BDM600 - Lab 3 - Group 8

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2024-02-12

Credentials

All members participated in this lab assignment. The file is the merged version.

Start

```
# install libraries
library(xtable)
library(vcd)
```

```
## Loading required package: grid
```

```
library(gnm)
library(grid)
library(vcdExtra)
```

Exercise (1)

```
# get the dataset list
ds <- datasets(package = c("vcd", 'vcdExtra'))
str(ds, vec.len = 2)
```

```
## 'data.frame':    78 obs. of  5 variables:
##  $ Package: chr  "vcd" "vcd" ...
##  $ Item   : chr  "Arthritis" "Baseball" ...
##  $ class  : chr  "data.frame" "data.frame" ...
##  $ dim    : chr  "84x5" "322x25" ...
##  $ Title  : chr  "Arthritis Treatment Data" "Baseball Data" ...
```

```
# (a): show the number of datasets on each package
table(ds$Package)
```

```
##
##      vcd vcdExtra
##       33       45
```

```
# (b): show the tabluer display based on Package and class
table(ds$Package, ds$class)
```

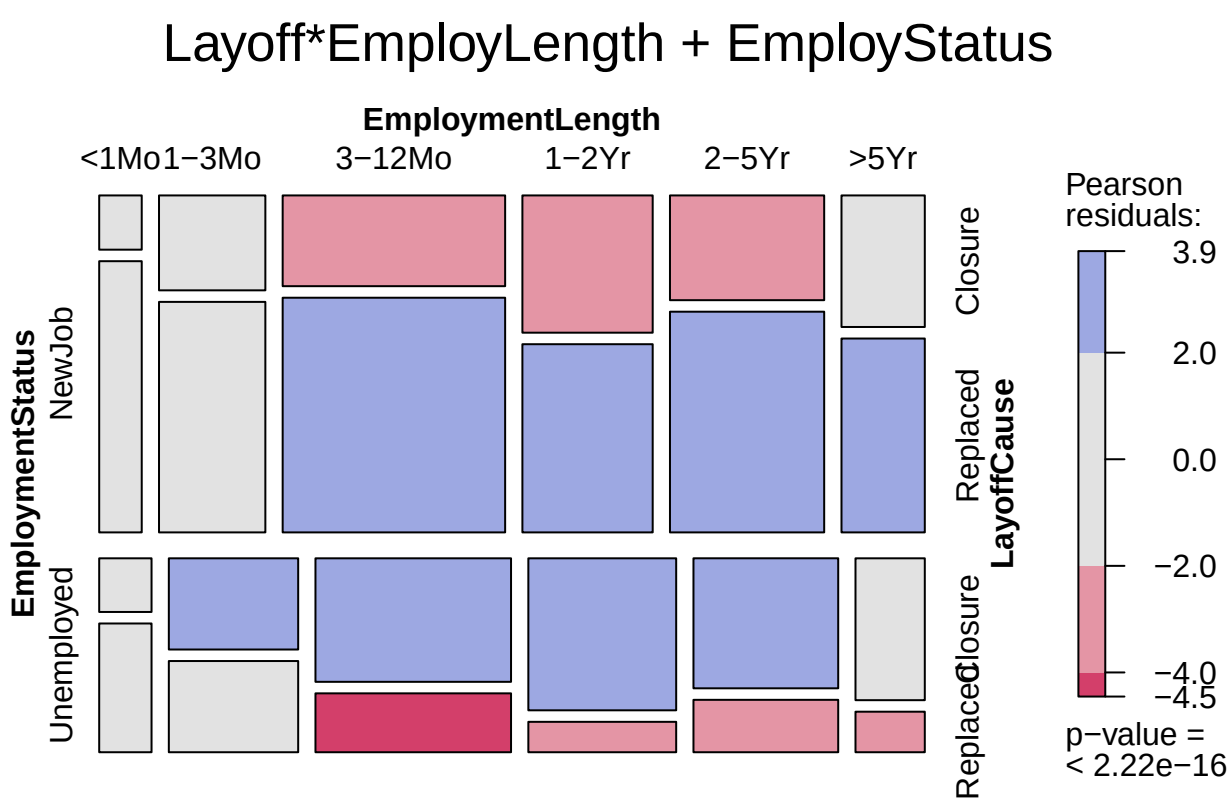
```
##
##             array data.frame table
##   vcd           1         17    15
##   vcdExtra      5         24    16
```

```
# (c): examine help files
help(Employment)
```

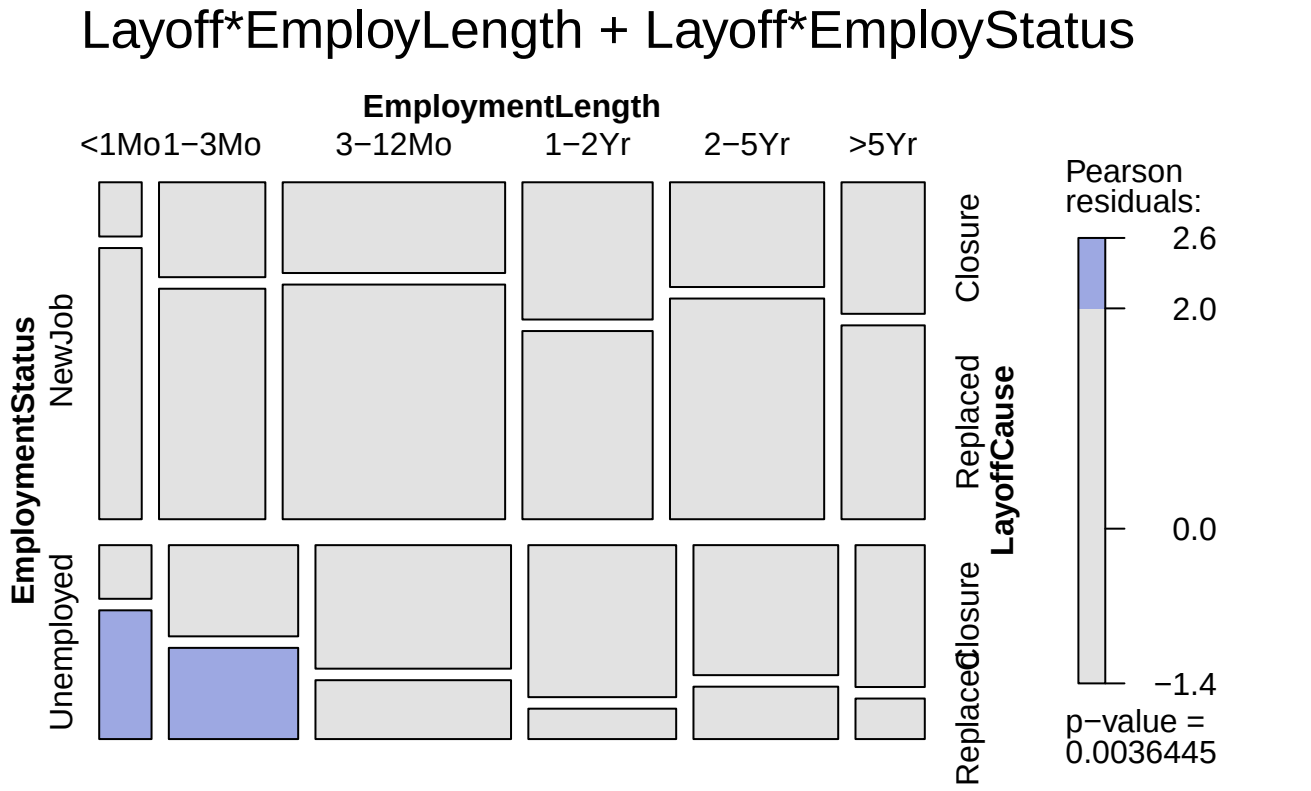
```
## starting httpd help server ... done
```

```
example(Employment)
```

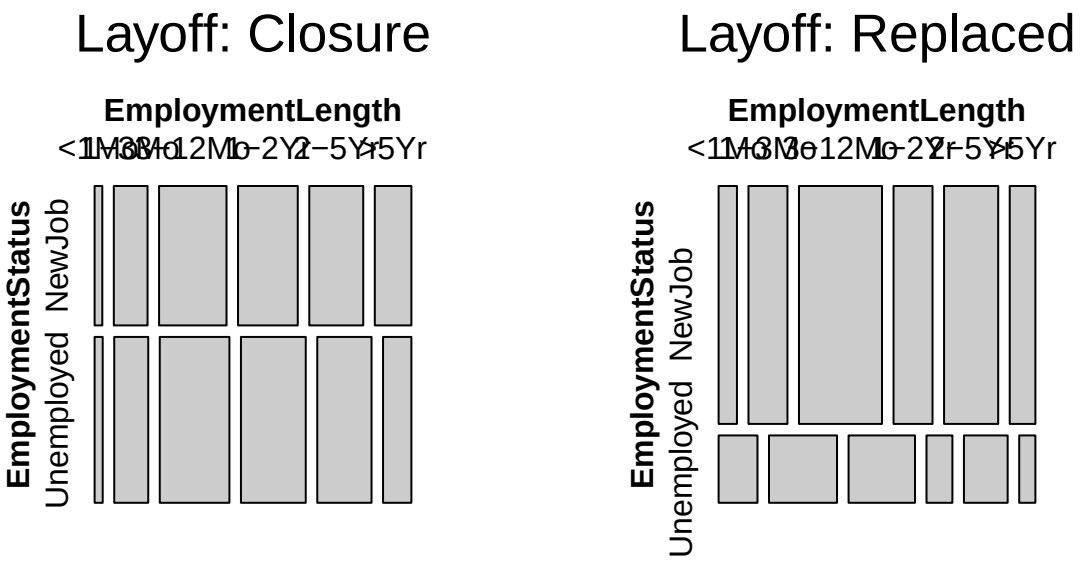
```
##
## Emplym> data("Employment")
##
## Emplym> ## Employment Status
## Emplym> mosaic(Employment,
## Emplym+        expected = ~ LayoffCause * EmploymentLength + EmploymentStatus,
## Emplym+        main = "Layoff*EmployLength + EmployStatus")
```



```
##
## Emplym> mosaic(Employment,
## Emplym+        expected = ~ LayoffCause * EmploymentLength + LayoffCause * EmploymentStatus,
## Emplym+        main = "Layoff*EmployLength + Layoff*EmployStatus")
```




```
##
## Emplym> ## Stratified view
## Emplym>
## Emplym> grid.newpage()
```




```
##
## Emplym> pushViewport(viewport(layout = grid.layout(ncol = 2)))
##
## Emplym> pushViewport(viewport(layout.pos.col = 1))
##
## Emplym> ## Closure
## Emplym> mosaic(Employment[,,1], main = "Layoff: Closure", newpage = FALSE)
##
## Emplym> popViewport(1)
##
## Emplym> pushViewport(viewport(layout.pos.col = 2))
##
## Emplym> ## Replaced
## Emplym> mosaic(Employment[,,2], main = "Layoff: Replaced", newpage = FALSE)
##
## Emplym> popViewport(2)
```

- (a): The outpus shows the 78 observations; 33 datasets in vcd and 45 datasets in vcdExtra.
- (b): Shown above
- (c): Retrieved the following description: Data from a 1974 Danish study given by Andersen (1991) on the employees who had been laid off. The workers are classified by their employment status on 1975-01-01, the cause of their layoff and the length of employment before they were laid off.

Exercise (2)

(a) Abortion opinion data: Abortion

```
data(Abortion, package="vcdExtra")
str(Abortion)
```

```
##  'table' num [1:2, 1:2, 1:2] 171 152 138 167 79 148 112 133
##  - attr(*, "dimnames")=List of 3
##   ..$ Sex             : chr [1:2] "Female" "Male"
##   ..$ Status          : chr [1:2] "Lo" "Hi"
##   ..$ Support_Abortion: chr [1:2] "Yes" "No"
```

```
help(Abortion)
```

- The "Support_Abortion" variable appears to be the response variable, indicating whether individuals support abortion or not.
- The "Sex" and "Status" variables could potentially serve as explanatory variables.
- "Sex" and "Support_Abortion"variables appear to be unordered (nominal) variables as they represent categorical data without inherent ordering. "Status" factor should be treated as ordered of "low" and "hight".
- Substantive questions of interest for analysis of the data might include:
- Is there a significant difference in abortion support between males and females?
- Does socioeconomic status (as represented by the "Status" variable) influence opinions on abortion?

(b) Caesarian Births: Caesar

```
data(Caesar, package="vcdExtra")
str(Caesar)
```

```
##  'table' num [1:3, 1:2, 1:2, 1:2] 0 1 17 0 1 1 11 17 30 4 ...
##  - attr(*, "dimnames")=List of 4
##   ..$ Infection  : chr [1:3] "Type 1" "Type 2" "None"
##   ..$ Risk       : chr [1:2] "Yes" "No"
##   ..$ Antibiotics: chr [1:2] "Yes" "No"
##   ..$ Planned    : chr [1:2] "Yes" "No"
```

```
help(Caesar)
```

- "Infection" is regarded as the response variable.
- "Risk", "Antibiotics", and "Planned" serve as explanatory variables.
- All four factors appear to be unordered (nominal) variables as they represent categorical data without inherent ordering.
- Substantive questions of interest for analysis of the data:
- What factors are associated with the likelihood of different types of infections during birth?
- Does the use of antibiotics affect the risk of infection?

(c) Dayton Survey: DaytonSurvey

```
data(DaytonSurvey, package="vcdExtra")
str(DaytonSurvey)
```

```
## 'data.frame':    32 obs. of  6 variables:
##  $ cigarette: Factor w/ 2 levels "Yes","No": 1 2 1 2 1 2 1 2 1 2 ...
##  $ alcohol  : Factor w/ 2 levels "Yes","No": 1 1 2 2 1 1 2 2 1 1 ...
##  $ marijuana: Factor w/ 2 levels "Yes","No": 1 1 1 1 2 2 2 2 1 1 ...
##  $ sex      : Factor w/ 2 levels "female","male": 1 1 1 1 1 1 1 1 2 2 ...
##  $ race     : Factor w/ 2 levels "white","other": 1 1 1 1 1 1 1 1 1 1 ...
##  $ Freq     : num  405 13 1 1 268 218 17 117 453 28 ...
```

```
help(DaytonSurvey)
```

- The factors "cigarette", "alcohol", "marijuana", and "Freq" serve as response variables.
- "sex" and "race" typically treated as explanatory variables.
- "Freq" can be treated as orders from low to high number, while others factors are unordered (nominal) variables as they represent categorical data without inherent ordering.
- Substantive questions of interest for analysis of the data:
- Is there a relationship between substance use and demographic characteristics such as sex or race?
- What is the largest category among the three addicted products for those who use them frequently, such as more than 50 or 100 times?

(d) Minnesota High School Graduates: Hoyt

```
data(Hoyt, package="vcdExtra")
str(Hoyt)
```

```
##  'table' num [1:4, 1:3, 1:7, 1:2] 87 3 17 105 216 4 14 118 256 2 ...
##  - attr(*, "dimnames")=List of 4
##   ..$ Status    : chr [1:4] "College" "School" "Job" "Other"
##   ..$ Rank      : chr [1:3] "Low" "Middle" "High"
##   ..$ Occupation: chr [1:7] "1" "2" "3" "4" ...
##   ..$ Sex       : chr [1:2] "Male" "Female"
```

```
help(Hoyt)
```

- "Status" is natural to consider as the response variable.
- "Rank", father's "Occupation", and "Sex" are explanatory variables.
- "Rank" and "Occupation" can be treated as ordered, while "Status" and "Sex" are unoerders (nominal) variables.
- Substantive questions of interest for analysis of the data:
- Is there a relationship between post-high school status and father's occupation or high school graduate rank?

Exercise (3)

```r
data(UCBAdmissions, package="vcdExtra")
```

```
## Warning in data(UCBAdmissions, package = "vcdExtra"): data set 'UCBAdmissions'
## not found
```

```r
str(UCBAdmissions)
```

```
##  'table' num [1:2, 1:2, 1:6] 512 313 89 19 353 207 17 8 120 205 ...
##  - attr(*, "dimnames")=List of 3
##   ..$ Admit : chr [1:2] "Admitted" "Rejected"
##   ..$ Gender: chr [1:2] "Male" "Female"
##   ..$ Dept  : chr [1:6] "A" "B" "C" "D" ...
```

```r
help(UCBAdmissions)
ftable(UCBAdmissions)
```

```
##                 Dept   A   B   C   D   E   F
## Admit    Gender
## Admitted Male        512 353 120 138  53  22
##          Female       89  17 202 131  94  24
## Rejected Male        313 207 205 279 138 351
##          Female       19   8 391 244 299 317
```

```r
# (a): Total number of cases contained in this table
total_cases <- sum(UCBAdmissions)
print(total_cases)
```

```
## [1] 4526
```

```r
# (b): For each department, find the total number of applicants
total_applicants_by_dept <- apply(UCBAdmissions, 3, sum)
print(total_applicants_by_dept)
```

```
##   A   B   C   D   E   F
## 933 585 918 792 584 714
```

```r
# (c): For each department, find the proportion of applicants who were admitted
admitted <- UCBAdmissions["Admitted", , ]
total_admitted_by_dept <- apply(admitted, 2, sum)
proportion_admitted_by_dept <- total_admitted_by_dept / total_applicants_by_dept
print(proportion_admitted_by_dept)
```

```
##         A         B         C         D         E         F
## 0.64415863 0.63247863 0.35076253 0.33964646 0.25171233 0.06442577
```

```r
# (d): Construct tabluar with row of department and column of gender.
#  get admitted applicants by gender and department
admitted_by_gender_dept <- apply(UCBAdmissions["Admitted", , , drop = FALSE], c("Dept", "Gender"), sum)
#  get total applicants by gender and department
total_by_gender_dept <- apply(UCBAdmissions, c("Dept", "Gender"), sum)
#  calculate proportions
prop_admitted_by_gender_dept <- admitted_by_gender_dept / total_by_gender_dept
print(prop_admitted_by_gender_dept)
```

```
##     Gender
## Dept       Male     Female
##    A 0.62060606 0.82407407
##    B 0.63035714 0.68000000
##    C 0.36923077 0.34064081
##    D 0.33093525 0.34933333
##    E 0.27748691 0.23918575
##    F 0.05898123 0.07038123
```

Exercise (4)

```r
data(DanishWelfare, package="vcd")
str(DanishWelfare)
```

```
## 'data.frame':    180 obs. of  5 variables:
##  $ Freq   : num  1 4 1 8 6 14 8 41 100 175 ...
##  $ Alcohol: Factor w/ 3 levels "<1","1-2",">2": 1 1 1 1 1 1 1 1 1 1 ...
##  $ Income : Factor w/ 4 levels "0-50","50-100",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ Status : Factor w/ 3 levels "Widow","Married",..: 1 1 1 1 1 2 2 2 2 2 ...
##  $ Urban  : Factor w/ 5 levels "Copenhagen","SubCopenhagen",..: 1 2 3 4 5 1 2 3 4 5 ...
```

```r
# (a): Total number of cases
total_cases <- sum(DanishWelfare$Freq)
print(total_cases)
```

```
## [1] 5144
```

```r
# (b): Change variables "Alcohol" and "Income" to make them ordered.
DanishWelfare$Alcohol <- ordered(DanishWelfare$Alcohol)
DanishWelfare$Income <- ordered(DanishWelfare$Income)

# (c): Convert to table form
DanishWelfare.tab <- xtabs(Freq ~ Alcohol + Income + Status + Urban, data = DanishWelfare)

# (d): display total frequencies for each category of Urban & Collapse categories.
#  frequency for each category
total_Freq_In_Urban <- aggregate(Freq ~ Urban, data = DanishWelfare, sum)
print(total_Freq_In_Urban)
```

```
##           Urban Freq
```

```
## 1    Copenhagen  552
## 2 SubCopenhagen  614
## 3     LargeCity  594
## 4          City 1765
## 5       Country 1619
```

```r
#  collapse
non_city_list <- c("Copenhagen", "SubCopenhagen", "LargeCity", "Country")
DanishWelfare$Urban <- ifelse(DanishWelfare$Urban %in% non_city_list, "City", "Non-city")
DanishWelfare.tab.collapsed <- xtabs(Freq ~ Alcohol + Income + Status + Urban, data = DanishWelfare)
print(DanishWelfare.tab.collapsed)
```

```
## , , Status = Widow, Urban = City
##
##        Income
## Alcohol 0-50 50-100 100-150 >150
##     <1    12     22       8  134
##     1-2    6      9      14   98
##     >2     4      8       4   47
##
## , , Status = Married, Urban = City
##
##        Income
## Alcohol 0-50 50-100 100-150 >150
##     <1   238    410     151  336
##     1-2   85    309     229  325
##     >2    12     84      82  127
##
## , , Status = Unmarried, Urban = City
##
##        Income
## Alcohol 0-50 50-100 100-150 >150
##     <1    18     48      10  140
##     1-2   21     49      36  171
##     >2     5     18      12   97
##
## , , Status = Widow, Urban = Non-city
##
##        Income
## Alcohol 0-50 50-100 100-150 >150
##     <1     8     14       5   95
##     1-2    4      8       9   48
##     >2     1      1       1   20
##
## , , Status = Married, Urban = Non-city
##
##        Income
## Alcohol 0-50 50-100 100-150 >150
##     <1   100    234      87  167
##     1-2   25    172     128  198
##     >2     7     38      36   53
##
## , , Status = Unmarried, Urban = Non-city
##
```

```
##        Income
## Alcohol 0-50 50-100 100-150 >150
##     <1     6     20      12   64
##     1-2    9     20      21   89
##     >2     5     12       9   39
```

```r
# (e): Use structable() or ftable() for a flattened display.
DanishWelfare.ftable <- ftable(DanishWelfare.tab.collapsed)
print(DanishWelfare.ftable)
```

```
##                           Urban City Non-city
## Alcohol Income  Status
## <1      0-50    Widow             12        8
##                 Married          238      100
##                 Unmarried         18        6
##         50-100  Widow             22       14
##                 Married          410      234
##                 Unmarried         48       20
##         100-150 Widow              8        5
##                 Married          151       87
##                 Unmarried         10       12
##         >150    Widow            134       95
##                 Married          336      167
##                 Unmarried        140       64
## 1-2     0-50    Widow              6        4
##                 Married           85       25
##                 Unmarried         21        9
##         50-100  Widow              9        8
##                 Married          309      172
##                 Unmarried         49       20
##         100-150 Widow             14        9
##                 Married          229      128
##                 Unmarried         36       21
##         >150    Widow             98       48
##                 Married          325      198
##                 Unmarried        171       89
## >2      0-50    Widow              4        1
##                 Married           12        7
##                 Unmarried          5        5
##         50-100  Widow              8        1
##                 Married           84       38
##                 Unmarried         18       12
##         100-150 Widow              4        1
##                 Married           82       36
##                 Unmarried         12        9
##         >150    Widow             47       20
##                 Married          127       53
##                 Unmarried         97       39
```

Exercise (5)

```r
data("UKSoccer", package = "vcd")
ftable(UKSoccer)
```

```
##      Away  0  1  2  3  4
## Home
## 0         27 29 10  8  2
## 1         59 53 14 12  4
## 2         28 32 14 12  4
## 3         19 14  7  4  1
## 4          7  8 10  2  0
```

```r
# (a): Verify the total number of games
games <- apply(UKSoccer, c(1), sum)
print(sum(games))
```

```
## [1] 380
```

```r
# (b): Marginal total of goals scored by each of the home and away teams
addmargins(UKSoccer)
```

```
##      Away
## Home    0   1   2   3   4 Sum
##   0    27  29  10   8   2  76
##   1    59  53  14  12   4 142
##   2    28  32  14  12   4  90
##   3    19  14   7   4   1  45
##   4     7   8  10   2   0  27
##   Sum 140 136  55  38  11 380
```

```r
# (c): Express each of the marginal totals as proportions
prop.table(UKSoccer)
```

```
##     Away
## Home           0           1           2           3           4
##    0 0.071052632 0.076315789 0.026315789 0.021052632 0.005263158
##    1 0.155263158 0.139473684 0.036842105 0.031578947 0.010526316
##    2 0.073684211 0.084210526 0.036842105 0.031578947 0.010526316
##    3 0.050000000 0.036842105 0.018421053 0.010526316 0.002631579
##    4 0.018421053 0.021052632 0.026315789 0.005263158 0.000000000
```

```r
# (d): Comment on the dist. of the numbers of home-team and away-team goals
marginal_home_goals <- rowSums(UKSoccer)
marginal_away_goals <- colSums(UKSoccer)

# Calculate the mean number of goals for home and away teams
mean_home_goals <- sum(marginal_home_goals * seq_along(marginal_home_goals)) / sum(marginal_home_goals)
mean_away_goals <- sum(marginal_away_goals * seq_along(marginal_away_goals)) / sum(marginal_away_goals)

# Homw:
print(mean_home_goals)
```

```
## [1] 2.486842
```

```
# Away:
print(mean_away_goals)
```

```
## [1] 2.063158
```

From the result above, home teams score more goals on average compared to the scores of the away teams.

Exercise (6)

```
data("Saxony", package = "vcd")
print(str(Saxony))
```

```
##  'table' num [1:13(1d)] 3 24 104 286 670 ...
##  - attr(*, "dimnames")=List of 1
##   ..$ nMales: chr [1:13] "0" "1" "2" "3" ...
## NULL
```

```
data("Geissler", package = "vcdExtra")
print(str(Geissler))
```

```
## 'data.frame':    90 obs. of  4 variables:
##  $ boys : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ girls: num  1 2 3 4 5 6 7 8 9 10 ...
##  $ size : num  1 2 3 4 5 6 7 8 9 10 ...
##  $ Freq : int  108719 42860 17395 7004 2839 1096 436 161 66 30 ...
## NULL
```

```
# (a): create data frame
sax12 <- subset(Geissler, Geissler$size == 12)
print(sax12)
```

```
##    boys girls size Freq
## 12    0    12   12    3
## 24    1    11   12   24
## 35    2    10   12  104
## 45    3     9   12  286
## 54    4     8   12  670
## 62    5     7   12 1033
## 69    6     6   12 1343
## 75    7     5   12 1112
## 80    8     4   12  829
## 84    9     3   12  478
## 87   10     2   12  181
## 89   11     1   12   45
## 90   12     0   12    7
```

```r
# (b): Select the columns for boys and Freq.
sax12_boy <- subset(sax12, select = c(boys, Freq))
print(sax12_boy)
```

```
##    boys Freq
## 12    0    3
## 24    1   24
## 35    2  104
## 45    3  286
## 54    4  670
## 62    5 1033
## 69    6 1343
## 75    7 1112
## 80    8  829
## 84    9  478
## 87   10  181
## 89   11   45
## 90   12    7
```

```r
# (c): Use xtabs() with a formula, Freq ~ boys, to create the one-way table
oneway_sax12_boy <- xtabs(Freq ~ boys, data = sax12_boy)
print(oneway_sax12_boy)
```

```
## boys
##    0    1    2    3    4    5    6    7    8    9   10   11   12
##    3   24  104  286  670 1033 1343 1112  829  478  181   45    7
```

```r
# (d): same step for size == 11.
Saxony11 <- subset(Geissler, Geissler$size == 11)
oneway_saxony11_boy <- subset(Saxony11, select = c(boys, Freq))
print(oneway_sax12_boy)
```

```
## boys
##    0    1    2    3    4    5    6    7    8    9   10   11   12
##    3   24  104  286  670 1033 1343 1112  829  478  181   45    7
```

Exercise (7)

```r
# (a)
# load data; might need to execute this code
#require(graphics)
# convert UCBAdmissions to data frame
ucb_df <- as.data.frame(UCBAdmissions)
# maipulate factors with interaction
ucb_df$AdmitGender <- with(ucb_df, interaction(Admit, Gender))
# convert back to table
UCB.tab2_long<- xtabs(Freq ~ AdmitGender + Dept, data = ucb_df)
# display table
structable(UCB.tab2_long)
```

```
##                 Dept   A   B   C   D   E   F
## AdmitGender
## Admitted.Male        512 353 120 138  53  22
## Rejected.Male        313 207 205 279 138 351
## Admitted.Female       89  17 202 131  94  24
## Rejected.Female       19   8 391 244 299 317
```

```r
# (b)
# Use ftable
ucb_ftable <- ftable(Admit ~ Gender + Dept, data = UCBAdmissions)
# convert ftable to a matrix
UCB.tab2_short <- as.matrix(ucb_ftable)
UCB.tab2_short
```

```
##            Admit
## Gender_Dept Admitted Rejected
##    Male_A        512      313
##    Male_B        353      207
##    Male_C        120      205
##    Male_D        138      279
##    Male_E         53      138
##    Male_F         22      351
##    Female_A       89       19
##    Female_B       17        8
##    Female_C      202      391
##    Female_D      131      244
##    Female_E       94      299
##    Female_F       24      317
```

```r
# Use structable
ucb_structable <- structable(Admit ~ Gender + Dept, data = UCBAdmissions)
UCB.tab2_structable <- as.matrix(ucb_structable)
UCB.tab2_structable
```

```
##            Admit
## Gender_Dept Admitted Rejected
##    Male_A        512      313
##    Male_B        353      207
##    Male_C        120      205
##    Male_D        138      279
##    Male_E         53      138
##    Male_F         22      351
##    Female_A       89       19
##    Female_B       17        8
##    Female_C      202      391
##    Female_D      131      244
##    Female_E       94      299
##    Female_F       24      317
```

Exercise (8)

```r
# show data info
data("VisualAcuity", package = "vcd")
str(VisualAcuity)
```

```
## 'data.frame':    32 obs. of  4 variables:
##  $ Freq  : num  1520 234 117 36 266 ...
##  $ right : Factor w/ 4 levels "1","2","3","4": 1 2 3 4 1 2 3 4 1 2 ...
##  $ left  : Factor w/ 4 levels "1","2","3","4": 1 1 1 1 2 2 2 2 3 3 ...
##  $ gender: Factor w/ 2 levels "male","female": 2 2 2 2 2 2 2 2 2 2 ...
```

```r
# (a): 4 x 4 freq table for each gender
xtabs(VisualAcuity)
```

```
## , , gender = male
##
##      left
## right    1    2    3    4
##     1  821  112   85   35
##     2  116  494  145   27
##     3   72  151  583   87
##     4   43   34  106  331
##
## , , gender = female
##
##      left
## right    1    2    3    4
##     1 1520  266  124   66
##     2  234 1512  432   78
##     3  117  362 1772  205
##     4   36   82  179  492
```

```r
# (b): organized tabular display
structable(VisualAcuity)
```

```
##           right     1           2           3           4
##           gender male female male female male female male female
## Freq left
## 27   1              0      0    0      0    0      0    0      0
##      2              0      0    0      0    0      0    0      0
##      3              0      0    0      0    0      0    0      0
##      4              0      0    1      0    0      0    0      0
## 34   1              0      0    0      0    0      0    0      0
##      2              0      0    0      0    0      0    1      0
##      3              0      0    0      0    0      0    0      0
##      4              0      0    0      0    0      0    0      0
## 35   1              0      0    0      0    0      0    0      0
##      2              0      0    0      0    0      0    0      0
##      3              0      0    0      0    0      0    0      0
##      4              1      0    0      0    0      0    0      0
## 36   1              0      0    0      0    0      0    0      1
##      2              0      0    0      0    0      0    0      0
```

```
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 43    1               0       0       0       0       0       0       1       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 66    1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       1       0       0       0       0       0       0
## 72    1               0       0       0       0       1       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 78    1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       1       0       0       0       0
## 82    1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       1
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 85    1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               1       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 87    1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       1       0       0       0
## 106   1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       1       0
##       4               0       0       0       0       0       0       0       0
## 112   1               0       0       0       0       0       0       0       0
##       2               1       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 116   1               0       0       1       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 117   1               0       0       0       0       0       1       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 124   1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       1       0       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
## 145   1               0       0       0       0       0       0       0       0
##       2               0       0       0       0       0       0       0       0
##       3               0       0       1       0       0       0       0       0
##       4               0       0       0       0       0       0       0       0
```

```
## 151  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    1    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 179  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    1
##      4    0    0    0    0    0    0    0    0
## 205  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    1    0    0
## 234  1    0    0    0    1    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 266  1    0    0    0    0    0    0    0    0
##      2    0    1    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 331  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    1    0
## 362  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    1    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 432  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    1    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 492  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    1
## 494  1    0    0    0    0    0    0    0    0
##      2    0    0    1    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 583  1    0    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    1    0    0    0
##      4    0    0    0    0    0    0    0    0
## 821  1    1    0    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 1512 1    0    0    0    0    0    0    0    0
##      2    0    0    0    1    0    0    0    0
##      3    0    0    0    0    0    0    0    0
##      4    0    0    0    0    0    0    0    0
## 1520 1    0    1    0    0    0    0    0    0
##      2    0    0    0    0    0    0    0    0
```

```
##      3              0      0    0      0    0      0    0      0
##      4              0      0    0      0    0      0    0      0
## 1772 1              0      0    0      0    0      0    0      0
##      2              0      0    0      0    0      0    0      0
##      3              0      0    0      0    0      1    0      0
##      4              0      0    0      0    0      0    0      0
```

```
# (c): HTML table
xtable(VisualAcuity, type = "html")
```

```
## % latex table generated in R 4.3.2 by xtable 1.8-4 package
## % Mon Feb 12 16:19:12 2024
## \begin{table}[ht]
## \centering
## \begin{tabular}{rrlll}
##   \hline
##  & Freq & right & left & gender \\
##   \hline
## 1 & 1520.00 & 1 & 1 & female \\
##   2 & 234.00 & 2 & 1 & female \\
##   3 & 117.00 & 3 & 1 & female \\
##   4 & 36.00 & 4 & 1 & female \\
##   5 & 266.00 & 1 & 2 & female \\
##   6 & 1512.00 & 2 & 2 & female \\
##   7 & 362.00 & 3 & 2 & female \\
##   8 & 82.00 & 4 & 2 & female \\
##   9 & 124.00 & 1 & 3 & female \\
##   10 & 432.00 & 2 & 3 & female \\
##   11 & 1772.00 & 3 & 3 & female \\
##   12 & 179.00 & 4 & 3 & female \\
##   13 & 66.00 & 1 & 4 & female \\
##   14 & 78.00 & 2 & 4 & female \\
##   15 & 205.00 & 3 & 4 & female \\
##   16 & 492.00 & 4 & 4 & female \\
##   17 & 821.00 & 1 & 1 & male \\
##   18 & 116.00 & 2 & 1 & male \\
##   19 & 72.00 & 3 & 1 & male \\
##   20 & 43.00 & 4 & 1 & male \\
##   21 & 112.00 & 1 & 2 & male \\
##   22 & 494.00 & 2 & 2 & male \\
##   23 & 151.00 & 3 & 2 & male \\
##   24 & 34.00 & 4 & 2 & male \\
##   25 & 85.00 & 1 & 3 & male \\
##   26 & 145.00 & 2 & 3 & male \\
##   27 & 583.00 & 3 & 3 & male \\
##   28 & 106.00 & 4 & 3 & male \\
##   29 & 35.00 & 1 & 4 & male \\
##   30 & 27.00 & 2 & 4 & male \\
##   31 & 87.00 & 3 & 4 & male \\
##   32 & 331.00 & 4 & 4 & male \\
##    \hline
## \end{tabular}
## \end{table}
```