QUIZ 4

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```
library(psych)

# QUESTION 3

S <- matrix(
    c(
        177, 40, -14, 4,
        40, 98, -37, -4,
        -14, -37, 314, 5,
        4, -4, 5, 1),
    4, 4)

n <- 30
p <- ncol(S)
R <- cov2cor(S)

(test_stat <- -n*log(det(R)))
```

```
## [1] 19.61531
```

```
(df <- p*(p-1)/2)
```

```
## [1] 6
```

```
(p_value <- pchisq(test_stat, df, lower.tail = FALSE))
```

```
## [1] 0.003241336
```

```
# QUESTION 4 - PART A

X <- read.csv("q4_data.csv")

# try 1 factor
# result: 1 factor is NOT sufficient
f1 <- factanal(X, 1)
f1$STATISTIC
```

```
## objective
##  126.9754
```

```
f1$dof
```

```
## [1] 27
```

```
f1$PVAL
```

```
##    objective
```

```
## 6.627751e-15
```

```
# try 2 factors
# result: 2 factors are sufficient
f2 <- factanal(X, 2)
f2$STATISTIC
```

```
## objective
##  24.09542
```

```
f2$dof
```

```
## [1] 19
```

```
f2$PVAL
```

```
## objective
## 0.1925176
```

```
# try 3 factors
# result: 3 factors are sufficient
f3 <- factanal(X, 3)
f3$STATISTIC
```

```
## objective
##  13.48187
```

```
f3$dof
```

```
## [1] 12
```

```
f3$PVAL
```

```
## objective
## 0.3350099
```

```
# overall result: 2 factors are sufficient

# QUESTION 4 - PART Bi

f2.vmax <- fa(X, 2, fm="ml", rotate="varimax")
f2.vmax$loadings
```

```
##
## Loadings:
##    ML2    ML1
## X1
## X2  0.155
## X3  0.726
## X4 -0.160 -0.612
## X5         0.866
## X6         0.997
## X7 -0.963  0.114
## X8  0.989
## X9 -0.117  0.120
##
##                  ML2   ML1
## SS loadings    2.510 2.156
## Proportion Var 0.279 0.240
## Cumulative Var 0.279 0.518
```

```r
# result:
# factor 1 = X3, X7, X8
# factor 2 = X4, X5, X6

# QUESTION 4 - PART Bii

Lambda <- f2.vmax$loadings
Sigma_e <- f2.vmax$uniquenesses

R <- Lambda %*% t(Lambda) + Sigma_e
dump(list=c("R"), file="")
```

```
## R <-
## structure(c(1, 0.96179714386334592, 0.40604708270840351, 0.62006178824693869,
## 0.2418547071530924, -0.0034077854865938659, 0.14555454632462131,
## -0.073740344180911147, 0.98112198542485274, 0.97779016053419321,
## 1, 0.58459031150407692, 0.56882835661170061, 0.24031391894561507,
## 0.012276006287353078, -0.08087059825156994, 0.16696843613023288,
## 0.95482700598598347, 0.92626002136141283, 1.0888102334862388,
## 1, 0.46425952629099088, 0.21570188654628736, 0.024635733317145518,
## -0.63544721811137994, 0.73008566888714066, 0.89061238406546772,
## 1.0122425077605903, 0.94501605945450484, 0.33622730715163307,
## 1, -0.27467543011208373, -0.60301237870208468, 0.14456719230299564,
## -0.092384105256179294, 0.91676070172309476, 0.9900950966195543,
## 0.97256129174122963, 0.44372933735973991, 0.081384239840726624,
## 0.99999999999999978, 0.87033767354461611, 0.23169699294466967,
## -0.13365196522608966, 1.0850515277458004, 0.98343025340795531,
## 0.98312102851105487, 0.49126083355868533, -0.0083550593211870749,
## 1.1089353229727035, 0.99999999999999989, 0.18902504710504203,
## -0.085532050551642286, 1.0938344773461006, 1.0772194724043251,
## 0.82758484958369949, -0.22399523068468552, 0.68405139886904787,
## 0.41512152955791154, 0.13385193429019665, 1, -0.94765024707800849,
## 1.0981364433322198, 0.90376599661803958, 1.1284817602583364,
## 1.187379071033082, 0.4929415160291199, 0.095613986106399179,
## -0.094863748647240703, -0.90180883235876153, 1, 0.84591577505027327,
## 1.0011526179668755, 0.95886462185715882, 0.39043007795448104,
## 0.54461061475146588, 0.35684177082136104, 0.12702707099357413,
## 0.18650214979453872, -0.11155993320665483, 1), dim = c(9L, 9L
## ), dimnames = list(c("X1", "X2", "X3", "X4", "X5", "X6", "X7",
## "X8", "X9"), c("X1", "X2", "X3", "X4", "X5", "X6", "X7", "X8",
## "X9")))
```