Multivariate Analysis for the Behavioral Sciences, Second Edition (Chapman and Hall/CRC, 2019)

Exercises of Chapter 13: Principal Components Analysis

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Exercises

Exercise 13.2

Use the matrix R below, modifying the related R code given in the **Examples of Chapter 13**.

```
R <- matrix(c(
  1,      0.6579, 0.0034,
  0.6579, 1,     -0.0738,
  0.0034,-0.0738, 1
  ), ncol = 3, byrow = TRUE)
```

Exercise 13.3

Use the matrix R below, modifying the related R code given in the **Examples of Chapter 13**.

Source of the data: Macdonnell, W. R. (1902). On criminal anthropometry and the identification of criminals. *Biometrika*, 1, 177-227 (Table 19 on page 202). https://www.jstor.org/stable/2331487 (Note: the original N is 3000.)

```
R <- matrix(c(
  1    , 0.402, 0.396, 0.301, 0.305, 0.339, 0.340,
  0.402, 1    , 0.618, 0.150, 0.135, 0.206, 0.183,
  0.396, 0.618, 1    , 0.321, 0.289, 0.363, 0.345,
  0.301, 0.150, 0.321, 1    , 0.846, 0.759, 0.661,
  0.305, 0.135, 0.289, 0.846, 1    , 0.797, 0.800,
  0.339, 0.206, 0.363, 0.759, 0.797, 1    , 0.736,
  0.340, 0.183, 0.345, 0.661, 0.800, 0.736, 1
  ), ncol=7,byrow=T)

labels <- c("HL", "HB", "FB", "LFinL", "LForL", "LFootL", "Height")
dimnames(R) <- list(labels, labels)

R
```

```
##           HL    HB    FB LFinL LForL LFootL Height
## HL     1.000 0.402 0.396 0.301 0.305  0.339  0.340
## HB     0.402 1.000 0.618 0.150 0.135  0.206  0.183
## FB     0.396 0.618 1.000 0.321 0.289  0.363  0.345
## LFinL  0.301 0.150 0.321 1.000 0.846  0.759  0.661
## LForL  0.305 0.135 0.289 0.846 1.000  0.797  0.800
## LFootL 0.339 0.206 0.363 0.759 0.797  1.000  0.736
## Height 0.340 0.183 0.345 0.661 0.800  0.736  1.000
```

Exercise 13.4

Use the prestige data, modifying the related R code given in the **Examples of Chapter 13** to visualize and analyse the data.

Source of the data: Labovitz, S. (1970). The assignments of numbers to rank order categories. *American Sociological Review*, 35, 515–524. (Table 1 on page 516). https://www.jstor.org/stable/2092993

```
prestige <- structure(
  c(
    82, 90, 76, 90, 87, 93, 90, 88, 89, 97, 59, 73, 81, 45, 39, 34, 41, 16,
    33, 53, 67, 57, 26, 29, 10, 15, 19, 10, 13, 24, 20, 7, 16, 11, 8, 41,

    23.8, 37.5, 37, 20.7, 10.6, 14.2, 45.6, 31.9, 24.3, 31.9, 16, 16.8, 64.8,
    47.3, 21.9, 16.5, 32.4, 24.1, 32.7, 30.8, 34.2, 34.5, 24.4, 29.4, 14.4,
    41.7, 19.2, 24.9, 17.9, 15.7, 36, 24.4, 42.2, 38.2, 20.3, 47.6,

    3977, 5509, 4303, 4091, 2410, 4366, 6448, 4590, 6284, 8302, 3176, 3456,
    4700, 3806, 2828, 3480, 3771, 2543, 2450, 3447, 4648, 3303, 2693, 3353,
    1898, 2410, 3424, 2213, 2590, 2915, 2357, 1942, 2249, 2551, 1866, 2866,

    14.4, 16, 15.6, 16, 16, 16, 16, 16, 16, 16, 15.8, 16, 12.2, 11.6, 12.7,
    12.2, 12.7, 12.1, 8.7, 11.1, 8.8, 9.6, 9.4, 9.3, 10.3, 8.2, 9.2, 8.9, 9.6,
    9.6, 8.8, 9.8, 8.7, 8.5, 8.2, 10.6
   ),

.Dim = c(36L, 4L),
.Dimnames = list(c("Accountants", "Architects", "Authors", "Chemists",
                   "Clergymen", "Academics", "Dentists", "Civengineers",
                   "Lawyers", "Physicians", "Socialwk", "Teachers",
                   "Mangmanuf", "Mangretail", "Bookkeepers", "Mail-carriers",
                   "Insurag", "Salesman", "Carpenters", "Electricians",
                   "Locmeng", "Machinists", "Mechanics", "Plumbers",
                   "Parkingatt", "Miners", "Railwaydr", "Taxidr", "Truckdr",
                   "Machoper", "Barbers", "Waiters", "Cooks", "Watchmen",
                   "Janitors", "Policemen"),
                 c("Prestige", "Suicide", "Medinc", "Mediansch")
                 )
)
head(prestige); tail(prestige)
```

```
##             Prestige Suicide Medinc Mediansch
## Accountants       82    23.8   3977       14.4
## Architects        90    37.5   5509       16.0
## Authors           76    37.0   4303       15.6
## Chemists          90    20.7   4091       16.0
## Clergymen         87    10.6   2410       16.0
## Academics         93    14.2   4366       16.0
```

```
##           Prestige Suicide Medinc Mediansch
## Barbers         20    36.0   2357        8.8
## Waiters          7    24.4   1942        9.8
## Cooks           16    42.2   2249        8.7
## Watchmen        11    38.2   2551        8.5
## Janitors         8    20.3   1866        8.2
## Policemen       41    47.6   2866       10.6
```