=c('10', '2', 'a', '1', 'x', 'b'); SORT(A,1,T)
# D=cbind(A=c(1,2,2,3), B=c(5,7,6,8)); SORT(D,c(1,2))
# D=cbind(A=c(1,2,2,3), B=c(5,7,6,8)); SORT(D,c(1,2),c(F,T))

SortA=function(A) {
 library(stringi);stri_sort(A,locale="es_ES",strength=4,uppercase_first=F)}
# Sort array of Spanish words

SortAO=function(A,O){
 Ind=order(match(A, Ord)); A[Ind] #sorted vector
} #Sort vector A by order vector Ord
#A=V('c,d,a,b,c'); O=V('b,c,a'); SortAOrd(A,O)

SortC=function(D,x=NULL,d=F,r=F){
 if(is.null(x)) return(D)
 #D=DF(D) #df とする
 if(!IsN(x)) x=FN(x,CN(D)) #x が数値でなければ列名とする
 A=IE(x==0, RN(D), D[,x]) #行名 or 列名でソート
 if(NC(D)==1){
```

```
   Rns=RN(D)[Order(A,d)]; Cns=CN(D)
   D=DF(D[Order(A,d),])
   rownames(D)=Rns; colnames(D)=Cns
  }else D=D[Order(A,d),] #順位に従って並べ替え
  if(r) rownames(D)=1:NR(D)
  D
} #列番号で行をソート(D:行列・DF,x=1:列番号,d=T:降順,r=T:行名連番)

SortD=function(D,col=1,dec=F,rn=T){
  #SortD(F2,'Lema,Cg,Lex,Num,Forma',c(F,F,F,F,F))
  if(is.numeric(col)) Cm=col else Cm=VT(col)
  for(i in Len(Cm):1){
   V=D[,Cm[i]]; if(is.character(V)) V=Spa(Vt)
   Or=order(Vt, decreasing=dec[i]); D=D[Or,] #  ソート
  }; if(rn) rownames(D)=1:NR(D); D
} #  スペイン語データフレームソート  (D: dataframe, col: column, dec: descreasing)

SortDO=function(D,O,c=0,d=F,r=F){
  A=IE(c==0,RN(D),D[,c]) #行名 or 列名でソート
  Id=order(match(A,O)) #O の順番に従ったインデックス
  D=D[Id,] #インデックスに従って並べ替え
  if(r) rownames(D)=1:NR(D) #行連番
  D
} #列番号で df を O に従ってソート(D:df,O:vt,c=0:列,d=T:降順,r=T:行連番)
# D=DF(x=V("penas,pena,penas,peña"),y=V("b,c,a,d"),z=c(3,1,5,2)); D
# A=V('z,d,a,x'); SortDO(D,A,2)

SortM=function(D, K=1, A=NULL) {
  D=DF(D)
  if(is.null(A)) A=rep(F,Len(K))
  #for(i in Len(K):1) D=D[order(D[,K[i]]),]; D #数値
  # for(i in Len(K):1) D=D[Order(D[,K[i]],A[i]),]; D #文字 or 数値
  for(i in Len(K):1) D=D[ORDER(D[,K[i]],A[i]),]; D #文字 or 数値
  D #文字 and 数値
} #複数キーK でデータフレーム D をソート, ex.K:c(1:3); A=F:昇順, T:降順
# D=DF(x=V("penas,pena,penas,peña"),y=V("b,c,a,d"),z=c(3,1,5,2)); D
# SortM(D,c(1,2)); SortM(D,c(2,1)); SortM(D,c(1,2),c(T,F))
# A=V("penas,pena,penas,peña"); SortM(A,1,F); SortM(A,1,T)

SortR=function(M=D,x=NULL,d=F,n=F){
```

```
 t(SortC(t(M),x,d,n))
} #行番号で列をソート(M:行列・DF,x=1:行番号,d=T:降順,n=T:数値処理)

SortS=function(D,cdo,rn=T){
 Sys.setlocale("LC_CTYPE", "Spanish_Spain.1252"); Cdo=VT(cdo)
 for(i in Len(Cdo):1){
  Sp=Sep(Cdo[i],':'); col=Sp[1]; dec=Sp[2]; ord=Sp[3] # column, decreasing, order
  dec=ifelse(dec=='T', T, F)
  vt=D[,col]
  if(ord!='xx') vt=match(vt,Sep(ord,';'), nomatch=99) # 完全一致
  else if(is.character(vt)) Encoding(vt)="UTF-8"
  Or=order(vt, decreasing=dec); D=D[Or,] # ソート
  #if(is.character(vt)) vt=Spa(vt) # スペイン語文字処理
 }; if(rn) rownames(D)=1:NR(D); D
} # スペイン語データフレームソート SortS(D,'Lema:F:a;c;b,...') (D: dataframe, col: column, dec: descreasing)

SortV=function(vt,dec=F){
 if(is.character(vt)) wt=Spa(vt) else wt=vt
 Or=order(wt, decreasing=dec); vt[Or] # ソート
} # スペイン語ベクターソート (df: dataframe, dec: descreasing)

SP=function() Sys.setlocale(category = 'LC_CTYPE', locale = 'spanish') #スペイン語文字設定

Spa=function(B1){
 St=strsplit(B1,' '); U1=unlist(St); U2=Spas(U1); Ln=NULL; n=0
 for(i in 1:Len(St)){
  len=Len(St[[i]]); n=n+1; e=n+len-1; Ln[i]=Concat(U2[n:e], ' '); n=e
 }; Ln
 # mx=max(str_count(B1,' ')); Df=mx-str_count(B1,' ') # スペース数の最大値からの不足数
 # B1=B1&str_dup(' ',Df) # スペース補充
 # St=str_split(B1,' '); K1=DF(St); B2=t(K1); B3=Spas(B2)
 # B4=DF(matrix(B3,Len(B1))); B5=ReplaceAll(B4,'^ 00=>')
 # Concat(B5, ' ') #df の横行を空白' 'で繋ぐ
} # スペイン語ベクトル=>ソート用文字ベクトル

Spas=function(vt){
 vt=ReplaceV(vt,'ñ=>nzz;ç=>czz;[{}()<>«»¡¿!?-]=>;¥¥[=>;¥¥]=>')
```

```
 Gr=gregexpr(pattern='[áéíóúüÁÉÍÓÚÜ]', vt)
 Ra=rapply(Gr, function(x) head(x, 1)[1])
 Ra=ifelse(Ra<0,0,Ra); Ra=ifelse(Ra<10, '0'&Ra, ''&Ra)
 od="áéíóúÁÉÍÓÚüÜïùà"
 nw="aeiouAEIOUuUiua"
 # od="áéíóúÁÉÍÓÚüÜàèìòùÀÈÌÒÙâêîôûÂÊÎÔÛäëïöÄËÏÖ"
 # nw="aeiouAEIOUuUaeiouAEIOUaeiouAEIOUaeioAEIO"
 chartr(od, nw, vt) & ' ' & Ra
} # スペイン語ベクトル=>ソート用文字ベクトル

Spl=function(str){
 #as.numeric(unlist(strsplit(C, ', *')))
 as.numeric(Split(str))
} #文字列=>数値ベクトル  ex '2,3,1' => c(2,3,1)

Split=function(str,r=', *') unlist(strsplit(str,r)) #文字列を RE でスプリット  =>  配列

SplitA=function(A,sep=',') DF(do.call(rbind, strsplit(A,sep)))
#文字ベクトル A の要素を sep で分離して df を返す

SplitAr=function(A=D,r='¥¥.',d=1){
 for (i in 1:Len(A)){A[i]=Split(A[i],r)[d]}; A
} #配列 A の要素を r でスプリットし d 番の要素を返す

SplitVt=function(Vt,s,n){
 sapply(strsplit(Vt, s), `[`, n)
} # 文字ベクトル Ar の要素を s でスプリットした n 番目のベクトル

SS=function(X,Y){return (MV(X,Y,'s'))} #行列・ベクトルの引き算  X - Y

STA=function(X=D,r=T,s='sum,mean,sd',d=1){
 R=NULL; for (st in Split(s)){W=Stat(X,r,st)
 if(r) R=cbind(R,W) else R=rbind(R,W)
 }; Rnd(R,d)
}#統計量: STA(X=D,r=F,s='sum,mean,sd',d=1)
##([D],r=[F]:列/T:行,s:統計値  ex.'sum,mean,sd',d:小数桁)
#s: sum,mean,median,mid,min,max,sd,SDp,var,varp,Qt1,q2,q3,rng,gini,entropy
#s: gm,gmz,gsd,gsdz,kurt,kurt.r,ldi,pareto,skew,skew.e,skew.r,

Start=function(){ #開始/初期化
```

```
 # load(".RData") #ワークスペースを復元
 # rm(list=ls(envir=globalenv()), envir=globalenv()); cat("¥014")
 # ワークスペースとコンソールをクリア Despejar espacio de trabajo y consola
 #options(scipen=1) #指数表示=>小数点表示
 options(timeout=120) #graphic time out: 120 sec
 windowsFonts(myFont = windowsFont("Courier")); par(family = "myFont") # Fuentes
windows
 Sys.setenv(LANGUAGE="en") # Console in English
 #Sys.setenv(LANGUAGE="ja") # Console in Japanese
 # Sys.setlocale(category = 'LC_CTYPE', locale = 'spanish')#スペイン語文字
 par(family = "HiraKakuProN-W3") #日本語文字(MAC)
 # dev.off() #デバイスを閉じる (初期値に戻る)
 #source('L.R');source('N.R'); source('G.R')
 options(scipen=999) # with NO scientific notation
 windowsFonts(myFont = windowsFont("Courier")); par(family="myFont")
 Library()
}

Stat=function(X,r=T,sta){
 #sta='sum',mean,median,mid,min,max,sd,SDp,var,varp,q1,q2,q3,etc.
 if(r==T){R=t(t(apply(X,1,eval(sta)))); colnames(R)=c(sta)} #行
 if(r==F){R=t(apply(X,2,eval(sta))); rownames(R)=c(sta)} #列
 R
} #統計量 (c=1:行 ; 2:列) sta(X,1,'mean')

Std=function(d) (d-Mean(d))/SDp(d) #標準化
#Sum=function(A) sum(As.numeric(A),na.rm=T) #NaN を除く

STD=function(D,s=1){
 Me=AP(D,s,mean); SDp=AP(D,s,SDp); MV(MV(D,Me,'s'),SDp)
} #標準得点 (s=1:行 ; 2:列; 3:全)

Str=function(A=D){toString(A)
} #ベクトル=>文字列

Str2Var=function(str){eval(parse(text=str))
} #string=>variable
Sustituir=Sus=function(df,col=1,sus,sep=';'){ #c(olumna), sus ex: 'a=>b;x=>y')
 Ss=Sep(sus,sep)
 for(i in 1:Len(Ss)){
```

```
   Ar=Sepa(Ss[i],'=>'); f=Ar[1]; t=Ar[2]
   if(class(df)=='data.frama') df[,Col]=gsub(f,t,df[,col],T)
   else df=gsub(f,t,df,T)
  }; df
} #置換  Sustituir por regex

Sum=function(A) sum(A,na.rm=T) #NaN を除く

SumCross=function(D,x,A){
  #(D:data frame, x:column of class, A:array of frequency columns)
  X=NULL; for(i in A){
    X=rbind(X,xtabs(D[,i]~D[,x],D))
  }; rownames(X)=colnames(D)[4:13]; t(X)
} #クロス集計  ex:SumCross(G1,'Sufijo',4:13)

Summary=function(D,d=1){
  nc=NC(D); A=rep(0,nc); R=DF(A,A,A,A,A,A)
  for(i in 1:NC(D)){
    A=D[,i]; A=sort(A); n=Len(A)
    a1=A[1];a2=A[n/4];a3=A[n/2];a4=A[n*3/4];a5=A[n]
    R[i,1]=ifelse(all(IsNum(A)), Rnd(min(A),d), a1)
    R[i,2]=ifelse(all(IsNum(A)), Rnd(quantile(A)[2],d), a2) #1-quartile
    R[i,3]=ifelse(all(IsNum(A)), Rnd(median(A),d), a3)
    R[i,4]=ifelse(all(IsNum(A)), Rnd(mean(A),d), '.')
    R[i,5]=ifelse(all(IsNum(A)), Rnd(quantile(A)[4],d), a4)
    R[i,6]=ifelse(all(IsNum(A)), Rnd(max(A),d), a5)
  }; rownames(R)=colnames(D); colnames(R)=VT('Min,1-Q,Median,Mean,3-Q,Max'); R
}

#### T ####

T.mean.g=function(V,p=0){
  R=rev(order(abs(V-Median(V)))); n=Len(V); M=NULL;
  if(p==0) k=IE(n%%2==0,n-1,n) else k=ceiling(n*(1-p/100))
  for(i in 1:k){
    if(i>1){r=R[i-1]; if(r<n/2) V[r]=NA else V[r]=NA}
    M[i]=Mean(V)
  }; Mean(M)} # Gradual trimmed mean. V: vt,p:percent ex.80
# V=c(0, 13, 18, 20, 42, 157); T.mean.g(V) # 21.80333
# V=c(0, 13, 18, 20, 42, 157); T.mean.g(V,p=80) # 30.13333
```

```
T.mean=function(V,t=1){
  V=sort(V); n=Len(V); for(i in 1:t) V[c(i,n-i+1)]=NA
  Mean(V)} # Trimmed mean. V:vt,t:trim-count ex.2
# V=c(0, 13, 18, 20, 42, 157); T.mean(V) # 23.25
# V=c(0, 13, 18, 20, 42, 157); T.mean(V,t=2) # 19

T2D=function(D) as.data.frame.matrix(D)
#T2M=function(Tb){matrix(Tb, NC(Tb), dimnames=dimnames(Tb))} # table => matrix

T2M=function(D){M=matrix(D, NC(D));rownames(M)=RN(D);colnames(M)=RN(D);M}
# table to matrix

Table=function(D,C){R=DF(table(D[,C])); names(R)=c(CN(D)[C],"freq"); R}
# Frequency table of D[,C] ex. Table(D,1:2) -> x,y,freq
# D=DF(x=Sample(VT('a,b,c'),10),y=Sample(VT('d,e'),10),z=Sample(VT('f,g'),10))
# D; Table(D,1:3)

Text2Word=function(D){
  nc=NC(D); A=D[,nc]
  A=gsub('([^0-9a-záéíóúàèìòìâêîôûäëïöüñçſ~&<>¥r¥n-])',' ¥¥1 ',A,T,T)
  D[,nc]=gsub('^([[:space:]]+)|([[:space:]]+)$','',A) # trim
  library(tidyr); W=separate_rows(D, nc, sep=" +")
  D=DF(N=1:NR(W),W); names(D)[nc+1]="Key"; D
} #テキストから単語へ 2024-02-10

ToLower=function(X,Y){
  I1=is.na(match(X,Y)); I2=!Detect(X,'^[IVXLCDM]+$')
  ifelse(I1&I2, tolower(X), X)
} #固有名詞・ローマ数字以外=>小文字

TR=function(D) noquote(t(D))
# (1) t-test, one sample

Trans=function(D) as.data.frame(t(D)) # t:transpose -> data-frame (x:DF)

Trim=function(str) gsub('^([[:space:]]+)|([[:space:]]+)$','',str)
#トリム(前後の空白, タブ, 改行を除去)
#T2D=function(Tb){mt=T2M(Tb); DF(mt)} # table => DF
```

```
Ttest1.z=function(A,pm,psd,side='t',cl=.95,r=3){
 #A:vector, pm:pop. mean, psd:pop.sd, cl:confidence level, side:l/g/t, r=Rnd
 n=Len(A);sm=mean(A);ssd=sd(A); dm=sm-pm
 t=dm/(ssd/sqrt(n))#sm:sample mean; n:sample size; t:t-value
 es=dm/sqrt((ssd^2+psd^2)/2); mx=max(A); mn=min(A); rg=mx-mn#effect size; range
 em=ifelse(side=='t', qt((1+cl)/2,n-1)*(ssd/sqrt(n)), qt(cl,n-1)*(ssd/sqrt(n)))
 #error margin
 if(side=='l') {p=pt(abs(t),n-1);Ci=c(-Inf,sm+em)} #p-value (lower side); CI
 if(side=='g') {p=1-pt(abs(t),n-1);Ci=c(sm-em,Inf)} #p-value (upper side); CI
 if(side=='t') {p=2*pt(abs(t),n-1,lower.tail=F);Ci=c(sm-em,sm+em)}
 pw=unlist(unname(pwr.t.test(n,es,1-cl,NULL,'one.sample',side)[4])) #power
 if(side=='t') wd=Ci[2]-Ci[1] else if(side=='g') wd=(sm-Ci[1])*2 else wd=(Ci[2]-sm)*2
 R=Rnd(c(sm,pm,dm,dm/pm,mx,mn,ssd,t,n-1,1-p,p,es,Ci,em*2,rg,em*2/rg,pw,n),r)
 names(R)=c('sm:sample                    mean','pm:pop.mean','sm-pm','(sm-
pm)/pm','max','min','sample-sd',
          't','df','security','p-value','effect-size','lower-bound','upper-bound',
          'width','range','width/range','power','n'); R
} #One sample t-test (Comparison with population mean)

Ttest1=function(A,pm,psd,side='t',cl=.95,r=3){
 #A:vector, pm:pop. mean, psd:pop.sd, cl:confidence level, side:l/g/t, r=Rnd
 n=Len(A);sm=mean(A);ssd=sd(A); dm=sm-pm
 Tt=t.test(A,NULL,side,pm,F,F,cl); U=unname(unlist(Tt[1:3]))
 t=U[1]; df=U[2]; p=U[3]; Ci=Tt$conf.int[1:2] #t, df, p-value, conf.interval
 es=dm/sqrt((ssd^2+psd^2)/2); mx=max(A); mn=min(A); rg=mx-mn#effect size; range
 if(side=='t') wd=Ci[2]-Ci[1] else if(side=='g') wd=(sm-Ci[1])*2 else wd=(Ci[2]-sm)*2
 pw=unlist(unname(pwr.t.test(n,es,1-cl,NULL,'one.sample',side)[4])) #power
 R=Rnd(c(sm,pm,dm,(dm)/pm,mx,mn,ssd,t,n-1,1-p,p,es,Ci,wd,rg,wd/rg,pw,n),r)
 names(R)=c('sm:sample                    mean','pm:pop.mean','sm-pm','(sm-
pm)/pm','max','min','sample-sd',
          't','df','security','p-value','effect-size','lower-bound','upper-bound',
          'width','range','width/range','power','n'); R
} #One sample t-test (Comparison with population mean)
# A=c(47,48,51,57,58,59,62,67); pm=50; psd=10; cl=.95; side='t'; r=5
# Ttest1.z(A,pm,psd,side,cl,r); Ttest1(A,pm,psd,side,cl,r)
# t.test(A,NULL,side,pm,F,F,cl)

Ttest2.z=function(A,B,side='t',cl=.95,r=3){
 Ds=A-B; m=mean(Ds);s=sd(Ds); n=Len(Ds); se=s/sqrt(n); t=m/se; df=n-1
 em=ifelse(side=='t', qt((1+cl)/2,df)*se, qt(cl,df)*se) #error margin
```

```
 m1=mean(A); v1=var(A); m2=mean(B); v2=var(B); rg=max(A,B)-min(A,B) #mean; range
 es=(m1-m2)/sqrt((v1+v2)/2); sd1=sqrt(v1); sd2=sqrt(v2) #effect size; sd
 if(side=='l') {p=pt(t,df);Ci=c(-Inf, m+em)} #'l'
 if(side=='g') {p=1-pt(t,df);Ci=c(m-em, Inf)} #'g'
 if(side=='t') {p=2*pt(-abs(t),df);Ci=c(m-em, m+em)} #'t'
 pw=unlist(unname(pwr.t.test(n,es,1-cl,NULL,'paired',side)[4])) #power
 m1=mean(A); m2=mean(B); dm=m1-m2;
 if(side=='t') wd=Ci[2]-Ci[1] else if(side=='g') wd=(sm-Ci[1])*2 else wd=(Ci[2]-sm)*2
 R=Rnd(c(m1,m2,dm,dm/m2,sd1,sd2,n,t,df,1-p,p,es,Ci,wd,rg,wd/rg,pw,n),r)
 names(R)=c('m1:mean.1','m2:mean.2','m1-m2','(m1-m2)/m2','sd1','sd2','n','t','df',
          'security','p-value','effect-size','lower-bound','upper-bound',
          'width','range','width/range','power','n'); R
}# Paired two sample t-test (difference in means)

Ttest2=function(A,B,side='t',cl=.95,r=3){
 Tt= t.test(A,B,side,0,T,F,cl)
 U=unname(unlist(Tt[1:3])); t=U[1]; df=U[2]; p=U[3]
 Ci=Tt$conf.int[1:2] #conf.int
 sd1=sd(A); sd2=sd(B); es=(m1-m2)/sqrt((sd1^2+sd2^2)/2) #effect size; sd
 pw=unlist(unname(pwr.t.test(n,es,1-cl,NULL,'paired',side)[4])) #power
 m1=mean(A); m2=mean(B); dm=m1-m2; n=Len(A); rg=max(A,B)-min(A,B)
 if(side=='t') wd=Ci[2]-Ci[1] else if(side=='g') wd=(dm-Ci[1])*2 else wd=(Ci[2]-dm)*2
 R=Rnd(c(m1,m2,dm,dm/m2,sd1,sd2,n,t,df,1-p,p,es,Ci,wd,rg,wd/rg,pw,n),r)
 names(R)=c('m1:mean.1','m2:mean.2','m1-m2','(m1-m2)/m2','sd1','sd2','n','t','df',
          'security','p-value','effect-size','conf.int.1','conf.int.1',
          'width','range','width/range','power','n'); R
}# Paired two sample t-test (difference in means)
# A=c(24,32,32,28,35); B=c(20,22,26,18,24); cl=.95; side='t'; r=4
# Ttest2.z(A,B,side,cl,r); Ttest2(A,B,side,cl,r)
# t.test(A,B,side,0,T,F,cl)

Ttest3.z=function(A,B,side='t',cl=.95,r=3){
 #A,B:vector; cl:confidence level; side:lower,greater,two.sided; r=Rnd
 if(Len(A)==3) {n1=A[1];m1=A[2]; v1=A[3]; n2=B[1];m2=B[2];v2=B[3]}
 else{n1=Len(A);m1=mean(A);v1=var(A); n2=Len(B);m2=mean(B);v2=var(B)}
 df=(v1/n1+v2/n2)^2/((v1^2/(n1^2*(n1-1)))+(v2^2/(n2^2*(n2-1)))) #Welch degree of freedom
 dm=m1-m2; t=dm/sqrt((v1/n1)+(v2/n2)) #Welch t-statistic
 em=ifelse(side=='t', qt((1+cl)/2,n1-1)*sqrt(v1/n1), qt(cl,n1-1)*sqrt(v1/n1))#error
```

```
margin
  se=sqrt((v1/n1)+(v2/n2)) #standard error for the difference in means
  es=(m1-m2)/sqrt((v1+v2)/2);  rg=max(A,B)-min(A,B);  sd1=sqrt(v1);  sd2=sqrt(v2)
#effect size; range
  pw=unlist(unname(pwr.t2n.test(n1,n2,es,1-cl,NULL,side)[5])) #power
  if(side=='l') {p=pt(t,df);em=qt(1-cl,df)*se;Ci=c(-Inf, dm-em)} #less
  if(side=='g') {p=1-pt(t,df);em=qt(cl,df)*se;Ci=c(dm-em, Inf)} #greater
  if(side=='t') {p=2*(1-pt(abs(t),df));em=qt((1+cl)/2,df)*se;Ci=c(dm-em, dm+em)} #two-
sided
  if(side=='t') wd=Ci[2]-Ci[1] else if(side=='g') wd=(dm-Ci[1])*2 else wd=(Ci[2]-dm)*2
  R=Rnd(c(m1,m2,dm,dm/m2,sd1,sd2,n1,n2,t,df,1-p,p,es,Ci,wd,rg,wd/rg,pw,n),r)
  names(R)=c('m1:mean.1','m2:mean.2','m1-m2','(m1-m2)/m2','sd1','sd2','n1','n2',
          't','df','security','p-value','effect-size','conf.int.1','conf.int.2',
          'width','range','width/range','power','n'); R
} # Non paired two sample t-test (difference in means)

Ttest3=function(A,B,side='t',cl=.95,r=3){
  #A,B:vector; cl:confidence level; side:lower,greater,two.sided; r=Rnd
  n1=Len(A);m1=mean(A);v1=var(A); n2=Len(B);m2=mean(B);v2=var(B); dm=m1-m2
  Tt=t.test(A,B,side,0,F,F,conf.level=cl); U=unname(unlist(Tt[1:3]))
  t=U[1]; df=U[2]; p=U[3]; Ci=Tt$conf.int[1:2] #t, df, p-value, conf.int
  es=(m1-m2)/sqrt((v1+v2)/2);  rg=max(A,B)-min(A,B);  sd1=sqrt(v1);  sd2=sqrt(v2)
#effect size; range
  em=ifelse(side=='t',  qt((1+cl)/2,n1-1)*sqrt(v1/n1),  qt(cl,n1-1)*sqrt(v1/n1))#error
margin
  pw=unlist(unname(pwr.t2n.test(n1,n2,es,1-cl,NULL,side)[5])) #power
  if(side=='t') wd=Ci[2]-Ci[1] else if(side=='g') wd=(dm-Ci[1])*2 else wd=(Ci[2]-dm)*2
  R=Rnd(c(m1,m2,dm,dm/m2,sd1,sd2,n1,n2,t,df,1-p,p,es,Ci,wd,rg,wd/rg,pw,n),r)
  names(R)=c('m1:mean.1','m2:mean.2','m1-m2','(m1-m2)/m2','sd1','sd2','n1','n2',
          't','df','security','p-value','effect-size','conf.int.1','conf.int.2',
          'width','range','width/range','power','n'); R
} # Non paired two sample t-test (difference in means)
# A=c(24,32,32,28,35); B=c(20,22,26,18,24,30); side='l'; cl=.95; r=6
# Ttest3.z(A,B,side,cl,r); Ttest3(A,B,side,cl,r)
# t.test(A,B,side,0,F,F,conf.level=cl)

#### U ####

uAX=function(a){ #axis a:angle-x
  theme(axis.text.x=element_text(angle=IE(a,90,0),
```

```
                        hjust=IE(a,0,.5),vjust=IE(a,0,.5)))+
   theme(axis.text.y=element_text(angle=0,hjust=0,vjust=.5))}

uLB=function(t,x,y){ #label: t:title,x:axis-x,y:axis-y
 labs(title=IE(t=='',NULL,t),x=IE(x=='',NULL,x&'¥n'),y=IE(y=='',NULL,y&'¥n'))}

uLM=function(x1=0,x2=0,y1=0,y2=0) { #limit of coordinate system
 if(x1!=0|x2!=0|y1!=0|y2!=0) coord_cartesian(xlim=c(x1,x2),ylim=c(y1,y2))}

uLMx=function(x1=0,x2=0,y1=0,y2=0) {
 R=NULL
 if(x1!=0|x2!=0) R=R+coord_cartesian(xlim=c(x1,x2))
 if(y1!=0|y2!=0) R=R+coord_cartesian(ylim=c(y1,y2)); R}

uLN=function(A) scale_color_discrete(limits=A) # legend name

uLog=function(a=0,b=10) { #Logarithmic axis. a:axis=1:x,2:y,3:x,y,b:log-base
 if(b==0) return()
 x=scale_x_continuous(trans=Log_trans(b)); y=scale_y_continuous(trans=Log_trans(b))
 if(a==1) x else if(a==2) y else if(a==3) x+y}
# uLog=function(xy=0) { #logarithmic axis
# x=scale_x_log10(); y=scale_y_log10()
# if(xy==1) x else if(xy==2) y else if(xy==3) x+y}

uMG=function(m) theme(plot.margin=margin(t=m,r=m,b=m,l=m,"mm"))#margin

UniDis=function(A=D){
 len=Len(A); M=matrix(0,len,len)
 for(i in 1:len){for(j in 1:len){M[i,j]=abs(A[i]-A[j])}}
 colnames(M)=rownames(as.matrix(A)); rownames(M)=colnames(M); M
} #一次元距離行列  unidimensional distance

Uniq=function(E=D,x=0,y=0,n=0){
 if(x==0){ #1 軸
   E=DF(v2=E[,y],n=E[,n]); colnames(E)=c('v2','n')
   E=E %>% group_by(v2) %>% summarise_all(sum) #Uniq-sum
 }else if(y==0){ #1 軸
   E=DF(v1=E[,x],n=E[,n]); colnames(E)=c('v1','n')
   E=E %>% group_by(v1) %>% summarise_all(sum) #Uniq-sum
 }else{ #2 軸
```

```
  E=DF(v1=E[,x],v2=E[,y],n=E[,n]); colnames(E)=c('v1','v2','n')
  E=E %>% group_by(v1,v2) %>% summarise_all(sum) #Uniq-sum
 }; E
} #ユニーク(sum)

Uniq2TV=function(D){R=NULL; for(i in 1:NC(D)){ #uniq to text vector
 A=unique(D[,i]); A=na.omit(sort(A)[1:20])
 R[i]=CN(D)[i]&': '&paste(A,collapse=', ')}; R
}

UniqC=function(D, col=1){
 # D=DF(D); D=D[!duplicated(D[,col]),];rownames(D)=1:NR(D); D
 D=DF(D); D[!duplicated(D[,col]),]
} # 重複行を削除, 例：UniqC(CC,V('Crit,Pr'))

UniqSum=function(D,Col){library(dplyr); count(D,D[,Col])}
#UniqSum=function(D,Col){summarize(group_by(D,D[,Col]),count=n())}
# D のユニークな行ごとの頻度を計算する ex.UniqSum(D,c(1:2))

UpperLeft=function(D){
 nr=NR(D); nc=NC(D); nt=nr+nc; W=D #W: weight-matrix
 for(i in 1:nr){for(j in 1:nc){W[i,j]=nt-i-j}}
 W=W/Sum(W); w=Sum(D*W); m=Mean(D); (w-m)/(w+m) #w:weighted mean
} # Preference:upper-left-part

uPT=function(x,y,s=15,sh=1,f=NA,c='red',a=.5){ # point
 annotate('point',x=x,y=y,size=s,shape=sh,fill=f,color=c,alpha=a)}

uRepel=function(x,y,l,c,s){ # x,y:coordinate,l:label,c:color,s:size
 geom_text_repel(aes(x=x,y=y,label=l),color=c,size=s,max.overlaps=Inf)}

uRT=function(x1,x2,y1,y2,f=NA,c='skyblue',w=1,a=.5){
 # Rectangle. f:fill,c:color,w:line-width
 annotate('rect',xmin=x1,xmax=x2,ymin=y1,ymax=y2,fill=f,color=c,lwd=w,alpha=a)}

uSC=function(s,f,t,br=waiver()){ #scale-continuous:x-y
 sc=IE(s,scale_x_continuous,scale_y_continuous);pos=IE(s,'bottom','right')
 sc(labels=scales::comma,limits=c(f,t),breaks=br,position=pos)}

uSD=function(s,Lb,dd=1){ # limits,labels,dodge,position
```

```
 sc=IE(s,scale_x_discrete,scale_y_discrete);pos=IE(s,'top','left')
 sc(limits=factor(1:Len(Lb)),labels=Lb,guide=guide_axis(n.dodge=dd),
    expand=expansion(mult=c(.01,.01)),position=pos)}

uSFG2=function(l,m,h) scale_fill_gradient2(low=l,mid=m,high=h,midpoint=0)
#scale_fill_gradient2

uSG=function(x1,x2,y1,y2,c,w,t=1){ # segment
 annotate('segment',x=x1,xend=x2,y=y1,yend=y2,color=c,lwd=w,linetype=t)}

uSZ=function(f,t) scale_size_continuous(range=c(f,t)) # scale-size

uTM=function(w=T,f=12,a=0,lb=T,lg=F,tl=F){
 #w:white,f:font,a:angle,lb:grid+label,lg:put legende,tl:title to left
 if(w) G=theme_bw()+theme( # white
   panel.border=element_rect(color="gray",fill=NA,linewidth=1),
   panel.background=element_rect(fill = "white"),
   plot.background=element_rect(fill = "white")
 ) else G=theme_gray() # gray
 G=G+theme(text=element_text(size=f,family="sans")) # font size,
family:serif,sans,mono
 if(tl) G=G+theme(
   plot.title=element_text(hjust=0), # title: justify left
   plot.title.position="plot") # title-position: left
 if(a!=0) G=G+theme(axis.text.x=element_text(angle=a,hjust=.0,vjust=.2))
 if(!lb) G=G+theme(panel.grid=gB(),
              axis.ticks=gB(),axis.text.x=gB(),axis.text.y=gB())
 if(lg) G=G+theme(legend.title=gB())
 else G=G+theme(legend.position="none") #no legend
 G}

uTX=function(x,y,l,s=4,a=F,h=.5,v=.5,c='gray30') { # text
 annotate('text',x=x,y=y,label=l,size=s,angle=ifelse(a,90,0),color=c,
        hjust=h,vjust=v)}

uVL=function(n){ # panel.grid.minor.x for discrete-scale-x
 s=seq(1.5, n-.5, by=1)
 geom_vline(xintercept=s,color='gray',linewidth=0.25,linetype=2)}

#### V ####
```

```
V2D=function(V,r){ # Vector to data-frame
 n=Len(V); c=n/r; D=DF(matrix(V,r,c,T))
 rownames(D)='r'&1:r; colnames(D)='c'&1:c; D}
#V=c(10,19,14,7,12,11,7,10,0,1,0,0,1,12,1,0,1,2,3,3); V2D(V,4)

V2M=function(V, nr=2, h=T){
 matrix(V, NR=nr, byrow=h)
} # ベクトル=>行列 (nr:行数, h:horizontal)

Var=function(A) var(unlist(A),na.rm=T) #var: sample variance

Var2Cha=function(x) as.character(substitute(x))
#name of variable/function 2 charater. ex. Fun2Cha(sum) => "sum"

Var2Str=function(x,s=T) {r=deparse(substitute(x)); if(s) r='['&r&']'; r}

Variables=function(D){
 functions=D[sapply(D,function(obj) is.function(get(obj)))]
 setdiff(D,functions)
} #list of variables: Variables(ls())

Varp=function(A) (Len(A)-1)/Len(A)*Var(A) # varp: population variance
#Varp=function(A) sum((A-Mean(A))^2)/Len(A) # Population variance

Vec2Str=function(A,sep=', ') paste(A,collapse=sep) #Vector of letter to string

Vector.asociativo=function(df){
 Ar=df[,2]; names(Ar)=df[,1]; Ar
} #連想配列 Vector asociativo

Vista=function(X=D){View(X)} #画面表示

Vlookup=function(X,Y,vx=1,vy=1,colx='',coly=''){
 #merge(X, Y, by=b, all.x=T) #長時間(!)
 if(is.character(vx)) vx=which(colnames(X)==vx) #vx:列番号(対象)
 if(is.character(vy)) vy=which(colnames(Y)==vy) #vy:列番号(参照)
 W=matrix('#',NR(X),NC(Y)); colnames(W)=CN(Y) #W:出力
 Mt=match(X[,vx],Y[,vy])
 for(i in 1:Len(Mt))if(!is.na(Mt[i])) W[i,]=as.character(Y[Mt[i],])
```

```
 if(colx!='') {X=as.matrix(X[,colx]); colnames(X)=colx}
 if(coly!='') {W=as.matrix(W[,coly]); colnames(W)=coly} else W=W[,-vy]
 cbind(X,W)
} # 縦参照: Excel-VLOOKUP
#(X:object file, Y:reference file, vx:vlook.x, vy:vlook.y,
#colx, coly:output colx, coly)
VLookUp <- function(D1, D2, c1=1, c2=1) {
 cn=names(D1)[c1]; names(D1)[c1]="v1"; names(D2)[c2]="v2"
 D2=distinct(D2, v2, .keep_all = TRUE)
 library(dplyr);R=left_join(D1,D2,by=c("v1"="v2"))
 names(R)[c1]=cn; R
} #D1 の列 c1 と D2 の c2 が一致すれば D2 のデータを繋ぐ
# D1=DF(ID=c(1, 2, 9),Name = c("John", "Alice", "Bob"))
# D2=DF(X=c(1, 2, 3, 4),Age = c(30, 25, 35, 40))
# VLookUp(D1,D2,1,1)

VlookupRn=function(X,Y,sel=T){
 Rn=RN(X); Cn=CN(Y); N=DF(Y[Rn,])
 rownames(N)=Rn; colnames(N)=Cn
 if(sel) cbind(X,N) else cbind(N,X)
} # 縦参照(行名による) Vlookup by nornames
#cf BindByAnyColumn=function(D,E,d,e) RnSeq(cbind(D,E[match(D[,d],E[,e]),]))

Vname=function(v) {deparse(substitute(v))
} #変数名

VT=function(str,sep=',',trim=F) {
 R=unlist(strsplit(str,sep)); if(trim) R=gsub('(^[ ]+|[ ]+$)','',R); R
}#V('a,b,cc') # vectorize a string of letters

#### W ####

W.head=function(tx){
 Lc=str_locate_all(tx,' ')[[1]] #Left
 if(Len(Lc)==0) tx else substring(tx,1,Lc[1,1]-1)
}; #tx='ax bc ddd'; W.head(tx) #Word in head: ax

W.mean.g=function(V,p=0){
 R=rev(order(abs(V-Median(V)))); n=Len(V); M=NULL
 if(p==0) k=IE(n%%2==0,n-1,n) else k=ceiling(n*(1-p/100))
```

```
  for(i in 1:k){
    if(i>1){r=R[i-1]; if(r<n/2) V[1:r]=V[r+1] else V[r:n]=V[r-1]}
    M[i]=Mean(V)
  }; Mean(M)} # Gradual winsorized mean. V: vt,p:percent ex.80
# V=c(0,13,18,20,42,157); W.mean.g(V) # 23.13333
# V=c(0,13,18,20,42,157); W.mean.g(V,p=80) # 32.08333

W.mean=function(V,p=.8){
  S=sort(V); n=Len(S); lw=ceiling((1-p)/2*n); up=ceiling((1+p)/2*n)
  mn=S[lw+1]; mx=S[up-1]; S[1:lw]=mn; S[up:n]=mx; Mean(S)}
# Winsorized mean. V: numeric vt

W.tail=function(tx){
  Lc=str_locate_all(tx,' ')[[1]] #Right
  if(Len(Lc)==0) tx else Mid(tx,Lc[NR(Lc),1]+1)
}# tx='ax bc ddd'; W.tail(tx) #Word in tail: ddd

W2L=function(D){ # Wide2long format. D:df=>R(v1,v2,r,c,n)
  V1=V2=N=R=C=NULL; k=0
  for (i in 1:NR(D)){for (j in 1:NC(D)){
    k=k+1; V1[k]=RN(D)[i]; V2[k]=CN(D)[j]; R[k]=i; C[k]=j; N[k]=D[i,j]
  }}; R=DF(V1,V2,R,C,N);rownames(R)=NULL;colnames(R)=VT('v1,v2,r,c,n')
  R$v1=factor(R$v1,levels=unique(R$v1))
  R$v2=factor(R$v2,levels=unique(R$v2)); R}

Wd2Five=function(W){
  nr=NR(W)
  A1=c("*",W[-nr,3]); A2=c("*","*",W[-c(nr,nr-1),3])
  P1=c(W[-1,3],"*"); P2=c(W[-(1:2),3],"*","*")
  cbind(W[,1:2],A2,A1,clave=W[,3],P1,P2)
} #from Wd to five words
# Wd=DF(N=1:3, Id=c(1,1,1), Clave=c("Coñocida","cosa","sea"))
# Wd2Five(Wd)

Where=function(A, B) which(B %in% A)
#文字ベクトル B の中でベクトル A に一致した文字列の位置  cf: FindIndex

WhereAB=function(A,B) {Pos=match(A,B); Pos[is.na(Pos)]=0; Pos}
#A の要素の B における位置。B にないときは 0 とする。
#A=c("a","b","c"); B=c("w","a","y","b"); WhereAB(A,B) #2, 4, 0
```

```
WhereFirst=function(n,A){
 w=which(A==n)[1]; if(is.na(w)) w=0; w
} #A の中で n がある最初の位置(ないときは 0)
#A=c(1,2,3,1); WhereFirst(1,A) # 1

WhereNA=function(D) which(is.na(D), arr.ind=T)
# D の中の NA の位置を知る
#D=DF(x = c(1, NA, 3), y = c(NA, 5, NA)); WhereNA(D)

WhereNa=function(D) which(is.na(D),arr.ind=T)#NA の位置の行/列番号
#D=DF(A=c(1,2,NA,4), B=c(NA,6,7,NaN)); WhereNa(D)

WhereNot=function(A,B) which(B %in% setdiff(B,A))
# B の中で A にない要素の位置を見つける
A=c(1,2,5); B=c(1,2,4,5,7); WhereNot(A,B) #3, 5

WhereRe=function(re,A,ic=T) which(str_detect(A,regex(re,ignore_case=ic)))
#文字ベクトル A の中で re に適合した文字列の位置(ic: ignore case)
#re="str"; A=c("Hello","str","STRING"); WhereRe(re,A,T) #2, 3

Which=function(x) which(x, arr.ind=T)
# Coordinate of element. ex: Which(D==0)

Win=function(wd=4,ht=2.5,ps=12) windows(wd,ht,ps,record=T) #window on

WordHead=function(A) {
 A=Trim(A); A=gsub('^([^a-zñçýáéíóúüç¥r¥nâòôàèìêë0-9&])','¥¥1 ',A); n=0
 Head=function(x) {
  n<<-n+1; l=floor(Len(A)/10000)
  if(floor(n/10000)*10000==n) print(n/10000&"/"&l)
  #n<<-n+1; if(floor(n/10000)*10000==n) print(n/10000)
  w=head(strsplit(x, " ")[[1]], 1)
  if(Len(w)==0) w="*"; w
 }; B=sapply(A, Head); names(B)=NULL; unlist(B)
} #最初の語のベクトル
#A=V("(a,a b,a b c"); WordHead(A) # a, a, a

WordHeadNot=function(A) {
 A=Trim(A); A=gsub('^([^a-zñçýáéíóúüç¥r¥nâòôàèìêë0-9&])','¥¥1 ',A); n=0
```

```
 Head=function(x) {
  #n<<-n+1; if(floor(n/10000)*10000==n) print(n/10000)
  n<<-n+1; l=floor(Len(A)/10000)
  if(floor(n/10000)*10000==n) print(n/10000&"/"&l)
  w=strsplit(x, " ")[[1]]; ln=Len(w)
  if(ln>1) {w=w[2:ln]; w=paste(w,collapse=" ")} else w="*"
 }; B=sapply(A, Head); names(B)=NULL; unlist(B)
} #最初の語以外のベクトル
#A=V("(a,a b,a b c"); WordHeadNot(A) # *, b, b c

WordTail=function(A){
 A=Trim(A); A=gsub('([^a-zñçýáéíóúüç¥r¥nâòôàèìêë0-9&])$',' ¥¥1',A); n=0
 Tail=function(x) {
  #n<<-n+1; ; if(floor(n/10000)*10000==n) print(n/10000)
  n<<-n+1; l=floor(Len(A)/10000)
  if(floor(n/10000)*10000==n) print(n/10000&"/"&l)
  w=tail(strsplit(x," ")[[1]],1)
  if(Len(w)==0) w="*"; w
 }; B=sapply(A,Tail); names(B)=NULL; unlist(B)
}
#A=V("a,a b,a b c"); WordTail(A) # a, b, c

WordTail=function(A){
 A=Trim(A); n=0
 Tail=function(x) {
  n<<-n+1; ; if(floor(n/10000)*10000==n) print(n/10000)
  w=tail(strsplit(x," ")[[1]],1)
  if(Len(w)==0) w=""; w
 }; B=sapply(A,Tail); names(B)=NULL; unlist(B)
}
# A=c("a1 bc dx","a2 dy","b b dz") #最後の語のベクトル c("dx","dy","dz")
# WordTail(A)

WordTailNot=function(A){
 A=Trim(A); A=gsub('([^a-zñçýáéíóúüç¥r¥nâòôàèìêë0-9&])$',' ¥¥1',A); n=0
 Tail=function(x) {
  #n<<-n+1; ; if(floor(n/10000)*10000==n) print(n/10000)
  n<<-n+1; l=floor(Len(A)/10000)
  if(floor(n/10000)*10000==n) print(n/10000&"/"&l)
  w=strsplit(x, " ")[[1]]; ln=Len(w)
```

```
  if(ln>1) {w=w[1:(ln-1)]; w=paste(w,collapse=" ")} else w="*"
 }; B=sapply(A,Tail); names(B)=NULL; unlist(B)
}
#A=V("a,a b,a b c"); WordTailNot(A) # *, a, a b
# s="(cosa sea)"
# gsub('^([^a-zñçýáéíóúüç¥r¥nâòôàèìêë0-9&])','¥¥1 ',s)
# gsub('([^a-zñçýáéíóúüç¥r¥nâòôàèìêë0-9&])$',' ¥¥1',s)

#### X ####

XX=function(X,Y){X %*% Y} #行列積

#### Y ####

#### Z ####

Z1.test=function(n,sm,ssd,pm,psd,side='s',cl=.95,r=3){
 #n:sample size, sm:Sample mean, ssd:sample sd,
 #pm:population mean, psd:population sd,
 #side:t:two-sided/g:greater/l:less,cl:conf.level,r:Rnd
 md=sm-pm; se=psd/sqrt(n); z=md/se; qn=qnorm; pn=pnorm
 #se:standard error; #z:z-value
 q=ifelse(side=='t',qn((1+cl)/2),qn(cl)); em=q*se #em:error margin
 if(side=='s') { #selective
  lw=sm-em; up=sm+em # two-sided
  if(sm<pm){ #left
   p=pn(z); cv=qn(1-cl,pm,psd); pw=pn(cv,sm,ssd); b=1-pw #p, power
  }else{ #right
   p=1-pn(z); cv=qn(cl,pm,psd); b=pn(cv,sm,ssd); pw=1-b #p, power
  }
 }
 if(side=='t') { #two-sided
  #p=2*(1-pn(abs(z))); lw=sm-em; up=sm+em
  p=2*pnorm(-abs(z)); lw=sm-em; up=sm+em
  cv1=qn((1-cl)/2,pm,psd); cv2=qn((1+cl)/2,pm,psd) #cv:crit.value
  pw=pn(cv1,sm,ssd)+pn(cv2,sm,ssd,F); b=1-pw #pw:power, b:beta
 }
 if(side=='l') { #left
  p=pn(z); lw=-Inf; up=sm+em
  cv=qn(1-cl,pm,psd); pw=pn(cv,sm,ssd); b=1-pw #pw:power
```

```
  }
  if(side=='g') { #right
    p=1-pn(z); lw=sm-em; up=Inf
    cv=qn(cl,pm,psd); b=pn(cv,sm,ssd); pw=1-b #pw:power
  }
  mx=qn(.95,sm,ssd); mn=qn(.05,sm,ssd)
  rw=2*em/(mx-mn) #rw: relativ width of conf. int.
  sc=1-p; cf=HM(c(abs(sc),abs(pw),(1-rw))) #Hm: harmonic mean
  R=Rnd(c(sm,pm,md,md/(sm+pm),ssd,psd,ssd/sm,psd/pm,n,z,sc,p,b,pw,lw,up,rw,cf),r)
  names(R)=c('sm:sample mean','pm:pop. mean','md:sm-pm','md/(sm+pm)',
             'ssd','psd','ssd/sm','psd/pm','n','z','security','p-value','beta','power',
             'lower-b.','upper-b.','rel.width','confidence'); R
} #Z1.test one sample (sample::population)
# A=c(88,92,94,94,96,97,97,97,99,99,91,100,94,110,99,
#    105,109,109,109,110,112,112,113,114,115)
# n=Len(A);sm=mean(A);ssd=sd(A)
# Z1.test(n,sm,ssd,95,15,'t',r=4)
# library(BSDA); z.test(A, NULL,'t',95,15)

Z2.matrix=function(D,n=12){
  ms=NC(D); M=Matrix(0,ms,ms)
  for(i in 1:ms){for(j in 1:ms){
    A=FreqDistVec(D[,i]); B=FreqDistVec(D[,j])
    M[i,j]=Z2.test(Len(A),mean(A),SDp(A),Len(B),mean(B),SDp(B),'s')[n]
  }}; rownames(M)=colnames(M)=colnames(D); M
} #Matrix analysis (D: Freq.dist., n=12:security,n=20:effect size)

Z2.test=function(n1,m1,sd1,n2,m2,sd2,side='s',cl=.95,r=3){
  #n:sample size, m1:Sample mean, sd1:sample sd,
  #m2:population mean, sd2:population sd,
  #side:t:two-sided/g:greater/l:less,cl:conf.level,r:Rnd
  md=m1-m2; qn=qnorm; pn=pnorm
  #es=md/sqrt((sd1^2+sd2^2)/2)
  es=md/sqrt(((n1-1)*sd1^2+(n2-1)*sd2^2)/(n1+n2-2)) #Cohen's d

  # ps=sqrt(((n1-1)*sd1^2+(n2-1)*sd2^2)/(n1+n2-2)) #pooled sd
  # ps=ps*sqrt(1/n1+1/n2) #standard error
  # z=md/ps #z-value
  ps=sqrt(sd1^2/n1+sd2^2/n2); z=md/ps # Kin 2009 Iwanami, p.121
  if(side=='s') { #selective
```

```
  em=qn((1+cl)/2)*ps; lw=md-em; up=md+em #confidence interval
  if(m1<m2){ #left
   #p=pn(z); cv=qn(1-cl); pw=pn(cv,md,ps); b=1-pw #p, pw:power
   p=pn(z); sc=1-p; cv=qn(1-cl,m2,sd2); pw=pn(cv,m1,sd1); b=1-pw #pw:power
   p=-1*p; sc=-1*sc; pw=-1*pw; b=-1*b
  }else{ #right
   #p=1-pn(z); cv=qn(cl); b=pn(cv,md,ps); pw=1-b #p, pw:power
   p=1-pn(z); sc=1-p; cv=qn(cl,m2,sd2); b=pn(cv,m1,sd1); pw=1-b #pw:power
  }
 }
 if(side=='t') { #two-sided
  p=2*(1-pn(abs(z))); sc=1-p #p-value
  #cv1=qn((1-cl)/2); cv2=qn((1+cl)/2) #cv:crit.value
  cv1=qn((1-cl)/2,m2,sd2); cv2=qn((1+cl)/2,m2,sd2) #cv:crit.value
  #pw=pn(cv1,md,ps)+pn(cv2,md,ps,F); b=1-pw #pw:power, b:beta
  pw=pn(cv1,m1,sd1)+pn(cv2,m1,sd1,F); b=1-pw #pw:power, b:beta
  em=qn((1+cl)/2)*ps; lw=md-em; up=md+em #confidence interval
 } #two-sided
 if(side=='l') { #left
  p=pn(z); sc=1-p; em=qn(cl)*ps; lw=-Inf; up=md+em #p, confidence interval
  #cv=qn(1-cl); pw=pn(cv,md,ps); b=1-pw #pw:power
  cv=qn(1-cl,m2,sd2); pw=pn(cv,m1,sd1); b=1-pw #pw:power
 }
 if(side=='g') { #right
  p=1-pn(z); sc=1-p; em=qn(cl)*ps; lw=md-em; up=Inf #p, confidence interval
  #cv=qn(cl); b=pn(cv,md,ps); pw=1-b #pw:power
  cv=qn(cl,m2,sd2); b=pn(cv,m1,sd1); pw=1-b #pw:power
 }
 mx1=qn(.95,m1,sd1); mn1=qn(.05,m1,sd1)
 mx2=qn(.95,m2,sd2); mn2=qn(.05,m2,sd2)
 rw=2*em/max(mx1-mn2,mx2-mn1) #rw: relativ width of conf. int.
 cf=HM(c(abs(sc),abs(pw),(1-rw))) #Hm: harmonic mean
 R=Rnd(c(m1,m2,md,md/(m1+m2),sd1,sd2,sd1/m1,sd2/m2,n1,n2,z,sc,
       p,b,pw,lw,up,rw,cf,es),r)
 names(R)=c('m1:mean.1','m2:mean.2','md:m1-m2','md/(m1+m2)',
          'sd1','sd2','sd1/m1','sd2/m2','n1','n2','z','security',
          'p-value','beta','power','lower-b.','upper-b.',
          'rel.width','confidence','effect size'); R
} #Z2.test two samples (sample.1::sample.2)
# A = c(82, 84, 85, 89, 91, 91, 92, 94, 99, 99,91, 92, 94, 99, 99,
```

```
#    105, 109, 109, 109, 110, 112, 112, 113, 114, 114)
# B = c(90, 91, 91, 91, 95, 95, 99, 99, 108, 109, 91, 92, 94, 99, 99,
#    109, 114, 115, 116, 117, 117, 128, 129, 130, 133)
# n1=Len(A); m1=mean(A); sd1=sd(A); n2=Len(B); m2=mean(B); sd2=sd(B)
# Z2.test(n1,m1,sd1,n2,m2,sd2,side='t',cl=.95,r=6)
# z.test(A,B,'t',0,sd1,sd2)

Ztest.b=function(A,pm,psd,side='t',cl=.95,r=3){
  #A:vector,pm:population mean,psd:population sd,
  #side:t:tw-sided/g:greater/l:less,cl:conf.level,r:Rnd
  sm=mean(A);ssd=sd(A);n=Len(A);se=psd/sqrt(n);qn=qnorm;pn=pnorm
  z=(sm-pm)/se; mx=max(A); mn=min(A); rg=mx-mn
  #sm:sample mean, ssd:sample st.dev.,,n:sample size, se:standard error;
  #z:z-value, mx:max, mn:min, rg:range
  q=ifelse(side=='t',qn((1+cl)/2),qn(cl)); em=q*se #em:error margin
  es=(sm-pm)/sqrt((ssd^2+psd^2)/2)#es:effect size
  if(side=='t') {
    p=2*pn(-abs(z)); Ci=c(sm-em, sm+em)
    cv1=qn((1-cl)/2,pm,psd); cv2=qn((1+cl)/2,pm,psd) #cv:crit.value
    pw=pn(cv1,sm,ssd)+pn(cv2,sm,ssd,F); b=1-pw #pw:power, b:beta
  } #two-sided
  if(side=='g') {
    p=1-pn(z); Ci=c(sm-em, Inf)
    cv=qn(cl,pm,psd); b=pn(cv,sm,ssd); pw=1-b #pw:power
  } #upper side
  if(side=='l') {
    p=pn(z); Ci=c(-Inf,sm+em)
    cv=qn(1-cl,pm,psd);pw=pn(cv,sm,ssd); b=1-pw #pw:power
  } #lower side
  R=Rnd(c(sm,pm,sm-pm,(sm-pm)/pm,n,mx,mn,1-p,p,es,Ci,em,em*2,rg,em*2/rg,pw,b),r)
  names(R)=c('sm:sample mean','pm:pop. mean','sm-pm','(sm-pm)/pm','n','max','min',
             'security','p-value','effect-size','lower-b.','upper-b.',
             'error-margin','width','range','width/range','power','beta'); R
}
# A=c(25,28,30,29,32,27,31,26,28,30); pm=26; psd=3; cl=.95; r=4
# library(BSDA) # z.test
#    side='t';    Ztest.b(A,pm,psd,side,cl,r);    z.test(A,NULL,side,pm,psd,NULL,cl)#z-test
library(BSDA)
#    side='l';    Ztest.b(A,pm,psd,side,cl,r);    z.test(A,NULL,side,pm,psd,NULL,cl)#z-test
library(BSDA)
```

```
# side='g'; Ztest.b(A,pm,psd,side,cl,r); z.test(A,NULL,side,pm,psd,NULL,cl)#z-test
library(BSDA)
draw_colnames_0=function(coln,gaps,...){ #sheatmap(pheatmap) 回転(rot)
 #https://slowkow.com/notes/pheatmap-tutorial/
 coord=pheatmap:::find_coordinates(Len(coln),gaps);x=coord$coord-0.5*coord$size
 res=textGrob(coln,x=x,y=unit(1,'npc')-unit(3,'bigpts'),
          rot=0,vjust=1,hjust=.5,gp=gpar(...));return(res)
}
draw_colnames_90=function(coln,gaps,...){ #sheatmap(pheatmap) 回転(rot)
 #https://slowkow.com/notes/pheatmap-tutorial/
 coord=pheatmap:::find_coordinates(Len(coln),gaps);x=coord$coord-0.5*coord$size
 res=textGrob(coln,x=x,y=unit(1,'npc')-unit(3,'bigpts'),
          rot=90,vjust=.5,hjust=1.1,gp=gpar(...));return(res)
}

Ztest=function(A,pm,psd,side='t',cl=.95,r=3){
 #A:vector,pm:population mean,psd:population sd,
 #side:t:tw-sided/g:greater/l:less,cl:conf.level,r:Rnd
 sm=mean(A);ssd=sd(A);n=Len(A);mx=max(A);mn=min(A);rg=mx-
mn;qn=qnorm;pn=pnorm
 se=psd/sqrt(n);q=ifelse(side=='t',qnorm((1+cl)/2),qnorm(cl));em=q*se          #em:error
margin
 #sm:sample mean, ssd:sample st.dev.,,n:sample size, se:standard error;
 #z:z-value, mx:max, mn:min, rg:range
 es=(sm-pm)/sqrt((ssd^2+psd^2)/2)#es:effect size
 Zt=z.test(A,NULL,side,pm,psd,NULL,cl);p=Zt$p.value;Ci=Zt$conf.int[1:2]
 if(side=='t') {
  cv1=qn((1-cl)/2,pm,psd); cv2=qn((1+cl)/2,pm,psd) #cv:crit.value
  pw=pn(cv1,sm,ssd)+pn(cv2,sm,ssd,F); b=1-pw #pw:power, b:beta
 } #two-sided
 if(side=='g') {cv=qn(cl,pm,psd); b=pn(cv,sm,ssd); pw=1-b} #greater
 if(side=='l') {cv=qn(1-cl,pm,psd);pw=pn(cv,sm,ssd); b=1-pw} #less
 R=Rnd(c(sm,pm,sm-pm,(sm-pm)/pm,n,mx,mn,1-p,p,es,Ci,em,em*2,rg,em*2/rg,pw,b),r)
 names(R)=c('sm:sample mean','pm:pop. mean','sm-pm','(sm-pm)/pm','n','max','min',
          'security','p-value','effect-size','lower-b.','upper-b.',
          'error-margin','width','range','width/range','power','beta'); R
}
# side='t'; Ztest(A,pm,psd,side,cl,r); Ztest.b(A,pm,psd,side,cl,r)
# side='l'; Ztest(A,pm,psd,side,cl,r); Ztest.b(A,pm,psd,side,cl,r)
# side='g'; Ztest(A,pm,psd,side,cl,r); Ztest.b(A,pm,psd,side,cl,r)
```