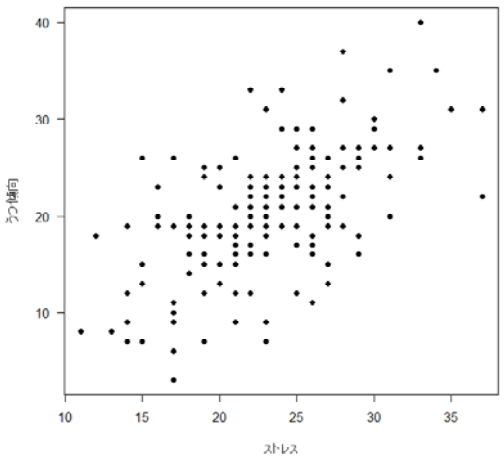
相関係数の推測

cor.test(変数名1, 変数名2, method="算出方法")

method : "pearson" (default), "spearman", or "kendall"

```
> setwd("i:¥¥Rdocuments¥¥scripts¥¥")
> d1 <- read.table("相関係数データ.csv", header=TRUE, sep=",")
> head(d1)
  番号 ストレス うつ傾向
1    1       20       18
2    2       23       21
3    3       30       29
4    4       25       29
5    5       26       22
6    6       21       19
>
>
> dtmp <- d1[,c(-1)]
>
>
> #記述統計量
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
           N  Mean   SD ストレス うつ傾向
ストレス 154 23.39 5.14     1.00     0.62
うつ傾向 154 20.45 6.71     0.62     1.00
>
>
> #相関係数の検定（H0:ρ＝0）
> cor.test(d1$ストレス, d1$うつ傾向, method="pearson")

        Pearson's product-moment correlation

data:  d1$ストレス and d1$うつ傾向
t = 9.6234, df = 152, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.5064286 0.7048699
sample estimates:
      cor
0.6153051

>
> #スピアマンの順位相関係数の検定
> cor.test(d1$ストレス, d1$うつ傾向, method="spearman")

        Spearman's rank correlation rho

data:  d1$ストレス and d1$うつ傾向
S = 239103.1, p-value < 2.2e-16
alternative hypothesis: true rho is not equal to 0
sample estimates:
      rho
0.6071809

 警告メッセージ:
In cor.test.default(d1$ストレス, d1$うつ傾向, method = "spearman") :
   タイのため正確な p 値を計算することができません
>
>
> # 散布図
> plot(d1$ストレス, d1$うつ傾向, xlab="ストレス",ylab="うつ傾向", las=1, pch=19)
>
```

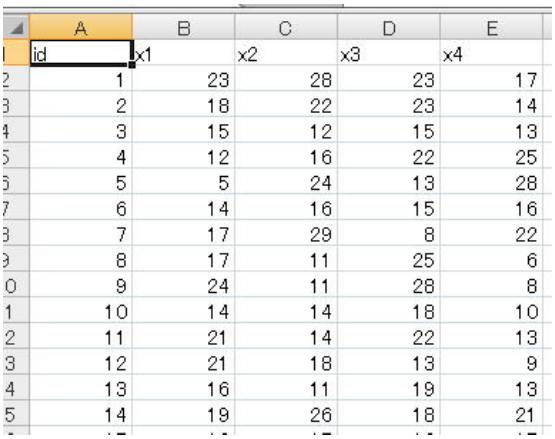
	A	B	C
1	番号	ストレス	うつ傾向
2	1	20	18
3	2	23	21
4	3	30	29
5	4	25	29
6	5	26	22
7	6	21	19
8	7	14	12
9	8	22	19
10	9	26	27
11	10	26	18
12	11	21	18
13	12	24	29
14	13	24	19
15	14	23	24
16	15	23	20
17	16	35	31
18	17	25	19
19	18	33	26
20	19	30	30
21	20	19	12



相関係数行列の各要素の検定

```
library(psych)
corr.test(データフレーム名, method="算出方法")

  method : "pearson" (default), "spearman", or "kendall"
```

```
> setwd("i:¥¥Rdocuments¥¥scripts¥¥")
> d1 <- read.table("データ例.csv", header=TRUE, sep=",")
> head(d1)
  id x1 x2 x3 x4
1  1 23 28 23 17
2  2 18 22 23 14
3  3 15 12 15 13
4  4 12 16 22 25
5  5  5 24 13 28
6  6 14 16 15 16
>
>
> dtmp <- d1[,c(-1)]
>
>
> #記述統計量
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
     N  Mean   SD    x1    x2    x3    x4
x1 245 15.22 5.37  1.00 -0.10  0.43 -0.26
x2 245 20.32 6.08 -0.10  1.00 -0.32  0.56
x3 245 18.52 5.12  0.43 -0.32  1.00 -0.46
x4 245 16.61 6.98 -0.26  0.56 -0.46  1.00
>
>
> # 相関係数行列の各要素の検定
> library(psych)
> (dr1 <- corr.test(dtmp))
Call:corr.test(x = dtmp)
Correlation matrix
      x1    x2    x3    x4
x1  1.00 -0.10  0.43 -0.26
x2 -0.10  1.00 -0.32  0.56
x3  0.43 -0.32  1.00 -0.46
x4 -0.26  0.56 -0.46  1.00
Sample Size
[1] 245
Probability values (Entries above the diagonal are adjusted for multiple tests.)
     x1   x2 x3 x4
x1 0.00 0.11  0  0
x2 0.11 0.00  0  0
x3 0.00 0.00  0  0
x4 0.00 0.00  0  0

 To see confidence intervals of the correlations, print with the short=FALSE option
>

> # t値
> dr1$t
          x1        x2        x3        x4
x1       Inf -1.620965  7.329962 -4.182839
x2 -1.620965       Inf -5.323804 10.559251
x3  7.329962 -5.323804       Inf -8.031193
x4 -4.182839 10.559251 -8.031193       Inf
>
>
```



	A	B	C	D	E
1	id	x1	x2	x3	x4
2	1	23	28	23	17
3	2	18	22	23	14
4	3	15	12	15	13
5	4	12	16	22	25
6	5	5	24	13	28
7	6	14	16	15	16
8	7	17	29	8	22
9	8	17	11	25	6
10	9	24	11	28	8
11	10	14	14	18	10
12	11	21	14	22	13
13	12	21	18	13	9
14	13	16	11	19	13
15	14	19	26	18	21

2群の相関係数の差の検定

```
library(psych)

独立な2群における相関係数の差(r12 vs r34)
r.test(r12=.3, r34=.5, n=100, n2=150)


対応のある2つの相関係数の差(r12 vs r34)
r.test(r12=.3, r34=.5, r13=.1, r14=.1, r23=.1, r24=.1, n=150)


１つの変数を共有する，対応のある2つの相関係数の差(r12 vs r13)
r.test(r12=.3, r13=.5, r23=.1, n=150)
```

あらかじめpsychパッケージをインストールしておく必要がある.

```
> # r.test を用いる方法
> library(psych)
>

> # 独立な2群における相関係数の差(r12 vs r34)
> r.test(r12=.3, r34=.5, n=100, n2=150)
Correlation tests
Call:r.test(n = 100, r12 = 0.3, r34 = 0.5, n2 = 150)
Test of difference between two independent correlations
 z value 1.83    with probability  0.07>
>


> # 対応のある2つの相関係数の差(r12 vs r34)
> r.test(r12=.3, r34=.5, r13=.1, r14=.1, r23=.1, r24=.1, n=150)
Correlation tests
Call:r.test(n = 150, r12 = 0.3, r34 = 0.5, r23 = 0.1, r13 = 0.1, r14 = 0.1,
    r24 = 0.1)
Test of difference between two dependent correlations
 z value -2.07    with probability  0.04>
>


> # １つの変数を共有する，対応のある2つの相関係数の差(r12 vs r13)
> r.test(r12=.3, r13=.5, r23=.1, n=150)
Correlation tests
Call:r.test(n = 150, r12 = 0.3, r23 = 0.1, r13 = 0.5)
Test of difference between two correlated  correlations
 t value -2.09    with probability < 0.038>
>
>
```

2群の相関係数の差の信頼区間

自作関数を使う

cor2.dif(n=人数ベクトル, r=相関係数ベクトル)

```
# ------------------------------------------------------------------------------------------------
cor2.dif <- function(n, r, conf=0.95){
 z <- 1/2 * log((1+r)/(1-r))
 d.r <- r %*% c(1, -1)
 d.z <- z %*% c(1, -1)
 n3 <- n - 3
 inv.n3 <- 1/ n3
 se <- sqrt(sum(inv.n3))
 p.value <- round(2 *(1 - pnorm(abs(d.z/se))),4)
 za <- qnorm(1-(1-confidence)/2)
 ci.l <- d.z - za * se
 ci.u <- d.z + za * se
 exp.2z.l <- exp(2*ci.l)
 exp.2z.u <- exp(2*ci.u)
 ci.l <- round((exp.2z.l-1)/(exp.2z.l+1),4)
 ci.u <- round((exp.2z.u-1)/(exp.2z.u+1),4)
 title <- "Difference of two correlation coefficients"
 stnames <- c("difference", "z", "p.value", paste("lower(",conf,")", sep=""), paste("upper(",con
f,")", sep=""))
 statistic <- data.frame(d.r, round(d.z/se,4), p.value, ci.l, ci.u)
 ts <- r/sqrt(1-r*r)*sqrt(n-2)
 ps <- 2*(1-pt(abs(ts),n-2))
 rhoTests <- round(data.frame(n,r, ts,ps),4)
 colnames(rhoTests) <- c("N","r", "t", "p")
 colnames(statistic) <- stnames
 out <- list(title, rhoTest=rhoTests, statistic=statistic)
 return(out)
}
# ------------------------------------------------------------------------------------------------
```

各群における無相関検定と，相関係数の差の検定，信頼区間を出力する．
conf= で信頼係数を調整できる．デフォルトは0.95.

```
> setwd("i:¥¥Rdocuments¥¥scripts¥¥")
> d1 <- read.table("相関係数の差データ.csv", header=TRUE, sep=",")
> head(d1)
  id shurou honnin kyouin
1  1      0     29      10
2  2      0     28      17
3  3      0     24      24
4  4      0     27      26
5  5      0     30      34
6  6      0     30      30
>
> d10 <- d1[d1$shurou==0, ]
> d11 <- d1[d1$shurou==1, ]
>
```

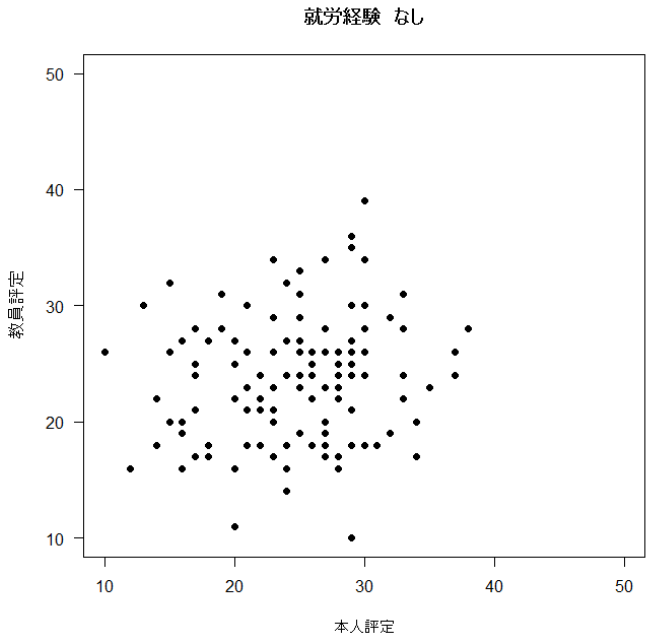
1	id	shurou	honnin	kyouin
2	1	0	29	10
3	2	0	28	17
4	3	0	24	24
5	4	0	27	26
6	5	0	30	34
7	6	0	30	30
8	7	0	20	25
9	8	0	23	23
10	9	0	12	16
11	10	0	25	29
12	11	0	15	20
13	12	0	21	18
14	13	0	17	24
15	14	0	29	30
16	15	0	24	16
17	16	0	35	23
18	17	0	22	24
19	18	0	29	10
20	19	0	29	27
21	20	0	28	22

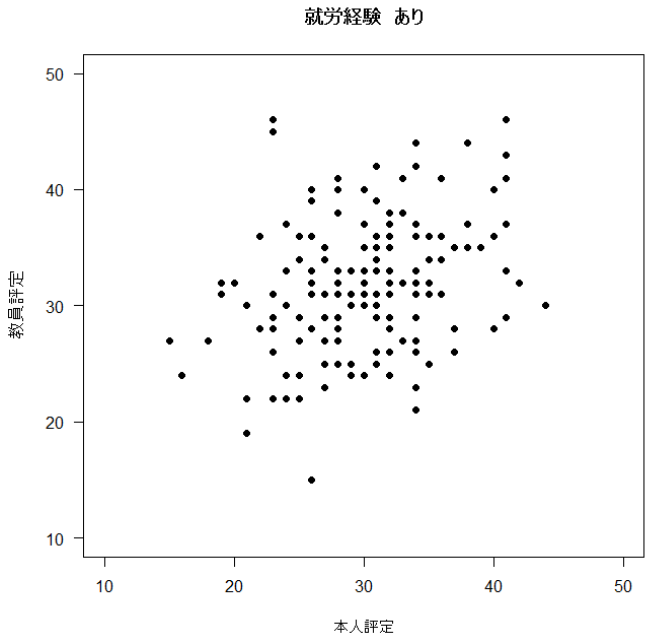
```
> # 記述統計量

> # shurou==0
> dtmp <- d10[,c(-1,-2)]
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
         N  Mean   SD honnin kyouin
honnin 117 24.48 5.89   1.00   0.18
kyouin 117 23.38 5.76   0.18   1.00
```

```
> #shurou==1
> dtmp <- d11[,c(-1,-2)]
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
         N  Mean   SD honnin kyouin
honnin 153 30.24 5.59    1.0    0.3
kyouin 153 31.78 5.77    0.3    1.0
>
>
>
```

```
> # 相関係数の差の検定・信頼区間
> nv <- c(nrow(d10), nrow(d11))
> rv <- c(cor(d10$honnin, d10$kyouin), cor(d11$honnin, d11$kyouin))
> cor2.dif(n=nv, r=rv)

[[1]]
[1] "Difference of two correlation coefficients"

$rhoTest
    N      r      t      p
1 117 0.1779 1.9384 0.0550
2 153 0.3016 3.8873 0.0002

$statistic
  difference       z p.value lower(0.95) upper(0.95)
1  -0.123742 -1.0584  0.2899     -0.3584      0.1116

>
```

```
> # 散布図
> plot(d10$honnin, d10$kyouin, xlim=c(10,50), ylim=c(10,50),
+  main="就労経験　なし", xlab="本人評定",ylab="教員評定", las=1, pch=19)
>
> plot(d11$honnin, d11$kyouin, xlim=c(10,50), ylim=c(10,50),
+  main="就労経験　あり", xlab="本人評定",ylab="教員評定", las=1, pch=19)
>
```





多群の相関係数の等質性の推測

自作関数を使う

cors.test(n=人数ベクトル, r=相関係数ベクトル, conf=信頼係数)

```
# ------------------------------------------------------------------------------------------
cors.test<- function(n,r, conf=0.95){
 z <- 1/2 * log((1+r)/(1-r))
 n3 <- n - 3
 df <- length(n) - 1
 X2 <- round(sum(z*z*n3) - sum(z*n3)^2 / sum(n3),4)
 p.value <- round(1 - pchisq(X2, df), 5)
 title <- "Test : equality of correlation coefficients"
 statistic <- round(cbind(X2, df, p.value), 4)
 ts <- r/sqrt(1-r*r)*sqrt(n-2)
 ps <- 2*(1-pt(abs(ts),n-2))
 rhoTests <- round(data.frame(n,r, ts,ps),4)
 colnames(rhoTests) <- c("N","r", "t", "p")
 colnames(statistic) <- c("X2","df","p")
 rownames(statistic) <- ""
 inv.n3 <- 1/ n3
 npair <- length(n)*(length(n)-1)
 za <- qnorm(1-((1-conf)/(npair/2))/2)
 pairs <- matrix(c(0), npair, 7)
 k <- 0
 for(i in 1:length(n)){
  for(j in c(1:length(n))[-i]){
   d.r <- r[i] - r[j]
   d.z <- z[i] - z[j]
   se <- sqrt(sum(inv.n3[i]+inv.n3[j]))
   p.value <- round(2 *(1 - pnorm(abs(d.z/se))),4)
   ci.l <- d.z - za * se
   ci.u <- d.z + za * se
   exp.2z.l <- exp(2*ci.l)
   exp.2z.u <- exp(2*ci.u)
   ci.l <- round((exp.2z.l-1)/(exp.2z.l+1),4)
   ci.u <- round((exp.2z.u-1)/(exp.2z.u+1),4)
   k <- k+1
   pairs[k,] <- round(c(r[i],r[j],d.r, round(d.z/se,4), p.value, ci.l, ci.u),4)
  }
 }
 rownames(pairs) <- c(1:npair)
 jconf <- round(100*(1-((1-conf)/(npair/2))),1)
 colnames(pairs) <- c("r1","r2","diff","z","p",paste("lower(",jconf,")", sep=""), paste("upper(",
jconf,")", sep=""))
 out <- list(title, rhoTest=rhoTests, statistic= statistic, CI= pairs)
 return(out)
}
# ------------------------------------------------------------------------------------------
```

各群における無相関検定と，相関係数の等質性の検定，同時信頼区間を出力する．
conf= で信頼係数を調整できる．デフォルトは0.95．

```
> setwd("i:¥¥Rdocuments¥¥scripts¥¥")
> d1 <- read.table("相関係数の等質性データ.csv", header=TRUE, sep=",")
> head(d1)
  id grade ruiji shinmitsu
1  1     L     5         4
2  2     L     5         4
3  3     L     3         2
4  4     L     2         3
5  5     L     3         3
6  6     L     5         6
>
```

```
> # 群別データの作成
> d10 <- d1[d1$grade=="L", ]
> d11 <- d1[d1$grade=="M", ]
> d12 <- d1[d1$grade=="H", ]
>
>

> #記述統計量
> #grade=="L"
> dtmp <- d10[,c(-1,-2)]
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
           N Mean   SD ruiji shinmitsu
ruiji     92 3.98 1.25  1.00      0.22
shinmitsu 92 3.96 1.14  0.22      1.00
>
>
> #grade=="M"
> dtmp <- d11[,c(-1,-2)]
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
            N Mean   SD ruiji shinmitsu
ruiji     108 3.60 1.27  1.00      0.34
shinmitsu 108 3.73 1.34  0.34      1.00
>
>
> #grade=="H"
> dtmp <- d12[,c(-1,-2)]
> ntmp <- nrow(dtmp)
> mtmp <- colMeans(dtmp)
> stmp <- apply(dtmp, 2, sd)
> ctmp <- cor(dtmp)
> ktmp <- round(data.frame(ntmp, mtmp, stmp, ctmp),2)
> colnames(ktmp) <- c("N","Mean","SD",colnames(ctmp))
> ktmp
            N Mean   SD ruiji shinmitsu
ruiji     102 3.47 1.36  1.00      0.52
shinmitsu 102 3.50 1.33  0.52      1.00
>
>

> # 相関係数の等質性
> n1 <- nrow(d10)
> n2 <- nrow(d11)
> n3 <- nrow(d12)
> nv <- c(n1,n2,n3)
> r1 <- cor(d10$ruiji, d10$shinmitsu)
> r2 <- cor(d11$ruiji, d11$shinmitsu)
> r3 <- cor(d12$ruiji, d12$shinmitsu)
> rv <- c(r1,r2,r3)

> cors.test(n=nv, r=rv)
[[1]]
[1] "Test : equality of correlation coefficients"

$rhoTest
    N      r      t      p
1  92 0.2158 2.0970 0.0388
2 108 0.3425 3.7534 0.0003
3 102 0.5209 6.1017 0.0000
```

1	id	grade	ruiji	shinmitsu
2	1	L	5	4
3	2	L	5	4
4	3	L	3	2
5	4	L	2	3
6	5	L	3	3
7	6	L	5	6
8	7	L	3	3
9	8	L	5	6
10	9	L	3	4
11	10	L	3	4
12	11	L	4	6
13	12	L	4	2
14	13	L	4	2
15	14	L	5	3
16	15	L	3	5
17	16	L	5	3
18	17	L	5	3
19	18	L	4	3
20	19	L	3	4
21	20	L	3	4

```
$statistic
     X2 df      p
 6.1903  2 0.0453

$CI
      r1     r2    diff       z      p lower(98.3) upper(98.3)
1 0.2158 0.3425 -0.1267 -0.9554 0.3394     -0.4483      0.2044
2 0.2158 0.5209 -0.3050 -2.4526 0.0142     -0.6094     -0.0086
3 0.3425 0.2158  0.1267  0.9554 0.3394     -0.2044      0.4483
4 0.3425 0.5209 -0.1784 -1.5747 0.1153     -0.5050      0.1143
5 0.5209 0.2158  0.3050  2.4526 0.0142      0.0086      0.6094
6 0.5209 0.3425  0.1784  1.5747 0.1153     -0.1143      0.5050

>
```