Project 7

Code

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13.8) Use the ramus bone data of Table 3.7

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```
bone <- read.csv("C:\\Users\\Taterthot\\Desktop\\da 410\\a8\\bone.csv", fileEncoding = 'UTF-8-BOM')
bone
```

y1 <dbl>	y2 <dbl>	y3 <dbl>	y4 <dbl>
47.8	48.8	49.0	49.7
46.4	47.3	47.7	48.4
46.3	46.8	47.8	48.5
45.1	45.3	46.1	47.2
47.6	48.5	48.9	49.3
52.5	53.2	53.3	53.7
51.2	53.0	54.3	54.5
49.8	50.0	50.3	52.7
48.1	50.8	52.3	54.4
45.0	47.0	47.3	48.3

1-10 of 20 rows Previous **1** 2 Next

(a) Extract loadings by the principal component method and do a varimax rotation. Use two Factors.

FINDING CORRELATION MATRIX C

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```
bone.cor <- cor(bone[,1:4])
bone.cor
```

```
         y1        y2        y3        y4
y1 1.0000000 0.9686511 0.8729938 0.8071246
y2 0.9686511 1.0000000 0.9212312 0.8537046
y3 0.8729938 0.9212312 1.0000000 0.9666227
y4 0.8071246 0.8537046 0.9666227 1.0000000
```

FINDING EIGENVALUE D AND EIGENVECTOR C

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```
eigen <- eigen(bone.cor)
eigen
```

```
eigen() decomposition
$values
[1] 3.69607865 0.25510100 0.03205254 0.01676781

$vectors
           [,1]       [,2]       [,3]       [,4]
[1,] -0.4936608  0.5853661 -0.5670593 -0.3034622
[2,] -0.5065948  0.3809756  0.5357837  0.5578127
[3,] -0.5088561 -0.3398954  0.4428191 -0.6553227
[4,] -0.4906385 -0.6298216 -0.4419171  0.4090329
```

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```
c <- eigen$vectors[,1:2]
c
```

```
           [,1]       [,2]
[1,] -0.4936608  0.5853661
[2,] -0.5065948  0.3809756
[3,] -0.5088561 -0.3398954
[4,] -0.4906385 -0.6298216
```

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```
d <- diag(eigen$values[1:2])
d
```

```
         [,1]     [,2]
[1,] 3.696079 0.000000
[2,] 0.000000 0.255101
```

LOADINGS LAMBDA 1 AND 2

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```
a <- c %*% sqrt(d)
a <- -(a)
round(a, 3)
```

```
     [,1]   [,2]
[1,] 0.949 -0.296
[2,] 0.974 -0.192
[3,] 0.978  0.172
[4,] 0.943  0.318
```

COMMUNALITIES

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```
com <- (a[,1]^2) + (a[,2]^2)
com <- round(com, 3)
com
```

```
[1] 0.988 0.986 0.987 0.991
```

SPECIFIC VARIANCES

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```
var <- round((1 - (com)), 3)
var
```

```
[1] 0.012 0.014 0.013 0.009
```

TOTAL VARIANCE ACCOUNTED FOR

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```
total.var <- eigen$values[1:2]
total.var
```

```
[1] 3.696079 0.255101
```

PROPORTION OF TOTAL VARIANCE

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```
x <- rep(NA, 2)
for (i in 1:2) {
  x[i] <-
    eigen$values[i] / (eigen$values[1] + eigen$values[2] + eigen$values[3] + eigen$values[4])
}
x <- round(x, digits = 3)
x
```

```
[1] 0.924 0.064
```

VARIMAX LOADINGS

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```
varimax <- varimax(a)
varimax
```

```
$loadings

Loadings:
     [,1]  [,2]
[1,] 0.886 0.451
[2,] 0.832 0.542
[3,] 0.581 0.806
[4,] 0.453 0.886

                [,1]  [,2]
SS loadings    2.019 1.932
Proportion Var 0.505 0.483
Cumulative Var 0.505 0.988

$rotmat
           [,1]      [,2]
[1,]  0.7159649 0.6981363
[2,] -0.6981363 0.7159649
```

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```
varimax <- c(varimax$loadings)
varimax <- data.frame(varimax[1:4], varimax[5:8])
```

FINAL RESULTS IN DATAFRAME

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```
final <- data.frame(a,varimax, com, var)
final <- rbind(final, total.var, x)
final[5,5] <- sum(com)
final[6,5] <- sum(x)
final[5:6,6] <- NA
final[5:6,6] <- NA
final[5,3] <- 2.019
final[5,4] <- 1.932
final[6,3] <- 0.505
final[6,4] <- 0.483


names(final)[names(final) == "X1"] <- "F1"
names(final)[names(final) == "X2"] <- "F2"
names(final)[names(final) == "com"] <- "Communalities"
names(final)[names(final) == "var"] <- "Specific Variances"
names(final)[names(final) == "varimax.1.4."] <- "Varimax F1"
names(final)[names(final) == "varimax.5.8."] <- "Varimax F2"

final <- cbind(Row.Names = c("8 years", "8.5 years", "9 years", "9.5 years", "Variance", "Propor
tion"), final)
names(final)[names(final) == "Row.Names"] <- "Variables"

final["F1"] <- round(final["F1"],3)
final["F2"] <- round(final["F2"],3)
final["Varimax F1"] <- round(final["Varimax F1"],3)
final["Varimax F2"] <- round(final["Varimax F2"],3)
final
```

Variables	F1	F2	Varimax F1	Varimax F2	Communalities	Specific Variances
<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
8 years	0.949	-0.296	0.886	0.451	0.988	0.012
8.5 years	0.974	-0.192	0.832	0.542	0.986	0.014
9 years	0.978	0.172	0.581	0.806	0.987	0.013
9.5 years	0.943	0.318	0.453	0.886	0.991	0.009
Variance	3.696	0.255	2.019	1.932	3.952	*NA*
Proportion	0.924	0.064	0.505	0.483	0.988	*NA*

6 rows