Supplementary Materials

Section A – Simulation Code Used in the Study

```
install.packages(distr)
install.packages(truncdist)
install.packages(boot)
install.packages(MASS)
intstall.pacakges(psych)
options(scipen=999)
set.seed(33883838)
labn <- 'C:/'
library(distr)
library(truncdist)
library(boot)
library(MASS)
library(psych)
rtoa <- function(r){
  return(asin(r)/pi+0.5)}
ator <- function(a){return(sin(pi*(a-0.5)))}
archtanh <- function(r){0.5*log((1+r)/(1-r))}
tanh <- function(z){(exp(2*z)-1)/(exp(2*z)+1)}
pb<- function(data, conf.level = .95, bootno = 2000, seed.no = 38383388){
  rtoa <- function(r){
    return(asin(r)/pi+0.5)}
  n <-length(data[,1])
  pb.est<-function(data){
    n <-length(data[,1])
    meanx <- mean(data[,1])
    meany <- mean(data[,2])
    diff <- (data[,1]-meanx)*(data[,2]-meany)
    tcount <- length(which(diff>0))
    PBS <- tcount/n
    return(PBS)}
  PBS <- pb.est(data)
  q <- 2*PBS-1
  SE<- sqrt(0.25*((1-q^2)/n))
  ll <- qnorm((1-conf.level)/2)*SE+PBS # symmetrical confidence interval when lambda^2, i.e., 1.96^2 << n
  ul <- qnorm(1-(1-conf.level)/2)*SE+PBS
  p <- 2*pnorm(-abs((PBS-0.5)/SE))
  tll <- qt((1-conf.level)/2,(n-2))*SE+PBS
  tul <- qt(1-(1-conf.level)/2,(n-2))*SE+PBS
  tp <- 2*pt(-abs((PBS-0.5)/SE),df=n)
  ##bootstrap##
  funbp <- function(d, i){
    d2 <- d[i,]
    return(pb.est(d2))}
  bootr <- boot(data, funbp, R = bootno)
  bci <- boot.ci(bootr, conf = conf.level, type = c("perc","bca"))
  sebsi <- sd(bootr[[2]])
  bsill <- qnorm((1-conf.level)/2)*sebsi+bci[[2]]
  bsiul <- qnorm((1-conf.level)/2+conf.level)*sebsi+bci[[2]]
  bsillT <- qt((1-conf.level)/2,(n-2))*sebsi+bci[[2]]
  bsiulT <- qt(1-(1-conf.level)/2,(n-2))*sebsi+bci[[2]]
  return(list(PBS = PBS, SE = SE, Lower_Limit_Z = ll, Upper_Limit_Z = ul, p_value_Z = 0,
```

```
            Lower_Limit_T = tll, Upper_Limit_T = tul , p_value_T = 0,
            BSI_LL_Z = bsill, BSI_UL_Z = bsiul,
            BSI_LL_T = bsillT, BSI_UL_T = bsiulT,
            BPI_LL = bci[[4]][4], BPI_UL = bci[[4]][5],
            BCaI_LL = bci[[5]][4], BCaI_UL =  bci[[5]][5]))
}
tot <- 32
conf.level <- .95
refpt <- 0
replications <- 1000
disV <- c(1,2,3,4,5) #1: bivaraite normal correlation, PBS -> 2: normal
#3: t distribution with 18 df; 4: uniform, 5: beta distribution with alpha = beta = 0.5,
pbsV <- seq(0.5,0.9,0.05)
nV <- c(20,50,100,300,500,1000)
tcond <- length(disV)*length(pbsV)*length(nV)
rep.re <- array(0, dim=c(tcond,tot))
des <- array(0, dim=c(tcond,4))
maxy <- sqrt(12)/2
miny <- -sqrt(12)/2
cond <- 1
for(disp in 1:length(disV)){
  dis <- disV[disp]
  for(pbsp in 1:length(pbsV)){
    prob <- pbsV[pbsp]
    rho <- ator(prob)
    for(np in 1:length(nV)){
      re <- array(0, dim=c(replications,tot))
      #data matrix to save the results: PBS, SE, Coverage Prob, p, CI width, ll, ul,
      #r, SE, Coverage Prob, p, CI width, ll, ul
      n <- nV[np]
      des[cond,] <- c(dis,prob,rho,n)
      for(rep in 1:replications){
        if(dis==1){
          x<-rnorm(n,0,1)
          e<-rnorm(n,0,sqrt(1-rho^2))
          y<-rho*x+e
          data <- as.matrix(t(rbind(x,y)))}
        else{
          gen <- function(dis,refpt,n){
            y<-array(0,dim=c(n))
            de <- array(0,dim=c(n))
            de <- rbinom(n,1,prob)
            if(dis==2){x<-rnorm(n,0,1)}
            if(dis==3){
              df <- 18 # 10 observations per group
              x <- rt(n, df)}
            if(dis==4){x<-runif(n,-sqrt(12)/2,sqrt(12)/2)}
            if(dis==5){x<-rbeta(n,0.5,0.5)}
            if(refpt==0){ref=mean(x)}
            if(refpt==1){ref=median(x)}
            if(dis==2){
              abovem <- union(intersect(which(x>ref),which(de==1)),intersect(which(x<ref),which(de==0)))
              for(i in 1:n){
                if(x[i]>ref&&de[i]==1){y[i]=rtrunc(1, spec="norm", a = 0.0000000001, b = Inf)}
                if(x[i]<ref&&de[i]==1){y[i]=rtrunc(1, spec="norm", a = -Inf, b = 0)}
                if(x[i]<ref&&de[i]==0){y[i]=rtrunc(1, spec="norm", a = 0.0000000001, b = Inf)}
```

```
      if(x[i]>ref&&de[i]==0){y[i]=rtrunc(1, spec="norm", a = -Inf, b = 0)}
     }}
    if(dis==3){
     for(i in 1:n){
      if(x[i]>ref&&de[i]==1){y[i]=rtrunc(1, spec="t", a = 0.0000000001, b = Inf, df)}
      if(x[i]<ref&&de[i]==1){y[i]=rtrunc(1, spec="t", a = -Inf, b = 0, df)}
      if(x[i]<ref&&de[i]==0){y[i]=rtrunc(1, spec="t", a = 0.0000000001, b = Inf, df)}
      if(x[i]>ref&&de[i]==0){y[i]=rtrunc(1, spec="t", a = -Inf, b = 0, df)}
     }}
    if(dis==4){
     for(i in 1:n){
      if(x[i]>ref&&de[i]==1){y[i]=runif(1,0,maxy)}
      if(x[i]<ref&&de[i]==1){y[i]=runif(1,miny,0)}
      if(x[i]<ref&&de[i]==0){y[i]=runif(1,0,maxy)}
      if(x[i]>ref&&de[i]==0){y[i]=runif(1,miny,0)}
     }}
    if(dis==5){
     for(i in 1:n){
      if(x[i]>ref&&de[i]==1){y[i]=rtrunc(1, spec="beta", a = 0.5000000001, b = 1, 0.5, 0.5)}
      if(x[i]<ref&&de[i]==1){y[i]=rtrunc(1, spec="beta", a = 0, b = 0.5, 0.5,0.5)}
      if(x[i]<ref&&de[i]==0){y[i]=rtrunc(1, spec="beta", a = 0.5000000001, b = 1, 0.5,0.5)}
      if(x[i]>ref&&de[i]==0){y[i]=rtrunc(1, spec="beta", a = 0, b = 0.5, 0.5,0.5)}
     }}
    return(as.matrix(t(rbind(x,y))))
   }
   data<-gen(dis,refpt,n)
   x <- data[,1]
   y <- data[,2]
  } # end of else
  # PBS estimates
  tc <- prob
  checkcp <- function(ll,ul,tc){
   re<-c(0,0,0,0,0)
   if(ll < tc && ul >tc){re[1] <- 1}
   if(ll > 0.5 || ul <0.5){re[2] <- 1}
   re[3] <- ul - ll
   re[4] <- ll
   re[5] <- ul
   return(re)
  }
  temp <-pb(data)
  re[rep,1] <- temp[[1]] #PBS estimate
  re[rep,2] <- temp[[2]] #Standard error of PBS
  re[rep,3:7] <- checkcp(temp[[3]],temp[[4]],tc) # coverage prob, type i error/power, width, limits based on Z
  re[rep,8:12] <- checkcp(temp[[6]],temp[[7]],tc) # coverage prob, type i error/power, width, limits based on t
  # Bootstrap Coverage Probabilities
  re[rep,13:17] <- checkcp(temp[[9]],temp[[10]],tc) # BSI based on Z
  re[rep,18:22] <- checkcp(temp[[11]],temp[[12]],tc) # BSI based on T
  re[rep,23:27] <- checkcp(temp[[13]],temp[[14]],tc) # BPI
  re[rep,28:32] <- checkcp(temp[[15]],temp[[16]],tc) # BCaI
 }
 for(i in 1:tot){
  rep.re[cond,i] <- mean(re[,i])
 }
 write.table(cond,paste(labn,'cond.csv',sep=''),row.names=FALSE,col.names=FALSE,sep=",")
 cond <- cond+1
```

```
   }}} # end of the "for" condition loops
col1 <- c("PBS", "SE",
        "CP_SE_Z","Type_1_Power_Z","width_Z","LL_Z","UL_Z",
        "CP_SE_T","Type_1_Power_T","width_T","LL_T","UL_T",
        "CP_SE_BSI_Z","Type_1_Power_BSI_Z","width_BSI_Z","LL_BSI_Z","UL_BSI_Z",
        "CP_SE_BSI_T","Type_1_Power_BSI_T","width_BSI_T","LL_BSI_T","UL_BSI_T",
        "CP_SE_BPI","Type_1_Power_BPI","width_BPI","LL_BPI","UL_BPI",
        "CP_SE_BCaI","Type_1_Power_BCaI","width_BCaI","LL_BCaI","UL_BCaI"
)
colnames(re) <- col1
colnames(rep.re) <- col1
write.table(rep.re,paste(labn,'results.csv',sep=''),row.names=FALSE,col.names=col1,sep=",")
write.table(des,paste(labn,'design.csv',sep=''),row.names=FALSE,col.names=FALSE,sep=",")
```

Section B – Code Used in the Real-World Example

```
library(distr)
library(truncdist)
library(boot)
library(MASS)
library(psych)
rtoa <- function(r){
  return(asin(r)/pi+0.5)}
ator <- function(a){return(sin(pi*(a-0.5)))}
archtanh <- function(r){0.5*log((1+r)/(1-r))}
tanh <- function(z){(exp(2*z)-1)/(exp(2*z)+1)}
pb<- function(data, conf.level = .95, bootno = 2000, seed.no = 38383388){
  rtoa <- function(r){
    return(asin(r)/pi+0.5)}
  n <-length(data[,1])
  pb.est<-function(data){
    n <-length(data[,1])
    meanx <- mean(data[,1])
    meany <- mean(data[,2])
    diff <- (data[,1]-meanx)*(data[,2]-meany)
    tcount <- length(which(diff>0))
    PBS <- tcount/n
    return(PBS)}
  PBS <- pb.est(data)
  q <- 2*PBS-1
  SE<- sqrt(0.25*((1-q^2)/n))
  ll <- qnorm((1-conf.level)/2)*SE+PBS # symmetrical confidence interval when lambda^2, i.e., 1.96^2 << n
  ul <- qnorm(1-(1-conf.level)/2)*SE+PBS
  p <- 2*pnorm(-abs((PBS-0.5)/SE))
  tll <- qt((1-conf.level)/2,(n-2))*SE+PBS
  tul <- qt(1-(1-conf.level)/2,(n-2))*SE+PBS
  tp <- 2*pt(-abs((PBS-0.5)/SE),df=n)
  ##bootstrap##
  funbp <- function(d, i){
    d2 <- d[i,]
    return(pb.est(d2))}
  bootr <- boot(data, funbp, R = bootno)
  bci <- boot.ci(bootr, conf = conf.level, type = c("perc","bca"))
  sebsi <- sd(bootr[[2]])
  bsill <- qnorm((1-conf.level)/2)*sebsi+bci[[2]]
  bsiul <- qnorm((1-conf.level)/2+conf.level)*sebsi+bci[[2]]
  bsillT <- qt((1-conf.level)/2,(n-2))*sebsi+bci[[2]]
  bsiulT <- qt(1-(1-conf.level)/2,(n-2))*sebsi+bci[[2]]
  return(list(PBS = PBS, SE = SE, Lower_Limit_Z = ll, Upper_Limit_Z = ul, p_value_Z = p,
              Lower_Limit_T = tll, Upper_Limit_T = tul , p_value_T = tp,
              BSI_LL_Z = bsill, BSI_UL_Z = bsiul,
              BSI_LL_T = bsillT, BSI_UL_T = bsiulT,
              BPI_LL = bci[[4]][4], BPI_UL = bci[[4]][5],
              BCaI_LL = bci[[5]][4], BCaI_UL =  bci[[5]][5]))
}
pb(data),bootno=4000)
#data is a n by 2 matrix that saves the age and SCS scores; data can be found in Section C below.
```

#RStudio Output#

$PBS
[1] 0.517037

$SE
[1] 0.008601632

$Lower_Limit_Z
[1] 0.5001781

$Upper_Limit_Z
[1] 0.5338959

$p_value_Z
[1] 0.04762773

$Lower_Limit_T
[1] 0.5001721

$Upper_Limit_T
[1] 0.533902

$p_value_T
[1] 0.0477088

$BSI_LL_Z
[1] 0.500247

$BSI_UL_Z
[1] 0.5338271

$BSI_LL_T
[1] 0.5002409

$BSI_UL_T
[1] 0.5338331

$BPI_LL
[1] 0.4998519

$BPI_UL
[1] 0.5336296

$BCaI_LL
[1] 0.5001481

$BCaI_UL
[1] 0.5342222

Section C – Real-World Data Example

A subset of the open-access data (Raw Data from Online Personality Tests, 2018) for demonstrating the results in the section of the real-world example

```
age <-
c(41,50,23,42,36,29,24,35,26,43,21,39,37,64,28,46,34,31,43,47,28,21,23,22,28,23,47,61,22,36,16,40,33,
16,36,30,56,22,24,49,31,51,18,46,24,36,20,18,18,45,21,23,50,26,32,18,30,32,26,45,15,30,23,27,25,39,5
9,41,58,22,23,26,19,27,27,26,20,16,21,64,25,51,18,43,16,39,32,19,27,20,28,30,18,40,29,24,29,33,26,40,
34,37,14,38,35,19,20,18,22,35,35,28,34,41,45,22,33,30,59,23,47,34,20,28,25,22,27,18,48,37,59,36,36,2
6,25,42,25,23,30,44,25,27,36,18,43,19,39,32,23,28,27,25,28,40,55,48,15,29,21,29,23,15,33,18,19,19,23,
20,41,19,20,33,27,41,100,23,25,24,24,22,21,22,31,37,16,28,15,25,18,18,31,23,14,56,27,23,22,33,25,23,
28,32,45,31,19,30,45,40,22,46,42,23,28,21,55,15,22,34,20,24,46,24,59,25,19,43,21,56,22,48,32,20,21,6
5,33,33,25,47,25,33,35,26,18,32,29,27,17,15,45,55,48,38,26,30,30,22,32,24,20,25,33,30,16,27,48,56,28,
25,18,35,21,18,22,29,29,77,44,19,45,34,41,26,45,28,29,29,45,29,26,18,20,16,42,40,18,20,25,32,44,34,2
1,20,36,29,23,22,32,19,35,49,36,44,24,16,36,29,18,24,28,42,38,15,35,57,33,15,31,21,31,61,40,48,37,21,
20,40,20,15,36,40,17,21,17,27,36,42,60,39,52,24,27,23,16,24,27,34,20,18,19,49,25,18,30,19,45,24,20,3
8,18,24,20,36,26,22,21,25,46,25,26,30,21,28,42,30,28,24,43,16,27,18,32,24,39,26,36,19,20,20,40,42,27,
28,19,31,59,22,31,33,34,26,53,21,26,27,40,38,19,19,24,24,25,24,36,44,40,35,15,25,32,19,33,21,20,26,1
9,14,21,40,40,28,19,25,21,24,27,60,31,38,31,15,24,44,62,56,77,35,19,18,29,18,29,27,28,37,18,22,22,48,
19,21,37,25,31,34,45,26,21,24,42,31,24,18,21,22,24,27,33,39,27,17,18,25,55,27,29,19,24,33,24,22,36,2
3,20,41,24,24,38,19,38,46,19,26,42,18,51,71,37,37,38,20,47,24,19,52,24,45,32,20,36,78,23,42,51,49,23,
23,22,20,38,20,50,34,32,23,39,30,32,20,28,27,27,18,21,24,29,20,49,23,23,32,15,34,23,25,27,22,26,25,4
0,31,32,46,25,33,30,17,31,30,40,24,16,61,25,27,31,29,25,34,33,33,34,21,21,26,24,21,22,21,21,22,33,26,
27,25,19,47,45,46,39,17,43,18,30,24,47,22,30,32,24,44,24,25,32,22,19,34,33,22,23,16,44,48,25,24,24,2
1,43,20,28,35,33,44,34,54,41,31,20,25,27,41,46,17,23,21,44,39,52,46,25,40,56,28,51,16,20,23,48,54,25,
54,56,42,42,25,40,27,28,22,22,42,37,17,18,57,47,37,26,48,45,32,26,29,40,18,29,36,36,20,71,32,28,63,2
9,52,35,31,28,22,20,26,25,31,30,48,19,31,67,20,19,31,49,30,17,24,50,48,28,20,49,21,34,32,15,19,19,25,
28,39,41,34,21,31,49,25,45,51,18,44,30,22,19,35,24,30,26,23,14,20,27,26,31,28,26,17,28,22,50,27,42,2
5,30,32,27,32,20,26,29,22,52,42,32,32,45,26,27,34,44,68,30,17,58,15,33,41,44,57,39,25,32,21,22,72,27,
20,31,33,27,47,39,52,39,26,28,29,34,55,19,21,34,26,40,30,36,31,18,24,18,72,32,38,21,29,21,22,31,33,2
0,35,30,28,33,24,18,25,55,46,34,18,31,40,45,21,25,25,25,22,33,28,26,42,31,48,27,33,30,21,24,55,19,23,
18,21,50,27,50,38,47,34,27,35,28,24,43,21,20,30,32,18,23,27,27,18,54,28,18,32,20,31,30,39,48,28,30,1
4,18,37,18,21,32,28,15,33,29,32,32,18,28,47,49,25,28,25,28,24,21,22,31,19,21,52,40,26,28,19,35,44,25,
41,37,28,40,21,18,38,45,21,21,42,25,42,20,32,33,22,16,27,25,26,35,22,22,25,29,46,25,50,28,24,32,24,1
9,26,30,35,24,47,35,44,31,23,23,43,25,27,47,20,24,38,35,22,21,22,20,34,35,20,20,19,28,19,42,36,25,33,
50,19,20,39,25,38,34,30,34,43,31,55,17,26,32,23,23,30,16,27,31,27,43,19,32,19,20,29,24,19,18,23,39,2
7,48,23,32,25,24,21,45,38,24,35,30,28,34,17,36,62,20,20,32,28,19,25,18,21,48,41,33,32,52,27,31,28,20,
21,27,28,50,43,22,40,16,21,37,40,18,19,18,21,17,28,35,50,42,51,26,27,33,24,52,19,40,59,42,35,23,34,3
9,28,22,64,30,23,22,33,42,41,30,31,36,27,28,28,60,17,25,25,23,19,19,18,16,23,19,38,24,18,20,50,29,46,
29,26,18,18,31,25,47,42,20,22,50,27,21,46,24,45,35,24,62,20,23,16,44,21,20,28,15,23,42,47,15,31,20,2
3,37,47,49,17,22,42,21,42,25,43,64,24,49,32,26,22,18,18,18,54,20,21,18,17,32,23,32,19,20,20,37,29,28,
32,23,52,32,26,26,50,20,20,60,18,31,43,25,29,25,18,24,63,85,36,37,20,20,30,23,24,43,27,23,25,45,16,4
```

2,31,28,21,22,33,31,19,40,19,19,35,40,42,23,33,47,60,23,27,18,29,40,30,40,26,15,25,27,24,18,25,22,23,
21,38,26,35,35,51,30,30,17,34,28,21,33,36,29,27,23,19,20,45,22,30,53,22,37,47,19,30,63,49,28,25,19,2
3,24,35,41,22,62,27,19,25,30,48,20,28,21,34,27,19,28,20,36,20,61,24,16,41,31,18,35,23,28,54,23,32,42,
69,20,20,26,26,21,41,17,36,25,30,20,44,18,42,23,38,32,60,17,65,25,24,55,18,30,54,69,22,19,38,18,26,3
0,27,29,19,33,20,38,54,64,22,23,19,28,25,18,46,36,21,22,37,50,41,18,18,34,44,34,25,27,29,20,23,23,20,
39,24,32,31,34,23,34,26,27,26,48,54,45,26,37,37,33,41,17,28,23,47,24,69,35,25,38,43,22,20,34,31,42,4
2,33,32,41,23,27,25,18,29,22,35,30,25,34,20,28,20,51,31,18,27,24,21,30,21,42,40,28,18,23,62,28,18,45,
21,15,25,31,36,40,40,21,35,25,18,32,36,22,22,32,21,48,24,16,31,20,27,41,30,21,24,23,41,23,43,36,24,1
9,21,70,30,41,20,40,25,43,69,55,25,34,36,21,55,28,30,24,50,26,27,26,25,32,21,28,32,35,23,28,20,27,27,
26,31,21,37,53,20,56,38,18,42,26,19,32,19,32,29,31,56,18,14,28,27,17,35,39,20,24,20,18,26,30,21,32,5
0,38,20,47,40,25,24,39,23,30,22,30,20,41,48,36,22,30,21,37,18,19,25,32,25,41,18,39,27,26,21,32,44,31,
58,23,34,30,43,25,25,19,29,28,18,20,37,39,24,48,50,22,42,40,45,24,54,33,28,21,39,25,59,46,27,43,20,3
3,34,17,34,33,21,61,22,48,42,25,28,29,28,52,28,25,45,18,30,55,50,33,25,20,27,28,27,35,51,28,18,20,17,
19,16,38,24,23,28,35,27,22,42,29,28,32,51,20,18,27,20,49,28,39,16,26,19,46,32,46,25,52,32,37,22,49,4
9,30,31,25,18,29,26,30,37,25,57,55,55,35,63,18,40,23,20,38,58,40,32,24,38,33,36,18,50,29,25,37,33,18,
50,22,22,19,28,27,42,45,52,21,27,33,23,19,39,25,20,60,20,43,18,25,30,40,22,38,21,29,27,35,48,24,38,5
8,36,32,66,21,24,17,38,39,22,38,24,33,19,24,21,29,29,25,26,44,29,22,31,62,55,22,25,20,36,38,17,31,45,
22,24,31,20,29,84,21,38,27,33,21,24,19,24,56,19,47,55,27,24,16,36,20,65,20,32,25,18,26,18,17,24,23,4
6,48,59,26,46,19,22,22,22,18,29,20,44,30,19,53,27,55,25,52,23,42,21,29,21,33,60,46,25,18,41,18,31,33,
19,18,36,32,32,33,33,21,27,30,33,37,24,20,50,34,19,20,20,31,53,26,26,32,22,20,22,23,26,41,31,19,34,2
1,21,21,31,37,39,21,50,38,55,23,35,15,19,31,46,42,24,31,45,20,23,23,22,31,30,46,35,17,16,22,18,35,41,
20,14,22,17,40,62,19,20,18,29,25,22,68,22,38,33,25,19,43,50,18,48,20,52,35,24,37,27,25,45,33,31,28,3
4,37,26,60,46,31,32,25,24,20,32,18,27,34,27,18,19,24,24,28,21,30,52,44,27,40,27,45,15,24,23,19,19,30,
21,33,16,32,18,20,23,21,30,35,25,20,21,46,32,28,19,23,50,31,20,21,36,40,23,18,22,53,36,18,19,26,20,2
1,29,28,31,37,24,29,20,21,36,21,19,36,20,27,24,52,50,38,59,52,25,17,38,41,38,30,26,41,47,35,34,23,43,
38,37,56,39,22,43,37,20,29,51,19,27,33,30,19,58,24,32,23,28,33,27,45,62,40,31,27,35,42,18,35,20,30,1
4,55,24,26,18,29,33,25,52,56,58,41,22,35,25,22,20,26,43,32,23,53,40,44,51,20,54,31,19,19,23,37,33,22,
16,18,27,24,21,56,41,21,54,30,38,14,36,19,25,31,25,26,51,50,45,23,26,32,24,53,17,19,42,32,33,28,32,3
1,21,30,25,35,41,40,37,25,26,45,30,54,27,27,18,50,26,21,43,19,15,25,29,37,44,28,22,29,78,15,19,42,25,
19,54,32,38,24,64,23,58,19,18,38,44,19,50,20,19,16,18,24,18,15,48,36,40,32,23,23,20,14,46,37,43,27,5
0,28,44,59,44,49,23,44,24,23,55,39,16,32,29,17,19,30,26,25,25,22,42,27,18,16,16,28,51,42,24,28,20,38,
24,24,40,27,42,64,42,28,18,23,23,25,40,27,19,31,20,23,50,37,47,30,22,28,29,30,52,15,43,21,42,49,23,2
7,23,27,37,44,59,22,30,25,18,18,19,25,71,31,64,40,31,23,21,20,43,41,31,51,25,30,15,27,23,17,40,43,26,
20,19,16,19,22,21,19,29,23,18,49,25,30,57,20,18,20,22,20,37,25,44,17,22,54,40,30,39,18,24,30,30,18,3
2,22,27,22,39,28,20,32,34,50,25,20,14,24,19,34,52,46,33,45,21,27,50,21,27,26,20,46,18,26,29,32,19,19,
42,21,35,25,26,23,23,41,20,26,40,20,40,59,40,23,30,27,26,19,21,51,44,22,36,19,28,28,31,19,25,26,39,3
1,68,53,32,27,44,42,41,22,27,46,33,21,20,45,55,20,20,30,18,30,26,28,40,22,25,29,23,18,22,41,26,23,28,
31,48,32,29,59,24,46,20,20,20,23,18,28,42,23,21,46,40,19,23,25,22,30,49,18,60,32,58,41,22,21,19,22,3
5,23,39,28,25,32,32,22,42,33,32,22,21,50,24,35,48,41,23,43,42,23,22,18,18,28,28,32,21,17,29,23,19,38,
45,48,28,19,31,35,46,22,16,32,38,22,21,43,50,26,42,44,46,32,34,34,55,26,20,35,55,33,31,21,26,40,27,4
7,23,19,33,54,21,18,27,19,32,21,18,22,34,21,18,20,27,37,23,53,20,22,28,18,43,18,56,35,30,31,26,35,49,
25,17,44,22,55,29,48,34,57,28,29,20,52,33,44,22,35,28,32,27,29,25,29,34,28,40,37,50,22,42,22,36,29,1
7,42,30,39,39,26,40,24,21,45,32,45,48,19,61,35,29,25,22,31,45,26,38,19,40,47,17,41,34,20,38,21,21,22,
21,38,20,37,60,21,31,23,37,44,27,25,19,36,28,33,32,40,23,21,26,35,47,25,20,34,40,20,21,21,20,48,28,2

5,33,28,30,20,45,24,33,23,42,23,23,25,24,22,43,20,18,30,23,20,42,26,23,35,21,23,67,38,37,29,25,26,22,
41,23,22,25,21,49,43,32,43,46,21,20,22,42,17,53,123,32,27,25,27,31,44,35,29,53,20,22,41,23,22,36,36,
25,28,23,34,38,25,23,45,50,27,35,53,33,22,27,58,32,33,20,25,35,30,21,31,25,37,60,26,55,30,38,23,23,2
2,49,22,26,24,33,28,31,43,20,31,30,52,23,30,46,55,20,23,32,25,34,34,28,15,15,27,39,46,16,30,45,26,23,
30,21,31,45,33,23,35,19,20,26,21,39,25,25,26,19,26,19,24,51,36,47,21,44,37,26,44,18,61,18,27,31,23,2
4,24,23,60,40,25,43,26,25,22,21,25,25,44,18,28,20,27,40,15,61,46,38,23,58,38,36,33,51,22,22,38,47,66,
37,56,40,34,15,23,30,32,33,27,27,21,38,45,42,48,18,20,23,18,20,41,37,34,28,23,17,45,26,21,36,27,30,2
1,33,37,27,20,21,43,57,23,28,35,22,40,50,41,23,19,35,27,26,50,46,64,18,27,30,15,18,46,25,42,39,52,27,
20,46,16,34,32,28,20,52,25,25,27,21,18,26,28,20,17,55,25,37,28,19,44,27,37,37,35,23,21,21,14,24,73,2
7,50,35,46,28,55,22,28,24,26,23,21,23,26,30,21,19,20,64,40,51,27,24,22,45,35,19,29,23,17,31,23,23,55,
21,18,22,16,31,18,40,18,49,24,37,22,25,22,18,41,39,35,36,30,35,19,19,38,21,26,33,19,37,21,39,20,37,2
2,41,40,29,28,25,47,21,53,40,19,35,32,36,22,36,27,18,24,25,17,24,23,40,29,34,54,33,50,24,61,41,45,22,
24,19,21,38,30,26,26,37,24,31,21,45,60,28,21,30,33,28,41,40,25,32,42,18,77,35,60,20,22,21,39,33,14,1
9,27,39,34,24,33,33,31,18,18,19,24,21,33,37,24,24,24,41,22,41,25,14,27,27,19,50,32,22,51,26,29,29,36,
28,27,37,28,20,24,29,17,30,32,48,39,22,30,30,30,41,20,17,32,60,35,25,30,22,16,31,19,24,30,61,30,41,3
9,19,69,41,51,33,43,38,28,28,47,20,24,48,22,23,21,20,33,42,56,22,26,23,24,54,25,32,35,31,63,39,18,21,
15,19,16,18,20,18,21,19,46,24,32,35,29,20,44,42,27,20,27,17,29,29,25,19,25,18,22,21,23,42,41,54,20,2
6,26,44,26,46,47,18,22,17,25,23,21,36,49,35,31,29,45,66,27,30,16,30,26,24,23,33,18,31,29,39,17,28,28,
14,40,29,21,46,29,36,23,34,26,40,27,28,72,29,22,58,27,25,49,25,38,34,60,24,24,26,46,31,35,38,28,36,5
1,29,24,25,25,20,18,25,38,47,58,25,32,40,19,19,21,26,43,32,19,38,22,49,44,30,40)

score <-
c(19,14,15,17,11,24,12,17,21,18,15,19,26,20,13,17,37,16,24,15,36,11,29,31,20,21,20,23,39,31,31,30,33,
28,20,28,29,25,27,29,15,19,33,19,26,23,29,14,23,11,21,38,22,15,14,21,16,28,17,25,31,30,23,32,25,17,1
9,24,21,37,21,11,12,35,23,18,16,23,16,22,17,21,17,19,24,29,29,26,21,19,24,24,18,40,12,21,29,22,29,36,
39,15,15,31,12,19,28,23,14,12,32,20,32,34,15,23,33,33,18,15,23,17,24,32,34,12,13,17,30,28,27,29,31,2
2,11,35,29,32,17,29,25,14,29,16,21,20,26,34,31,31,22,12,27,18,24,32,39,30,17,26,24,20,26,15,21,40,26,
28,27,36,19,25,18,25,40,12,18,22,40,29,21,17,17,23,30,19,15,21,35,21,37,16,21,19,14,21,31,17,13,24,2
2,16,27,23,28,15,19,28,23,32,15,29,28,17,15,19,21,20,27,16,29,37,32,29,23,36,32,4,15,13,34,13,25,12,2
4,10,32,26,30,40,27,23,36,16,18,21,24,15,14,22,30,21,30,10,34,20,38,36,17,32,18,13,27,21,34,39,30,12,
12,19,25,21,40,14,12,23,30,23,26,21,11,29,18,24,24,20,29,19,20,30,23,35,13,19,20,23,19,33,32,23,18,1
9,13,26,22,25,30,29,40,10,19,16,22,22,32,28,29,17,31,29,38,16,22,27,27,33,25,24,17,13,27,27,12,12,40,
20,32,15,11,30,20,17,31,20,23,26,32,39,33,13,39,13,10,36,20,32,34,31,23,11,19,16,14,9,20,22,16,17,14,
27,26,21,13,39,28,20,11,19,25,26,25,25,12,17,39,31,34,35,17,31,19,30,32,35,40,25,27,10,25,33,36,32,3
1,17,15,18,38,34,23,20,14,19,24,23,24,34,25,23,16,38,16,31,19,16,24,21,14,30,26,28,40,17,14,20,18,16,
19,32,20,36,13,19,13,21,20,31,13,37,25,33,18,18,25,25,21,23,27,22,23,20,24,22,18,23,26,23,12,19,19,2
6,15,26,18,36,26,34,11,23,25,31,23,37,11,33,35,28,30,33,30,33,25,18,14,11,30,12,29,17,18,11,21,28,21,
16,30,17,14,27,31,21,40,18,14,20,13,21,17,34,21,19,12,26,23,11,17,20,26,28,14,14,30,15,20,15,15,24,3
7,29,22,30,28,39,28,31,12,13,19,27,31,26,20,19,31,22,22,29,11,28,35,18,37,31,17,11,22,32,32,13,13,19,
16,21,12,22,11,32,16,15,29,31,16,23,19,31,12,30,24,21,25,39,20,22,36,26,32,27,18,19,26,30,19,20,20,3
6,26,12,17,19,18,12,27,24,19,31,24,28,21,33,21,36,37,24,26,27,12,25,35,22,28,29,28,18,24,15,15,18,19,
10,36,21,21,32,33,12,30,16,25,31,14,35,25,29,16,17,38,16,23,22,24,20,28,34,24,19,16,33,11,23,36,16,1
0,20,35,26,15,21,19,11,23,31,23,32,17,13,19,38,24,19,22,29,13,34,29,36,35,27,26,24,15,31,10,33,29,24,

14,34,20,19,30,14,27,14,16,16,30,35,30,18,35,19,26,31,18,21,13,22,24,34,28,27,16,33,16,15,27,10,18,1
6,30,24,26,27,17,23,27,23,17,29,14,25,40,30,17,29,20,19,28,22,17,25,31,37,25,10,40,25,19,10,10,30,29,
28,24,19,14,17,31,31,15,14,27,23,23,33,15,28,12,16,34,13,35,16,22,17,15,34,40,16,18,37,18,26,20,30,2
3,34,30,12,39,25,11,13,33,20,22,16,23,29,21,22,40,40,15,20,36,16,28,37,20,19,24,15,31,15,21,32,33,26,
29,14,21,37,29,14,33,38,25,20,29,27,21,29,11,22,26,27,17,10,14,19,31,32,30,37,12,17,22,16,29,29,13,1
3,12,13,26,35,20,32,17,15,16,40,24,35,16,19,20,26,20,21,26,23,14,26,25,37,33,40,22,23,21,18,38,22,16,
34,13,14,22,29,33,32,24,28,29,28,15,13,28,24,25,30,20,17,13,13,20,4,14,32,11,14,17,20,19,21,26,27,32,
25,16,22,13,19,22,15,19,17,32,11,12,21,24,32,24,11,31,26,18,32,21,15,19,23,21,28,12,27,15,23,22,15,1
3,22,25,14,33,15,17,40,14,12,29,24,24,19,18,12,18,18,29,30,23,31,14,24,34,34,20,15,39,31,13,32,31,25,
19,37,16,19,20,12,31,26,24,17,20,14,21,16,29,15,26,18,18,39,15,19,13,16,14,33,19,16,40,29,33,10,26,2
1,28,17,37,16,21,19,26,20,40,30,39,30,18,12,25,29,18,40,29,33,24,31,10,34,13,34,26,38,32,36,22,27,29,
16,12,34,15,16,25,18,26,28,15,25,27,19,15,26,13,30,22,31,16,14,20,23,12,17,15,19,22,34,20,34,18,22,2
8,10,29,16,16,34,29,40,11,27,29,26,23,24,20,34,14,19,19,31,27,19,16,15,30,25,17,20,30,22,28,38,35,22,
11,13,23,17,32,23,16,30,22,32,14,29,17,37,31,22,20,36,24,16,27,21,11,15,23,18,18,11,23,26,13,34,34,1
2,16,19,38,12,28,29,14,38,12,15,20,20,28,31,27,30,26,14,20,26,19,17,11,35,18,19,12,18,13,22,0,19,25,2
5,33,28,18,16,35,13,38,28,12,14,12,17,21,31,19,13,14,21,18,13,26,19,25,18,28,14,25,15,27,22,20,32,18,
32,16,24,34,10,30,29,27,24,22,30,18,18,36,28,32,11,18,21,15,22,29,32,9,34,16,34,25,29,40,11,21,26,16,
12,14,27,13,24,23,18,30,38,29,24,34,23,33,10,24,29,29,24,37,15,28,34,19,11,18,29,12,28,35,13,22,32,2
8,30,21,14,31,28,37,30,22,25,16,22,34,27,24,25,29,21,16,29,37,27,27,34,15,30,23,22,24,29,28,28,14,28,
24,24,28,26,23,22,24,28,38,15,15,24,27,19,25,25,35,21,21,11,13,29,25,10,21,38,29,19,14,16,35,36,15,2
5,21,26,19,19,34,13,31,22,16,21,27,20,29,30,21,38,10,40,16,35,16,25,27,27,25,16,22,18,27,40,29,26,20,
16,31,18,28,37,17,13,11,11,31,15,32,34,19,31,13,36,13,40,27,15,14,22,22,13,21,37,18,15,19,31,13,14,1
5,24,39,28,25,34,36,19,10,26,32,19,18,12,35,30,40,28,21,15,27,34,16,32,36,30,32,21,15,28,31,13,40,22,
26,11,20,37,16,33,19,13,24,20,40,26,27,40,29,36,10,27,13,30,13,13,39,38,33,27,33,26,12,28,17,23,23,3
4,35,26,39,19,17,26,12,27,19,32,35,23,19,15,13,28,27,10,11,18,15,12,17,10,26,36,28,18,10,10,34,23,13,
21,26,12,30,35,34,27,34,14,17,18,18,24,17,30,16,12,26,14,12,26,15,14,17,13,32,34,19,23,30,14,19,19,1
4,19,24,23,34,25,40,27,22,28,29,16,25,24,20,12,26,22,21,33,30,37,25,24,22,18,34,15,23,38,13,27,21,25,
29,36,20,35,13,25,17,36,19,29,40,20,18,17,21,15,13,27,15,25,40,38,22,33,35,20,29,10,25,31,29,32,22,1
6,32,36,28,11,31,29,25,28,15,13,20,29,32,21,17,27,36,32,36,30,12,10,15,26,18,13,23,40,11,35,27,30,22,
23,25,28,18,24,40,31,25,21,24,20,25,11,15,27,30,24,21,16,22,19,12,19,19,13,15,24,18,21,31,30,24,16,2
1,18,14,20,25,32,17,34,23,12,31,21,23,0,22,20,24,11,30,22,27,11,22,23,36,26,13,16,21,33,24,31,11,30,1
1,12,30,38,23,12,18,31,33,23,24,28,30,14,15,22,14,28,37,19,40,33,18,31,10,21,10,13,20,10,26,22,29,39,
24,20,27,16,18,15,31,20,25,12,12,31,33,35,22,21,16,14,34,19,12,40,12,17,19,28,30,29,16,28,21,13,38,2
4,10,31,13,23,27,21,21,28,34,24,26,31,30,20,18,21,15,40,17,34,16,32,23,22,12,24,17,16,28,32,38,35,23,
19,10,27,28,32,24,26,35,22,32,30,28,28,40,38,21,35,22,27,18,17,29,23,33,13,15,20,21,21,26,26,25,15,2
0,37,15,24,26,35,27,17,19,21,14,34,34,32,20,20,19,33,29,29,14,10,33,26,27,20,27,21,33,34,15,16,10,24,
21,24,26,12,3,27,23,32,24,20,30,20,38,22,33,30,35,28,32,14,11,33,14,20,32,10,17,29,11,36,32,22,19,22,
15,30,19,28,16,40,21,13,20,29,34,23,17,29,19,29,20,14,25,21,11,33,19,40,26,33,32,17,13,16,34,13,30,2
3,34,27,21,23,26,21,19,13,19,38,28,26,32,10,32,17,40,20,23,18,30,24,30,40,12,26,33,12,26,32,28,22,21,
12,40,14,40,30,25,20,11,15,32,22,22,31,29,10,28,21,36,30,26,18,23,21,15,27,24,27,21,16,16,15,13,18,2
0,32,38,27,30,35,40,22,21,33,14,16,27,12,19,13,11,19,23,13,12,23,31,14,12,36,29,13,13,28,24,31,24,17,
29,30,25,21,20,15,17,29,24,13,12,25,29,15,34,33,16,21,23,16,13,25,16,21,15,14,35,19,18,40,22,21,17,2
9,27,17,26,23,18,14,23,23,23,21,16,23,16,35,35,24,19,28,20,16,40,13,16,21,24,17,18,17,23,34,21,19,30,
21,23,36,33,19,30,22,37,35,29,18,18,27,18,30,23,19,30,30,28,23,37,21,18,20,21,26,25,14,10,25,31,28,2

0,21,11,33,35,19,21,11,12,23,20,24,18,23,14,16,15,29,21,26,25,13,24,17,19,13,25,31,15,24,23,13,31,40,35,27,18,21,15,12,17,36,17,25,13,18,14,24,19,33,28,29,20,29,19,20,12,32,16,27,26,18,30,32,34,15,25,30,23,20,29,29,23,32,32,33,26,21,11,24,25,28,27,39,14,27,14,25,23,23,25,26,34,28,33,24,26,29,13,13,29,20,14,37,10,26,28,33,14,20,13,13,16,26,13,20,12,21,21,32,26,18,20,16,20,14,25,40,17,20,12,23,21,31,32,31,31,30,23,11,19,21,19,32,35,17,12,24,14,28,20,17,24,22,30,16,17,31,29,29,31,34,15,29,16,11,19,16,15,25,30,24,15,14,14,29,21,31,16,15,30,17,31,17,31,13,28,16,16,38,35,20,17,35,36,36,15,16,24,33,26,18,33,29,23,12,24,23,20,36,13,35,40,36,22,34,21,24,17,25,11,37,23,35,40,35,18,15,31,27,15,22,10,25,22,22,18,21,31,18,16,38,14,25,12,24,21,20,19,35,32,27,29,10,33,25,11,27,40,30,22,32,17,25,20,17,20,12,15,31,25,33,22,13,30,25,33,25,20,33,15,13,34,31,36,28,18,33,40,19,10,33,21,30,17,19,19,23,31,35,11,28,20,29,12,19,20,32,24,21,12,27,37,28,31,29,15,19,12,38,35,14,29,13,23,19,23,32,29,10,24,22,12,11,11,26,35,12,19,24,26,15,15,31,18,15,40,17,27,20,22,20,14,27,14,20,28,22,11,40,16,32,19,15,29,28,38,15,26,29,24,18,28,15,17,15,11,19,28,36,27,23,40,26,36,17,21,20,10,23,21,35,37,22,34,22,37,24,30,31,12,16,20,31,29,24,30,15,26,26,38,31,21,14,11,36,26,37,14,26,25,23,19,31,11,26,29,31,38,26,18,30,37,33,16,27,27,26,14,20,24,21,14,18,19,26,22,34,24,33,10,30,36,14,19,20,21,32,13,21,20,17,37,18,12,21,23,13,28,14,27,23,15,21,26,17,31,28,18,13,19,14,32,27,19,12,17,21,14,18,28,32,25,22,31,13,12,12,17,25,36,14,25,13,13,21,35,30,23,13,27,30,26,36,21,14,11,24,24,22,40,21,27,31,33,23,32,12,12,26,31,24,18,27,32,14,13,36,40,29,10,23,25,26,31,25,29,18,20,19,34,30,10,26,32,13,24,13,19,26,19,24,19,33,25,25,37,18,14,11,27,17,27,32,22,26,20,22,26,36,16,10,10,23,36,24,34,15,17,21,15,12,11,28,23,30,11,14,37,33,23,10,29,31,13,35,16,31,36,22,17,27,20,29,25,30,29,12,12,24,24,11,34,26,23,29,18,10,27,12,15,25,11,35,36,26,28,26,21,27,36,19,39,19,30,19,18,29,16,18,20,10,12,24,29,13,16,20,26,32,14,14,11,24,13,30,23,16,24,29,28,21,17,36,26,20,30,11,28,18,13,33,13,19,11,28,29,14,21,34,37,21,11,14,16,28,19,35,27,16,21,38,30,26,24,32,11,20,15,40,19,30,17,17,19,19,21,36,29,19,20,37,28,40,27,39,32,15,20,25,19,27,23,17,18,30,30,28,18,18,38,13,39,26,30,27,13,33,24,16,33,27,30,12,28,40,25,13,25,13,21,31,24,11,10,36,12,24,40,29,20,29,20,19,26,30,25,35,32,13,33,25,20,24,29,35,40,27,25,16,38,21,17,21,22,35,28,20,16,25,12,25,15,33,18,20,20,26,17,17,37,31,12,35,32,36,32,34,17,22,13,13,31,35,13,38,26,22,16,27,10,21,26,24,36,19,12,18,37,26,14,18,25,31,16,15,23,23,18,30,26,35,37,24,26,27,14,25,32,17,16,22,31,18,21,27,30,19,25,17,14,23,21,25,35,14,20,33,35,29,28,34,40,15,17,13,21,40,11,13,28,25,23,19,26,37,24,20,27,13,24,27,21,25,21,40,33,16,18,27,22,28,23,20,13,17,26,17,28,19,24,35,14,31,17,25,21,24,25,20,27,14,21,27,14,13,29,16,35,17,21,12,28,12,19,26,14,14,15,15,27,38,15,23,17,13,20,10,28,34,16,14,22,35,35,36,40,29,21,20,16,22,24,30,26,20,29,26,38,23,19,27,27,26,27,25,32,30,33,32,12,22,28,17,32,22,29,18,23,28,27,23,33,38,28,39,32,17,16,28,27,17,13,30,33,16,31,30,37,32,25,19,36,15,13,18,33,24,22,35,20,29,23,19,20,22,10,38,24,38,21,32,30,14,18,23,22,21,14,36,14,21,28,28,24,32,17,28,24,29,20,27,19,36,24,10,36,22,21,30,31,21,26,14,40,12,29,18,10,21,29,27,26,29,18,10,17,13,28,26,40,29,15,19,13,14,20,23,40,28,17,16,17,26,40,12,32,22,19,33,11,24,33,35,10,12,36,11,25,37,23,24,22,31,31,32,18,31,28,25,28,23,12,15,34,29,16,18,28,11,12,35,24,31,14,25,22,21,27,38,24,33,35,31,28,26,17,19,13,27,32,38,15,14,26,30,25,0,15,38,32,20,28,16,30,18,28,24,29,32,26,28,14,18,31,17,30,27,18,33,15,37,14,26,28)