Лабораторна робота 2

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Завдання 1

Файл код3df

```
# Читаємо data.frame з файлу
mydata <- read.csv('evals.csv')
```

```
# Summaries

# Друкуємо 3 перших рядки
head(mydata, 3)
```

```
##   score         rank ethnicity gender language age cls_perc_eval cls_did_eval
## 1   4.7 tenure track  minority female  english  36      55.81395           24
## 2   4.1 tenure track  minority female  english  36      68.80000           86
## 3   3.9 tenure track  minority female  english  36      60.80000           76
##   cls_students cls_level cls_profs  cls_credits bty_f1lower bty_f1upper
## 1           43     upper    single multi credit           5           7
## 2          125     upper    single multi credit           5           7
## 3          125     upper    single multi credit           5           7
##   bty_f2upper bty_m1lower bty_m1upper bty_m2upper bty_avg pic_outfit pic_color
## 1           6           2           4           6       5 not formal     color
## 2           6           2           4           6       5 not formal     color
## 3           6           2           4           6       5 not formal     color
```

```
# Друкуємо 6 (по замовчуванню) останніх рядків
tail(mydata)
```

```
##     score         rank    ethnicity gender    language age cls_perc_eval
## 458   4.1 tenure track not minority   male     english  32      42.85714
## 459   4.5 tenure track not minority   male     english  32      60.46511
## 460   3.5 tenure track     minority female non-english  42      57.14286
## 461   4.4 tenure track     minority female non-english  42      77.61194
## 462   4.4 tenure track     minority female non-english  42      81.81818
## 463   4.1 tenure track     minority female non-english  42      80.00000
##     cls_did_eval cls_students cls_level cls_profs  cls_credits bty_f1lower
## 458            9           21     lower  multiple multi credit           6
## 459           52           86     upper  multiple multi credit           6
## 460           48           84     upper  multiple multi credit           3
## 461           52           67     upper  multiple multi credit           3
## 462           54           66     upper  multiple multi credit           3
## 463           28           35     lower  multiple   one credit           3
##     bty_f1upper bty_f2upper bty_m1lower bty_m1upper bty_m2upper bty_avg
## 458           6           9           7           8           5   6.833
```

```
## 459           6           9           7           8           5   6.833
## 460           8           7           4           6           4   5.333
## 461           8           7           4           6           4   5.333
## 462           8           7           4           6           4   5.333
## 463           8           7           4           6           4   5.333
##     pic_outfit pic_color
## 458 not formal     color
## 459 not formal     color
## 460 not formal     color
## 461 not formal     color
## 462 not formal     color
## 463 not formal     color
```

```r
# Виводимо таблицю у DataViewer
View(mydata)
# Друкуємо компактно структуру фрейму
str(mydata)
```

```
## 'data.frame':    463 obs. of  21 variables:
##  $ score        : num  4.7 4.1 3.9 4.8 4.6 4.3 2.8 4.1 3.4 4.5 ...
##  $ rank         : chr  "tenure track" "tenure track" "tenure track" "tenure track" ...
##  $ ethnicity    : chr  "minority" "minority" "minority" "minority" ...
##  $ gender       : chr  "female" "female" "female" "female" ...
##  $ language     : chr  "english" "english" "english" "english" ...
##  $ age          : int  36 36 36 36 59 59 59 51 51 40 ...
##  $ cls_perc_eval: num  55.8 68.8 60.8 62.6 85 ...
##  $ cls_did_eval : int  24 86 76 77 17 35 39 55 111 40 ...
##  $ cls_students : int  43 125 125 123 20 40 44 55 195 46 ...
##  $ cls_level    : chr  "upper" "upper" "upper" "upper" ...
##  $ cls_profs    : chr  "single" "single" "single" "single" ...
##  $ cls_credits  : chr  "multi credit" "multi credit" "multi credit" "multi credit" ...
##  $ bty_f1lower  : int  5 5 5 5 4 4 4 5 5 2 ...
##  $ bty_f1upper  : int  7 7 7 7 4 4 4 2 2 5 ...
##  $ bty_f2upper  : int  6 6 6 6 2 2 2 5 5 4 ...
##  $ bty_m1lower  : int  2 2 2 2 2 2 2 2 2 3 ...
##  $ bty_m1upper  : int  4 4 4 4 3 3 3 3 3 3 ...
##  $ bty_m2upper  : int  6 6 6 6 3 3 3 3 3 2 ...
##  $ bty_avg      : num  5 5 5 5 3 ...
##  $ pic_outfit   : chr  "not formal" "not formal" "not formal" "not formal" ...
##  $ pic_color    : chr  "color" "color" "color" "color" ...
```

```r
# Змінна a буде зберігати вектор назв стовпчиків фрейму
a <- names(mydata)
# Друкуємо загальні статистики фрейму
summary(mydata)
```

```
##      score           rank            ethnicity           gender
##  Min.   :2.300   Length:463         Length:463         Length:463
##  1st Qu.:3.800   Class :character   Class :character   Class :character
##  Median :4.300   Mode  :character   Mode  :character   Mode  :character
##  Mean   :4.175
##  3rd Qu.:4.600
##  Max.   :5.000
##    language              age        cls_perc_eval     cls_did_eval
##  Length:463         Min.   :29.00   Min.   : 10.42   Min.   :  5.00
##  Class :character   1st Qu.:42.00   1st Qu.: 62.70   1st Qu.: 15.00
```

```
##  Mode  :character   Median :48.00   Median : 76.92   Median : 23.00
##                     Mean   :48.37   Mean   : 74.43   Mean   : 36.62
##                     3rd Qu.:57.00   3rd Qu.: 87.25   3rd Qu.: 40.00
##                     Max.   :73.00   Max.   :100.00   Max.   :380.00
##   cls_students     cls_level          cls_profs         cls_credits
##  Min.   :  8.00   Length:463         Length:463         Length:463
##  1st Qu.: 19.00   Class :character   Class :character   Class :character
##  Median : 29.00   Mode  :character   Mode  :character   Mode  :character
##  Mean   : 55.18
##  3rd Qu.: 60.00
##  Max.   :581.00
##   bty_f1lower     bty_f1upper     bty_f2upper      bty_m1lower
##  Min.   :1.000   Min.   :1.000   Min.   : 1.000   Min.   :1.000
##  1st Qu.:2.000   1st Qu.:4.000   1st Qu.: 4.000   1st Qu.:2.000
##  Median :4.000   Median :5.000   Median : 5.000   Median :3.000
##  Mean   :3.963   Mean   :5.019   Mean   : 5.214   Mean   :3.413
##  3rd Qu.:5.000   3rd Qu.:7.000   3rd Qu.: 6.000   3rd Qu.:5.000
##  Max.   :8.000   Max.   :9.000   Max.   :10.000   Max.   :7.000
##   bty_m1upper     bty_m2upper       bty_avg       pic_outfit
##  Min.   :1.000   Min.   :1.000   Min.   :1.667   Length:463
##  1st Qu.:3.000   1st Qu.:4.000   1st Qu.:3.167   Class :character
##  Median :4.000   Median :5.000   Median :4.333   Mode  :character
##  Mean   :4.147   Mean   :4.752   Mean   :4.418
##  3rd Qu.:5.000   3rd Qu.:6.000   3rd Qu.:5.500
##  Max.   :9.000   Max.   :9.000   Max.   :8.167
##   pic_color
##  Length:463
##  Class :character
##  Mode  :character
##
##
##
```

```r
# Variables

# Змінна b буде зберігати стовпчик score
b <- mydata$score
# Друкуємо середнє стовпчика score
mean(mydata$score)
```

```
## [1] 4.17473
```

```r
# Друкуємо загальні статистики стовпчика score
summary(mydata$score)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   2.300   3.800   4.300   4.175   4.600   5.000
```

```r
# Друкуємо стовпчика score помножений на 2
mydata$score * 2
```

```
##   [1]  9.4  8.2  7.8  9.6  9.2  8.6  5.6  8.2  6.8  9.0  7.6  9.0  9.2  7.8  7.8
##  [16]  8.6  9.0  9.6  9.2  9.2  9.8  9.2  9.0  8.8  9.2  9.4  9.0  9.6  9.8  9.0
##  [31]  8.8  8.6  8.2  8.4  7.0  6.8  9.0  8.8  8.8  5.0  8.6  9.0  9.6  9.6  8.8
##  [46]  9.4  8.8  9.4  9.0  8.0  8.6  8.8  9.0 10.0  9.8  9.2 10.0  9.4 10.0  7.2
##  [61]  7.4  8.6  8.2  8.4  9.4  9.4  7.0  8.2  8.4  8.0  8.0  7.8  8.8  7.6  7.0
```

```
##  [76]  8.4  7.0  7.2  5.8  6.6  6.6  6.4  9.2  8.4  8.6  8.8  8.2  9.2  8.8  9.6
##  [91]  8.6  7.2  8.6  8.0  8.4  8.2  8.2  8.8  8.6  8.8  8.8  9.8 10.0  8.8  9.6
## [106]  9.8  8.6 10.0  9.4  9.0  7.0  7.8  8.0  8.0  7.4  6.8  6.6  7.6  7.8  6.8
## [121]  7.4  8.2  7.4  7.0  7.0  8.8  6.8  8.6  7.4  9.4  7.8  7.2  9.0  9.0  9.6
## [136]  9.6  9.4  9.0  8.6  9.6  8.2  8.8  8.6  7.2  9.0  8.6  8.8  9.4  9.6  7.0
## [151]  7.6  7.2  8.4  7.2  8.8  7.4  8.6  9.2  9.2  8.2  7.2  4.6  8.6  8.8  7.2
## [166]  8.8  7.8  7.6  6.8  9.8  8.2  6.4  8.4  7.8  9.8  9.4  8.8  8.4  8.0  8.8
## [181]  7.8  8.8  6.0  7.0  5.6  9.2  8.6  6.8  6.0  8.4  8.6  8.2  9.2  7.8  7.0
## [196]  8.0  8.0  7.8  6.6  8.0  7.6  8.4  8.0  7.6  6.6  8.2  9.4  8.8  9.6  9.6
## [211]  9.2  9.2  9.6  8.8  9.4  9.4  6.6  8.8  8.6  9.8  8.8  9.4  8.6  9.6  9.0
## [226]  9.4  6.6  9.4  9.2  7.2  8.0  8.2  8.0  9.0  9.2  9.6  9.2  9.8  6.2  7.4
## [241]  7.4  7.8  7.8  6.4  8.8  8.4  9.4  7.8  7.2  6.8  8.8  8.8  8.2  7.2  7.0
## [256]  8.2  7.6  8.0  9.6  8.4  9.2  8.6  9.6  7.6  9.0  9.8  9.8  9.6  9.4  9.2
## [271]  8.6  8.8  9.0  8.4  9.6  9.2  9.8  9.6  9.6  9.2  9.4  8.2  7.6  8.0  8.2
## [286]  8.0  8.2  7.0  8.2  7.2  8.0  7.8  7.6  8.8  9.4  7.6  8.2  8.2  9.4  8.6
## [301]  8.8  9.0  6.2  7.4  9.0  6.0  9.2  7.4  7.2  6.4  6.6  5.8  8.4  9.0  7.6
## [316]  7.4  7.4  8.0  7.4  9.0  7.6  7.8  9.2  9.0  8.4  8.0  7.6  7.0  5.4  8.0
## [331]  9.2  7.8  9.0  7.4  4.8  6.2  5.0  6.0  9.0  9.6  9.8  9.0  9.2  9.0  9.8
## [346]  8.8  9.2  9.2 10.0  9.8  9.2  9.6  9.8  9.8  9.8 10.0  9.0  7.0  7.6  7.8
## [361]  7.8  8.4  8.2  9.6  9.6  9.6  9.6  9.8  8.4  9.0  7.8  8.8  8.0  7.2  7.4
## [376]  5.4  9.0  8.8  7.8  7.2  8.8  8.8  9.4  9.0  8.2  7.4  8.6  7.0  7.4  8.0
## [391]  8.0  6.2  9.0  9.6  8.4  9.8  9.6  7.0  7.2  8.8  6.8  7.8  7.6  9.6  9.2
## [406] 10.0  7.6  8.4  6.6  9.4  9.2  9.2  8.0  8.4  9.8  9.0  9.6  7.6  9.6 10.0
## [421] 10.0  9.8  9.2 10.0  9.6  9.8  9.8  7.8  7.8  9.0  9.0  6.6  6.2  5.6  6.2
## [436]  8.4  6.8  6.0  6.6  7.2  7.4  7.2  8.6  8.2  9.8  9.6  7.4  7.8  9.0  7.2
## [451]  8.8  6.8  8.8  9.0  9.0  9.0  9.2  8.2  9.0  7.0  8.8  8.8  8.2
```

```r
# Новий стовпчик score ten_point_scale це score помножений на 2
mydata$ten_point_scale <- mydata$score * 2
# Друкуємо загальні статистики стовпчика ten_point_scale
summary(mydata$ten_point_scale)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   4.600   7.600   8.600   8.349   9.200  10.000
```

```r
# Новий стовпчик new_varible заповнений нулями
mydata$new_varible <- 0
# Новий стовпчик number заповнений нумерацією рядків
mydata$number <- 1:nrow(mydata)
# Друкуємо загальні статистики стовпчика number
summary(mydata$number)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     1.0   116.5   232.0   232.0   347.5   463.0
```

```r
# Друкуємо кількість рядків фрейму
nrow(mydata)
```

```
## [1] 463
```

```r
# Друкуємо кількість стовпчиків фрейму
ncol(mydata)
```

```
## [1] 24
```

```r
# Subsetting

# Друкуємо стовпчик score з 1 по 10
```

```
mydata$score[1:10]
```

```
##  [1] 4.7 4.1 3.9 4.8 4.6 4.3 2.8 4.1 3.4 4.5
```

```
# Друкуємо елемент 1-й елемент 1-го рядка
mydata[1,1]
```

```
## [1] 4.7
```

```
# Друкуємо елемент 1-й елемент 2-го, 193-го, 225-го рядків
mydata[c(2,193,225),1]
```

```
## [1] 4.1 4.6 4.5
```

```
# Друкуємо елемент 1-й елемент рядків з 101 по 200
mydata[101:200,1]
```

```
##   [1] 4.4 4.9 5.0 4.4 4.8 4.9 4.3 5.0 4.7 4.5 3.5 3.9 4.0 4.0 3.7 3.4 3.3 3.8
##  [19] 3.9 3.4 3.7 4.1 3.7 3.5 3.5 4.4 3.4 4.3 3.7 4.7 3.9 3.6 4.5 4.5 4.8 4.8
##  [37] 4.7 4.5 4.3 4.8 4.1 4.4 4.3 3.6 4.5 4.3 4.4 4.7 4.8 3.5 3.8 3.6 4.2 3.6
##  [55] 4.4 3.7 4.3 4.6 4.6 4.1 3.6 2.3 4.3 4.4 3.6 4.4 3.9 3.8 3.4 4.9 4.1 3.2
##  [73] 4.2 3.9 4.9 4.7 4.4 4.2 4.0 4.4 3.9 4.4 3.0 3.5 2.8 4.6 4.3 3.4 3.0 4.2
##  [91] 4.3 4.1 4.6 3.9 3.5 4.0 4.0 3.9 3.3 4.0
```

```
# Друкуємо 5-й рядок
mydata[5,]
```

```
##   score    rank    ethnicity gender language age cls_perc_eval cls_did_eval
## 5   4.6 tenured not minority   male  english  59            85           17
##   cls_students cls_level cls_profs  cls_credits bty_f1lower bty_f1upper
## 5           20     upper  multiple multi credit           4           4
##   bty_f2upper bty_m1lower bty_m1upper bty_m2upper bty_avg pic_outfit pic_color
## 5           2           2           3           3       3 not formal     color
##   ten_point_scale new_varible number
## 5             9.2           0      5
```

```
# Друкуємо вектор порівняння стовпчика score з самим собою (весь TRUE)
mydata[,1] == mydata$score
```

```
##   [1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [16] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [31] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [46] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [61] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [76] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [91] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [106] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [121] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [136] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [151] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [166] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [181] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [196] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [211] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [226] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [241] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [256] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [271] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
```

```
## [286] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [301] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [316] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [331] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [346] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [361] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [376] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [391] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [406] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [421] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [436] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [451] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
```

```
# Друкуємо стовпчики з 2-го по 5-тий
mydata[,2:5]
```

```
##             rank    ethnicity gender    language
## 1   tenure track     minority female     english
## 2   tenure track     minority female     english
## 3   tenure track     minority female     english
## 4   tenure track     minority female     english
## 5        tenured not minority   male     english
## 6        tenured not minority   male     english
## 7        tenured not minority   male     english
## 8        tenured not minority   male     english
## 9        tenured not minority   male     english
## 10       tenured not minority female     english
## 11       tenured not minority female     english
## 12       tenured not minority female     english
## 13       tenured not minority female     english
## 14       tenured not minority female     english
## 15       tenured not minority female     english
## 16       tenured not minority female     english
## 17       tenured not minority female     english
## 18  tenure track not minority female     english
## 19  tenure track not minority female     english
## 20  tenure track not minority female     english
## 21  tenure track not minority female     english
## 22  tenure track not minority female     english
## 23  tenure track not minority female     english
## 24       tenured not minority   male     english
## 25       tenured not minority   male     english
## 26       tenured not minority   male     english
## 27       tenured not minority   male     english
## 28       tenured not minority   male     english
## 29       tenured not minority   male     english
## 30       tenured not minority   male     english
## 31  tenure track not minority female     english
## 32  tenure track not minority female     english
## 33  tenure track not minority female     english
## 34  tenure track not minority female     english
## 35  tenure track not minority female     english
## 36       tenured not minority female     english
## 37       tenured not minority female     english
## 38       tenured not minority female     english
```

```
## 39       tenured not minority female     english
## 40       tenured not minority female     english
## 41       tenured not minority female     english
## 42       tenured not minority female     english
## 43  tenure track not minority female     english
## 44  tenure track not minority female     english
## 45  tenure track not minority female     english
## 46  tenure track not minority female     english
## 47  tenure track not minority female     english
## 48  tenure track not minority female     english
## 49  tenure track not minority female     english
## 50      teaching not minority   male     english
## 51      teaching not minority   male     english
## 52      teaching not minority   male     english
## 53      teaching not minority   male     english
## 54      teaching not minority   male     english
## 55      teaching not minority   male     english
## 56      teaching not minority   male     english
## 57      teaching not minority   male     english
## 58      teaching not minority   male     english
## 59      teaching not minority   male     english
## 60  tenure track     minority   male non-english
## 61  tenure track     minority   male non-english
## 62  tenure track     minority   male non-english
## 63      teaching not minority   male     english
## 64      teaching not minority   male     english
## 65      teaching not minority   male     english
## 66      teaching not minority   male     english
## 67      teaching not minority   male     english
## 68       tenured not minority   male     english
## 69       tenured not minority   male     english
## 70       tenured not minority   male     english
## 71       tenured not minority   male     english
## 72       tenured not minority   male     english
## 73       tenured not minority   male     english
## 74       tenured not minority   male     english
## 75       tenured not minority   male non-english
## 76       tenured not minority   male non-english
## 77       tenured not minority   male non-english
## 78       tenured not minority   male non-english
## 79  tenure track not minority female     english
## 80  tenure track not minority female     english
## 81  tenure track not minority female     english
## 82  tenure track not minority female     english
## 83       tenured not minority   male     english
## 84       tenured not minority   male     english
## 85       tenured not minority   male     english
## 86       tenured not minority   male     english
## 87       tenured not minority   male     english
## 88       tenured not minority   male     english
## 89      teaching not minority female     english
## 90      teaching not minority female     english
## 91      teaching not minority female     english
## 92      teaching not minority female     english
```

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## 93      teaching not minority female     english
## 94      teaching not minority   male     english
## 95      teaching not minority   male     english
## 96      teaching not minority   male     english
## 97      teaching not minority   male     english
## 98      teaching not minority   male     english
## 99      teaching not minority   male     english
## 100     teaching not minority   male     english
## 101     teaching not minority   male     english
## 102      tenured not minority female     english
## 103      tenured not minority female     english
## 104      tenured not minority female     english
## 105      tenured not minority female     english
## 106      tenured not minority female     english
## 107      tenured not minority female     english
## 108      tenured not minority female     english
## 109      tenured not minority female     english
## 110      tenured not minority female     english
## 111     teaching not minority female     english
## 112     teaching not minority female     english
## 113     teaching not minority female     english
## 114     teaching not minority female     english
## 115     teaching not minority female     english
## 116     teaching not minority female     english
## 117     teaching not minority female     english
## 118     teaching not minority female     english
## 119     teaching not minority female     english
## 120     teaching not minority female     english
## 121     teaching not minority female     english
## 122     teaching not minority female     english
## 123     teaching not minority female     english
## 124     teaching not minority female     english
## 125     teaching not minority female     english
## 126     teaching not minority female     english
## 127 tenure track     minority female non-english
## 128      tenured not minority   male     english
## 129      tenured not minority   male     english
## 130      tenured not minority   male     english
## 131      tenured not minority   male     english
## 132      tenured not minority   male     english
## 133      tenured not minority   male     english
## 134      tenured not minority   male     english
## 135      tenured not minority   male     english
## 136      tenured not minority   male     english
## 137      tenured not minority   male     english
## 138      tenured not minority   male     english
## 139      tenured not minority   male     english
## 140 tenure track not minority female     english
## 141 tenure track not minority female     english
## 142      tenured not minority   male     english
## 143      tenured not minority   male     english
## 144      tenured not minority   male     english
## 145      tenured not minority   male     english
## 146      tenured not minority   male     english
```

```
## 147      tenured     minority   male non-english
## 148      tenured     minority   male non-english
## 149      tenured     minority   male non-english
## 150      tenured     minority   male non-english
## 151      tenured     minority   male non-english
## 152      tenured     minority   male non-english
## 153      tenured     minority   male non-english
## 154      tenured not minority   male     english
## 155      tenured not minority   male     english
## 156      tenured not minority   male     english
## 157      tenured not minority   male     english
## 158      tenured not minority   male     english
## 159      tenured not minority   male     english
## 160      tenured not minority   male     english
## 161      tenured not minority   male     english
## 162 tenure track not minority female     english
## 163     teaching not minority   male     english
## 164     teaching not minority   male     english
## 165     teaching not minority   male     english
## 166     teaching not minority   male     english
## 167     teaching not minority   male     english
## 168     teaching not minority   male     english
## 169     teaching not minority   male     english
## 170      tenured not minority   male     english
## 171      tenured not minority   male     english
## 172      tenured not minority   male     english
## 173      tenured not minority   male     english
## 174      tenured not minority   male     english
## 175      tenured not minority   male     english
## 176      tenured not minority   male     english
## 177      tenured not minority   male     english
## 178 tenure track     minority female     english
## 179 tenure track     minority female     english
## 180 tenure track     minority female     english
## 181 tenure track     minority female     english
## 182 tenure track     minority female     english
## 183 tenure track     minority female     english
## 184 tenure track     minority female     english
## 185 tenure track     minority female     english
## 186 tenure track     minority female     english
## 187 tenure track     minority female     english
## 188 tenure track     minority female     english
## 189 tenure track     minority female     english
## 190 tenure track     minority female     english
## 191      tenured not minority   male     english
## 192      tenured not minority   male     english
## 193      tenured not minority   male     english
## 194      tenured     minority female     english
## 195      tenured     minority female     english
## 196      tenured     minority female     english
## 197      tenured     minority female     english
## 198      tenured     minority   male     english
## 199      tenured     minority   male     english
## 200      tenured     minority   male     english
```

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## 201      tenured     minority   male     english
## 202      tenured     minority   male     english
## 203      tenured     minority   male     english
## 204      tenured     minority   male     english
## 205      tenured     minority   male     english
## 206      tenured not minority   male     english
## 207      tenured not minority   male     english
## 208      tenured not minority   male     english
## 209      tenured not minority   male     english
## 210      tenured not minority   male     english
## 211      tenured not minority   male     english
## 212      tenured not minority   male     english
## 213      tenured not minority   male     english
## 214      tenured not minority   male     english
## 215      tenured not minority   male     english
## 216      tenured not minority   male     english
## 217 tenure track not minority   male     english
## 218 tenure track not minority   male     english
## 219 tenure track not minority   male     english
## 220 tenure track not minority   male     english
## 221 tenure track not minority   male     english
## 222 tenure track not minority   male     english
## 223      tenured not minority   male     english
## 224      tenured not minority   male     english
## 225      tenured not minority   male     english
## 226      tenured not minority   male     english
## 227     teaching not minority female     english
## 228     teaching not minority female     english
## 229     teaching not minority female     english
## 230     teaching not minority female     english
## 231      tenured not minority   male     english
## 232      tenured not minority   male     english
## 233      tenured not minority   male     english
## 234      tenured not minority   male     english
## 235      tenured not minority   male     english
## 236      tenured not minority   male     english
## 237      tenured not minority   male     english
## 238 tenure track not minority   male     english
## 239 tenure track not minority   male     english
## 240 tenure track not minority   male     english
## 241      tenured not minority female     english
## 242      tenured not minority female     english
## 243      tenured not minority female     english
## 244      tenured not minority female     english
## 245     teaching not minority female     english
## 246     teaching not minority female     english
## 247     teaching not minority female     english
## 248     teaching not minority female     english
## 249     teaching not minority female     english
## 250     teaching not minority female     english
## 251     teaching not minority female     english
## 252      tenured not minority   male     english
## 253      tenured not minority   male     english
## 254      tenured not minority   male     english
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## 255      tenured not minority   male     english
## 256      tenured not minority   male     english
## 257      tenured not minority   male     english
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## 260      tenured not minority   male     english
## 261      tenured not minority   male     english
## 262      tenured not minority   male     english
## 263      tenured not minority   male     english
## 264      tenured not minority   male     english
## 265 tenure track not minority female     english
## 266 tenure track not minority female     english
## 267 tenure track not minority female     english
## 268 tenure track not minority female     english
## 269 tenure track not minority female     english
## 270 tenure track not minority female     english
## 271      tenured not minority   male     english
## 272      tenured not minority   male     english
## 273      tenured not minority   male     english
## 274      tenured not minority   male     english
## 275      tenured not minority female     english
## 276      tenured not minority female     english
## 277      tenured not minority female     english
## 278      tenured not minority female     english
## 279      tenured not minority female     english
## 280      tenured not minority female     english
## 281      tenured not minority female     english
## 282 tenure track not minority female     english
## 283 tenure track not minority female     english
## 284 tenure track not minority female     english
## 285 tenure track not minority female     english
## 286 tenure track not minority female     english
## 287 tenure track not minority female     english
## 288 tenure track not minority   male     english
## 289 tenure track not minority   male     english
## 290 tenure track not minority   male     english
## 291 tenure track not minority   male     english
## 292 tenure track not minority   male     english
## 293 tenure track not minority   male     english
## 294 tenure track not minority   male     english
## 295 tenure track not minority   male     english
## 296      tenured not minority female     english
## 297      tenured not minority female     english
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## 300      tenured not minority female     english
## 301      tenured not minority female     english
## 302      tenured not minority female     english
## 303      tenured not minority female     english
## 304      tenured not minority female     english
## 305      tenured not minority female     english
## 306      tenured not minority female     english
## 307      tenured not minority female     english
## 308 tenure track not minority   male non-english
```

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## 309 tenure track not minority   male non-english
## 310      tenured not minority female     english
## 311      tenured not minority female     english
## 312      tenured not minority female     english
## 313      tenured not minority   male     english
## 314      tenured not minority   male     english
## 315      tenured not minority female     english
## 316      tenured not minority female     english
## 317      tenured not minority female     english
## 318      tenured not minority female     english
## 319      tenured not minority female     english
## 320     teaching not minority female     english
## 321     teaching not minority female     english
## 322     teaching not minority female     english
## 323     teaching not minority female     english
## 324     teaching not minority female     english
## 325     teaching not minority female     english
## 326     teaching not minority female     english
## 327      tenured not minority   male     english
## 328      tenured not minority   male     english
## 329      tenured not minority   male     english
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## 331      tenured not minority   male     english
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## 333      tenured not minority   male     english
## 334      tenured not minority   male     english
## 335      tenured not minority   male     english
## 336      tenured not minority   male     english
## 337      tenured not minority   male     english
## 338      tenured not minority female     english
## 339 tenure track not minority   male     english
## 340 tenure track not minority   male     english
## 341 tenure track not minority   male     english
## 342 tenure track not minority   male     english
## 343 tenure track not minority   male     english
## 344 tenure track not minority   male     english
## 345 tenure track not minority   male     english
## 346 tenure track not minority   male     english
## 347 tenure track not minority   male     english
## 348     teaching     minority   male     english
## 349     teaching     minority   male     english
## 350     teaching     minority   male     english
## 351     teaching     minority   male     english
## 352     teaching     minority   male     english
## 353     teaching     minority   male     english
## 354     teaching     minority   male     english
## 355     teaching     minority   male     english
## 356     teaching     minority   male     english
## 357     teaching     minority   male     english
## 358      tenured not minority   male     english
## 359      tenured not minority   male     english
## 360      tenured not minority   male     english
## 361      tenured not minority   male     english
## 362      tenured not minority   male     english
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## 363      tenured not minority   male     english
## 364      tenured not minority   male     english
## 365      tenured not minority   male     english
## 366      tenured not minority   male     english
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## 368      tenured not minority   male     english
## 369      tenured not minority   male     english
## 370      tenured not minority   male     english
## 371      tenured not minority   male     english
## 372      tenured not minority   male     english
## 373      tenured not minority female     english
## 374      tenured not minority female     english
## 375      tenured     minority female     english
## 376      tenured     minority female     english
## 377     teaching not minority female     english
## 378     teaching not minority female     english
## 379     teaching not minority female     english
## 380     teaching not minority female     english
## 381     teaching not minority female     english
## 382     teaching not minority female     english
## 383      tenured not minority   male     english
## 384      tenured not minority   male     english
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## 386      tenured not minority   male     english
## 387      tenured not minority   male     english
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## 389      tenured not minority   male     english
## 390      tenured not minority female     english
## 391      tenured not minority female     english
## 392      tenured not minority female     english
## 393      tenured not minority female     english
## 394     teaching not minority   male     english
## 395     teaching not minority   male     english
## 396     teaching not minority   male     english
## 397     teaching not minority   male     english
## 398      tenured not minority   male     english
## 399      tenured not minority   male     english
## 400      tenured not minority   male     english
## 401      tenured not minority   male     english
## 402      tenured not minority   male     english
## 403      tenured not minority   male     english
## 404      tenured not minority   male     english
## 405      tenured not minority   male     english
## 406      tenured not minority   male     english
## 407      tenured not minority   male     english
## 408      tenured not minority   male     english
## 409     teaching not minority female     english
## 410     teaching not minority female     english
## 411     teaching not minority female     english
## 412     teaching not minority female     english
## 413     teaching not minority female     english
## 414      tenured     minority female     english
## 415      tenured     minority female     english
## 416      tenured     minority female     english
```

```
## 417      tenured     minority female     english
## 418      tenured     minority female     english
## 419     teaching not minority   male     english
## 420     teaching not minority   male     english
## 421     teaching not minority   male     english
## 422     teaching not minority   male     english
## 423     teaching not minority   male     english
## 424     teaching not minority   male     english
## 425     teaching not minority   male     english
## 426     teaching not minority   male     english
## 427      tenured not minority   male     english
## 428      tenured not minority   male     english
## 429      tenured not minority   male     english
## 430 tenure track not minority   male     english
## 431 tenure track not minority   male     english
## 432      tenured not minority   male     english
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## 435      tenured not minority   male     english
## 436      tenured not minority   male     english
## 437      tenured not minority   male     english
## 438      tenured not minority   male     english
## 439 tenure track     minority female     english
## 440 tenure track     minority female     english
## 441 tenure track     minority female     english
## 442      tenured not minority   male     english
## 443      tenured not minority   male     english
## 444      tenured not minority female     english
## 445      tenured not minority female     english
## 446      tenured not minority female     english
## 447 tenure track not minority female non-english
## 448 tenure track not minority female non-english
## 449 tenure track not minority female non-english
## 450 tenure track not minority female non-english
## 451 tenure track not minority female non-english
## 452 tenure track not minority female non-english
## 453 tenure track not minority female non-english
## 454 tenure track not minority   male     english
## 455 tenure track not minority   male     english
## 456 tenure track not minority   male     english
## 457 tenure track not minority   male     english
## 458 tenure track not minority   male     english
## 459 tenure track not minority   male     english
## 460 tenure track     minority female non-english
## 461 tenure track     minority female non-english
## 462 tenure track     minority female non-english
## 463 tenure track     minority female non-english
```

```
# Друкуємо перші 6-ть рядків стовпчиків з 2-го по 5-тий
head(mydata[,2:5])
```

```
##           rank    ethnicity gender language
## 1 tenure track     minority female  english
## 2 tenure track     minority female  english
## 3 tenure track     minority female  english
```

```
## 4 tenure track     minority female  english
## 5      tenured not minority   male  english
## 6      tenured not minority   male  english
```

```
# Subsetting with condition

# Друкуємо стовпчик gender
mydata$gender
```

```
##   [1] "female" "female" "female" "female" "male"   "male"   "male"   "male"
##   [9] "male"   "female" "female" "female" "female" "female" "female" "female"
##  [17] "female" "female" "female" "female" "female" "female" "female" "male"
##  [25] "male"   "male"   "male"   "male"   "male"   "male"   "female" "female"
##  [33] "female" "female" "female" "female" "female" "female" "female" "female"
##  [41] "female" "female" "female" "female" "female" "female" "female" "female"
##  [49] "female" "male"   "male"   "male"   "male"   "male"   "male"   "male"
##  [57] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
##  [65] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
##  [73] "male"   "male"   "male"   "male"   "male"   "male"   "female" "female"
##  [81] "female" "female" "male"   "male"   "male"   "male"   "male"   "male"
##  [89] "female" "female" "female" "female" "female" "male"   "male"   "male"
##  [97] "male"   "male"   "male"   "male"   "male"   "female" "female" "female"
## [105] "female" "female" "female" "female" "female" "female" "female" "female"
## [113] "female" "female" "female" "female" "female" "female" "female" "female"
## [121] "female" "female" "female" "female" "female" "female" "female" "male"
## [129] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [137] "male"   "male"   "male"   "female" "female" "male"   "male"   "male"
## [145] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [153] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [161] "male"   "female" "male"   "male"   "male"   "male"   "male"   "male"
## [169] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [177] "male"   "female" "female" "female" "female" "female" "female" "female"
## [185] "female" "female" "female" "female" "female" "female" "male"   "male"
## [193] "male"   "female" "female" "female" "female" "male"   "male"   "male"
## [201] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [209] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [217] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [225] "male"   "male"   "female" "female" "female" "female" "male"   "male"
## [233] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [241] "female" "female" "female" "female" "female" "female" "female" "female"
## [249] "female" "female" "female" "male"   "male"   "male"   "male"   "male"
## [257] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [265] "female" "female" "female" "female" "female" "female" "male"   "male"
## [273] "male"   "male"   "female" "female" "female" "female" "female" "female"
## [281] "female" "female" "female" "female" "female" "female" "female" "male"
## [289] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "female"
## [297] "female" "female" "female" "female" "female" "female" "female" "female"
## [305] "female" "female" "female" "male"   "male"   "female" "female" "female"
## [313] "male"   "male"   "female" "female" "female" "female" "female" "female"
## [321] "female" "female" "female" "female" "female" "female" "male"   "male"
## [329] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [337] "male"   "female" "male"   "male"   "male"   "male"   "male"   "male"
## [345] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [353] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [361] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
```

```
## [369] "male"   "male"   "male"   "male"   "female" "female" "female" "female"
## [377] "female" "female" "female" "female" "female" "female" "male"   "male"
## [385] "male"   "male"   "male"   "male"   "male"   "female" "female" "female"
## [393] "female" "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [401] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [409] "female" "female" "female" "female" "female" "female" "female" "female"
## [417] "female" "female" "male"   "male"   "male"   "male"   "male"   "male"
## [425] "male"   "male"   "male"   "male"   "male"   "male"   "male"   "male"
## [433] "male"   "male"   "male"   "male"   "male"   "male"   "female" "female"
## [441] "female" "male"   "male"   "female" "female" "female" "female" "female"
## [449] "female" "female" "female" "female" "female" "male"   "male"   "male"
## [457] "male"   "male"   "male"   "female" "female" "female" "female"
```

```
# Друкуємо вектор порівняння стовпчика gender зі значенням  female
mydata$gender == 'female'
```

```
##   [1]  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE
##  [13]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
##  [25] FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [37]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [49]  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [61] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [73] FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE
##  [85] FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE
##  [97] FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [109]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [121]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE
## [133] FALSE FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE FALSE FALSE FALSE
## [145] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [157] FALSE FALSE FALSE FALSE FALSE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE
## [169] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE
## [181]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE
## [193] FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [205] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [217] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE
## [229]  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [241]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
## [253] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [265]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE  TRUE  TRUE
## [277]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
## [289] FALSE FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE
## [301]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE
## [313] FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [325]  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [337] FALSE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [349] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [361] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [373]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE
## [385] FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE
## [397] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [409]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE
## [421] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [433] FALSE FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE FALSE FALSE  TRUE
## [445]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE
## [457] FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE
```

```r
# Друкуємо перші 6-ть рядків стовпчиків з 1-го по 3-тий, де gender == 'female'
head(mydata[mydata$gender == 'female',1:3])
```

```
##    score         rank    ethnicity
## 1    4.7 tenure track     minority
## 2    4.1 tenure track     minority
## 3    3.9 tenure track     minority
## 4    4.8 tenure track     minority
## 10   4.5      tenured not minority
## 11   3.8      tenured not minority
```

```r
# Друкуємо перші 6-ть рядків вибірки із фрейму, де gender == 'female'
head(subset(mydata, gender == 'female'))
```

```
##    score         rank    ethnicity gender language age cls_perc_eval
## 1    4.7 tenure track     minority female  english  36      55.81395
## 2    4.1 tenure track     minority female  english  36      68.80000
## 3    3.9 tenure track     minority female  english  36      60.80000
## 4    4.8 tenure track     minority female  english  36      62.60163
## 10   4.5      tenured not minority female  english  40      86.95652
## 11   3.8      tenured not minority female  english  40      88.88889
##    cls_did_eval cls_students cls_level cls_profs  cls_credits bty_f1lower
## 1            24           43     upper    single multi credit           5
## 2            86          125     upper    single multi credit           5
## 3            76          125     upper    single multi credit           5
## 4            77          123     upper    single multi credit           5
## 10           40           46     upper    single multi credit           2
## 11           24           27     upper    single multi credit           2
##    bty_f1upper bty_f2upper bty_m1lower bty_m1upper bty_m2upper bty_avg
## 1            7           6           2           4           6   5.000
## 2            7           6           2           4           6   5.000
## 3            7           6           2           4           6   5.000
## 4            7           6           2           4           6   5.000
## 10           5           4           3           3           2   3.167
## 11           5           4           3           3           2   3.167
##    pic_outfit pic_color ten_point_scale new_varible number
## 1  not formal     color             9.4           0      1
## 2  not formal     color             8.2           0      2
## 3  not formal     color             7.8           0      3
## 4  not formal     color             9.6           0      4
## 10 not formal     color             9.0           0     10
## 11 not formal     color             7.6           0     11
```

```r
# Друкуємо перші 6-ть рядків вибірки із фрейму, де score > 3.5
head(subset(mydata, score > 3.5))
```

```
##   score         rank    ethnicity gender language age cls_perc_eval
## 1   4.7 tenure track     minority female  english  36      55.81395
## 2   4.1 tenure track     minority female  english  36      68.80000
## 3   3.9 tenure track     minority female  english  36      60.80000
## 4   4.8 tenure track     minority female  english  36      62.60163
## 5   4.6      tenured not minority   male  english  59      85.00000
## 6   4.3      tenured not minority   male  english  59      87.50000
##   cls_did_eval cls_students cls_level cls_profs  cls_credits bty_f1lower
## 1           24           43     upper    single multi credit           5
```

```
## 2           86          125     upper    single multi credit           5
## 3           76          125     upper    single multi credit           5
## 4           77          123     upper    single multi credit           5
## 5           17           20     upper  multiple multi credit           4
## 6           35           40     upper  multiple multi credit           4
##   bty_f1upper bty_f2upper bty_m1lower bty_m1upper bty_m2upper bty_avg
## 1           7           6           2           4           6       5
## 2           7           6           2           4           6       5
## 3           7           6           2           4           6       5
## 4           7           6           2           4           6       5
## 5           4           2           2           3           3       3
## 6           4           2           2           3           3       3
##   pic_outfit pic_color ten_point_scale new_varible number
## 1 not formal     color             9.4           0      1
## 2 not formal     color             8.2           0      2
## 3 not formal     color             7.8           0      3
## 4 not formal     color             9.6           0      4
## 5 not formal     color             9.2           0      5
## 6 not formal     color             8.6           0      6
```

```
# rbind, cbind

# Створюємо новий фрейм, де gender == 'female'
mydata2 <- subset(mydata, gender == 'female')
# Створюємо новий фрейм, де gender == 'male'
mydata3 <- subset(mydata, gender == 'male')
# Створюємо новий фрейм з рядків mydata2 та mydata3
mydata4 <- rbind(mydata2, mydata3)
# Створюємо новий фрейм із стовпчиків з 1-го по 10-й
mydata5 <- mydata[,1:10]
# Створюємо новий фрейм із стовпчиків з 11-го по 24-й
mydata6 <- mydata[,11:24]
# Створюємо новий фрейм із стовпчиків mydata6 та mydata5
mydata7 <- cbind(mydata6, mydata5)
```

Файл код4cond

```
# Читаємо data.frame з файлу
mydata <- read.csv('evals.csv')
```

```
# control statements

mydata <- read.csv('evals.csv')

# if

a <- 0
# Друкуємо 'not positive'
if (a > 0){
  print('positive')
} else {
  print('not positive')
}
```

```
## [1] "not positive"
```

```r
# Друкуємо 'not positive'
if (a > 0){
  print('positive')
} else print('not positive')
```

```
## [1] "not positive"
```

```r
# Друкуємо 'zero'
if (a > 0){
  print('positive')
} else if (a < 0) {
  print('negative')
} else print('zero')
```

```
## [1] "zero"
```

```r
# ifelse

a <- 10
# Друкуємо 'positive'
ifelse(a > 0, 'positive', 'not positive')
```

```
## [1] "positive"
```

```r
a <- c(1, -1)

# for

# Друкуємо числа від 1-го до 100
for (i in 1:100){
  print(i)
}
```

```
## [1] 1
## [1] 2
## [1] 3
## [1] 4
## [1] 5
## [1] 6
## [1] 7
## [1] 8
## [1] 9
## [1] 10
## [1] 11
## [1] 12
## [1] 13
## [1] 14
## [1] 15
## [1] 16
## [1] 17
## [1] 18
## [1] 19
## [1] 20
## [1] 21
## [1] 22
## [1] 23
```

```
## [1] 24
## [1] 25
## [1] 26
## [1] 27
## [1] 28
## [1] 29
## [1] 30
## [1] 31
## [1] 32
## [1] 33
## [1] 34
## [1] 35
## [1] 36
## [1] 37
## [1] 38
## [1] 39
## [1] 40
## [1] 41
## [1] 42
## [1] 43
## [1] 44
## [1] 45
## [1] 46
## [1] 47
## [1] 48
## [1] 49
## [1] 50
## [1] 51
## [1] 52
## [1] 53
## [1] 54
## [1] 55
## [1] 56
## [1] 57
## [1] 58
## [1] 59
## [1] 60
## [1] 61
## [1] 62
## [1] 63
## [1] 64
## [1] 65
## [1] 66
## [1] 67
## [1] 68
## [1] 69
## [1] 70
## [1] 71
## [1] 72
## [1] 73
## [1] 74
## [1] 75
## [1] 76
## [1] 77
```

```
## [1] 78
## [1] 79
## [1] 80
## [1] 81
## [1] 82
## [1] 83
## [1] 84
## [1] 85
## [1] 86
## [1] 87
## [1] 88
## [1] 89
## [1] 90
## [1] 91
## [1] 92
## [1] 93
## [1] 94
## [1] 95
## [1] 96
## [1] 97
## [1] 98
## [1] 99
## [1] 100
```

```r
# Друкуємо елементи стовпчика score
for (i in 1:nrow(mydata)){
  print(mydata$score[i])
}
```

```
## [1] 4.7
## [1] 4.1
## [1] 3.9
## [1] 4.8
## [1] 4.6
## [1] 4.3
## [1] 2.8
## [1] 4.1
## [1] 3.4
## [1] 4.5
## [1] 3.8
## [1] 4.5
## [1] 4.6
## [1] 3.9
## [1] 3.9
## [1] 4.3
## [1] 4.5
## [1] 4.8
## [1] 4.6
## [1] 4.6
## [1] 4.9
## [1] 4.6
## [1] 4.5
## [1] 4.4
## [1] 4.6
## [1] 4.7
```

```
## [1] 4.5
## [1] 4.8
## [1] 4.9
## [1] 4.5
## [1] 4.4
## [1] 4.3
## [1] 4.1
## [1] 4.2
## [1] 3.5
## [1] 3.4
## [1] 4.5
## [1] 4.4
## [1] 4.4
## [1] 2.5
## [1] 4.3
## [1] 4.5
## [1] 4.8
## [1] 4.8
## [1] 4.4
## [1] 4.7
## [1] 4.4
## [1] 4.7
## [1] 4.5
## [1] 4
## [1] 4.3
## [1] 4.4
## [1] 4.5
## [1] 5
## [1] 4.9
## [1] 4.6
## [1] 5
## [1] 4.7
## [1] 5
## [1] 3.6
## [1] 3.7
## [1] 4.3
## [1] 4.1
## [1] 4.2
## [1] 4.7
## [1] 4.7
## [1] 3.5
## [1] 4.1
## [1] 4.2
## [1] 4
## [1] 4
## [1] 3.9
## [1] 4.4
## [1] 3.8
## [1] 3.5
## [1] 4.2
## [1] 3.5
## [1] 3.6
## [1] 2.9
## [1] 3.3
```

```
## [1] 3.3
## [1] 3.2
## [1] 4.6
## [1] 4.2
## [1] 4.3
## [1] 4.4
## [1] 4.1
## [1] 4.6
## [1] 4.4
## [1] 4.8
## [1] 4.3
## [1] 3.6
## [1] 4.3
## [1] 4
## [1] 4.2
## [1] 4.1
## [1] 4.1
## [1] 4.4
## [1] 4.3
## [1] 4.4
## [1] 4.4
## [1] 4.9
## [1] 5
## [1] 4.4
## [1] 4.8
## [1] 4.9
## [1] 4.3
## [1] 5
## [1] 4.7
## [1] 4.5
## [1] 3.5
## [1] 3.9
## [1] 4
## [1] 4
## [1] 3.7
## [1] 3.4
## [1] 3.3
## [1] 3.8
## [1] 3.9
## [1] 3.4
## [1] 3.7
## [1] 4.1
## [1] 3.7
## [1] 3.5
## [1] 3.5
## [1] 4.4
## [1] 3.4
## [1] 4.3
## [1] 3.7
## [1] 4.7
## [1] 3.9
## [1] 3.6
## [1] 4.5
## [1] 4.5
```

```
## [1] 4.8
## [1] 4.8
## [1] 4.7
## [1] 4.5
## [1] 4.3
## [1] 4.8
## [1] 4.1
## [1] 4.4
## [1] 4.3
## [1] 3.6
## [1] 4.5
## [1] 4.3
## [1] 4.4
## [1] 4.7
## [1] 4.8
## [1] 3.5
## [1] 3.8
## [1] 3.6
## [1] 4.2
## [1] 3.6
## [1] 4.4
## [1] 3.7
## [1] 4.3
## [1] 4.6
## [1] 4.6
## [1] 4.1
## [1] 3.6
## [1] 2.3
## [1] 4.3
## [1] 4.4
## [1] 3.6
## [1] 4.4
## [1] 3.9
## [1] 3.8
## [1] 3.4
## [1] 4.9
## [1] 4.1
## [1] 3.2
## [1] 4.2
## [1] 3.9
## [1] 4.9
## [1] 4.7
## [1] 4.4
## [1] 4.2
## [1] 4
## [1] 4.4
## [1] 3.9
## [1] 4.4
## [1] 3
## [1] 3.5
## [1] 2.8
## [1] 4.6
## [1] 4.3
## [1] 3.4
```

```
## [1] 3
## [1] 4.2
## [1] 4.3
## [1] 4.1
## [1] 4.6
## [1] 3.9
## [1] 3.5
## [1] 4
## [1] 4
## [1] 3.9
## [1] 3.3
## [1] 4
## [1] 3.8
## [1] 4.2
## [1] 4
## [1] 3.8
## [1] 3.3
## [1] 4.1
## [1] 4.7
## [1] 4.4
## [1] 4.8
## [1] 4.8
## [1] 4.6
## [1] 4.6
## [1] 4.8
## [1] 4.4
## [1] 4.7
## [1] 4.7
## [1] 3.3
## [1] 4.4
## [1] 4.3
## [1] 4.9
## [1] 4.4
## [1] 4.7
## [1] 4.3
## [1] 4.8
## [1] 4.5
## [1] 4.7
## [1] 3.3
## [1] 4.7
## [1] 4.6
## [1] 3.6
## [1] 4
## [1] 4.1
## [1] 4
## [1] 4.5
## [1] 4.6
## [1] 4.8
## [1] 4.6
## [1] 4.9
## [1] 3.1
## [1] 3.7
## [1] 3.7
## [1] 3.9
```

```
## [1] 3.9
## [1] 3.2
## [1] 4.4
## [1] 4.2
## [1] 4.7
## [1] 3.9
## [1] 3.6
## [1] 3.4
## [1] 4.4
## [1] 4.4
## [1] 4.1
## [1] 3.6
## [1] 3.5
## [1] 4.1
## [1] 3.8
## [1] 4
## [1] 4.8
## [1] 4.2
## [1] 4.6
## [1] 4.3
## [1] 4.8
## [1] 3.8
## [1] 4.5
## [1] 4.9
## [1] 4.9
## [1] 4.8
## [1] 4.7
## [1] 4.6
## [1] 4.3
## [1] 4.4
## [1] 4.5
## [1] 4.2
## [1] 4.8
## [1] 4.6
## [1] 4.9
## [1] 4.8
## [1] 4.8
## [1] 4.6
## [1] 4.7
## [1] 4.1
## [1] 3.8
## [1] 4
## [1] 4.1
## [1] 4
## [1] 4.1
## [1] 3.5
## [1] 4.1
## [1] 3.6
## [1] 4
## [1] 3.9
## [1] 3.8
## [1] 4.4
## [1] 4.7
## [1] 3.8
```

```
## [1] 4.1
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## [1] 4.7
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## [1] 4.4
## [1] 4.5
## [1] 3.1
## [1] 3.7
## [1] 4.5
## [1] 3
## [1] 4.6
## [1] 3.7
## [1] 3.6
## [1] 3.2
## [1] 3.3
## [1] 2.9
## [1] 4.2
## [1] 4.5
## [1] 3.8
## [1] 3.7
## [1] 3.7
## [1] 4
## [1] 3.7
## [1] 4.5
## [1] 3.8
## [1] 3.9
## [1] 4.6
## [1] 4.5
## [1] 4.2
## [1] 4
## [1] 3.8
## [1] 3.5
## [1] 2.7
## [1] 4
## [1] 4.6
## [1] 3.9
## [1] 4.5
## [1] 3.7
## [1] 2.4
## [1] 3.1
## [1] 2.5
## [1] 3
## [1] 4.5
## [1] 4.8
## [1] 4.9
## [1] 4.5
## [1] 4.6
## [1] 4.5
## [1] 4.9
## [1] 4.4
## [1] 4.6
## [1] 4.6
## [1] 5
## [1] 4.9
```

```
## [1] 4.6
## [1] 4.8
## [1] 4.9
## [1] 4.9
## [1] 4.9
## [1] 5
## [1] 4.5
## [1] 3.5
## [1] 3.8
## [1] 3.9
## [1] 3.9
## [1] 4.2
## [1] 4.1
## [1] 4.8
## [1] 4.8
## [1] 4.8
## [1] 4.8
## [1] 4.9
## [1] 4.2
## [1] 4.5
## [1] 3.9
## [1] 4.4
## [1] 4
## [1] 3.6
## [1] 3.7
## [1] 2.7
## [1] 4.5
## [1] 4.4
## [1] 3.9
## [1] 3.6
## [1] 4.4
## [1] 4.4
## [1] 4.7
## [1] 4.5
## [1] 4.1
## [1] 3.7
## [1] 4.3
## [1] 3.5
## [1] 3.7
## [1] 4
## [1] 4
## [1] 3.1
## [1] 4.5
## [1] 4.8
## [1] 4.2
## [1] 4.9
## [1] 4.8
## [1] 3.5
## [1] 3.6
## [1] 4.4
## [1] 3.4
## [1] 3.9
## [1] 3.8
## [1] 4.8
```

```
## [1] 4.6
## [1] 5
## [1] 3.8
## [1] 4.2
## [1] 3.3
## [1] 4.7
## [1] 4.6
## [1] 4.6
## [1] 4
## [1] 4.2
## [1] 4.9
## [1] 4.5
## [1] 4.8
## [1] 3.8
## [1] 4.8
## [1] 5
## [1] 5
## [1] 4.9
## [1] 4.6
## [1] 5
## [1] 4.8
## [1] 4.9
## [1] 4.9
## [1] 3.9
## [1] 3.9
## [1] 4.5
## [1] 4.5
## [1] 3.3
## [1] 3.1
## [1] 2.8
## [1] 3.1
## [1] 4.2
## [1] 3.4
## [1] 3
## [1] 3.3
## [1] 3.6
## [1] 3.7
## [1] 3.6
## [1] 4.3
## [1] 4.1
## [1] 4.9
## [1] 4.8
## [1] 3.7
## [1] 3.9
## [1] 4.5
## [1] 3.6
## [1] 4.4
## [1] 3.4
## [1] 4.4
## [1] 4.5
## [1] 4.5
## [1] 4.5
## [1] 4.6
## [1] 4.1
```

```
## [1] 4.5
## [1] 3.5
## [1] 4.4
## [1] 4.4
## [1] 4.1
```

```r
# for + if

# Друкуємо елементи стовпчика score, які відповідають значенню 'male' в стовпчику gender
for (i in 1:nrow(mydata)){
  if (mydata$gender[i] == 'male'){
    print(mydata$score[i])
  }
}
```

```
## [1] 4.6
## [1] 4.3
## [1] 2.8
## [1] 4.1
## [1] 3.4
## [1] 4.4
## [1] 4.6
## [1] 4.7
## [1] 4.5
## [1] 4.8
## [1] 4.9
## [1] 4.5
## [1] 4
## [1] 4.3
## [1] 4.4
## [1] 4.5
## [1] 5
## [1] 4.9
## [1] 4.6
## [1] 5
## [1] 4.7
## [1] 5
## [1] 3.6
## [1] 3.7
## [1] 4.3
## [1] 4.1
## [1] 4.2
## [1] 4.7
## [1] 4.7
## [1] 3.5
## [1] 4.1
## [1] 4.2
## [1] 4
## [1] 4
## [1] 3.9
## [1] 4.4
## [1] 3.8
## [1] 3.5
## [1] 4.2
## [1] 3.5
```

```
## [1] 3.6
## [1] 4.6
## [1] 4.2
## [1] 4.3
## [1] 4.4
## [1] 4.1
## [1] 4.6
## [1] 4
## [1] 4.2
## [1] 4.1
## [1] 4.1
## [1] 4.4
## [1] 4.3
## [1] 4.4
## [1] 4.4
## [1] 4.3
## [1] 3.7
## [1] 4.7
## [1] 3.9
## [1] 3.6
## [1] 4.5
## [1] 4.5
## [1] 4.8
## [1] 4.8
## [1] 4.7
## [1] 4.5
## [1] 4.3
## [1] 4.4
## [1] 4.3
## [1] 3.6
## [1] 4.5
## [1] 4.3
## [1] 4.4
## [1] 4.7
## [1] 4.8
## [1] 3.5
## [1] 3.8
## [1] 3.6
## [1] 4.2
## [1] 3.6
## [1] 4.4
## [1] 3.7
## [1] 4.3
## [1] 4.6
## [1] 4.6
## [1] 4.1
## [1] 3.6
## [1] 4.3
## [1] 4.4
## [1] 3.6
## [1] 4.4
## [1] 3.9
## [1] 3.8
## [1] 3.4
```

```
## [1] 4.9
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## [1] 3.9
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## [1] 4.7
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## [1] 5
```

```
## [1] 4.5
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## [1] 5
## [1] 4.9
## [1] 4.6
## [1] 5
## [1] 4.8
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## [1] 4.5
## [1] 4.5
## [1] 3.3
## [1] 3.1
## [1] 2.8
```

```
## [1] 3.1
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## [1] 4.3
## [1] 4.5
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## [1] 4.5
```

```
# for + if  VS  ifelse

# Новий стовпчик quality заповнений NA
mydata$quality <- rep(NA, nrow(mydata))
# Прописуємо стовпчик quality - якщо score > 4, то 'good', інакше - 'bad'
mydata$quality <- rep(NA, nrow(mydata))
for (i in 1:nrow(mydata)){
  if (mydata$score[i] > 4){
    mydata$quality[i] <- 'good'
  } else mydata$quality[i] <- 'bad'
}
# Новий стовпчик quality2 заповнений - якщо score > 4, то 'good', інакше - 'bad
mydata$quality2 <- ifelse(mydata$score > 4, 'good', 'bad')

# while

i <- 1

# Друкуємо елементи стовпчика score від 1-го до 50-го
while(i < 51){
  print(mydata$score[i])
  i <- i+1
}
```

```
## [1] 4.7
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```

```
## [1] 4.6
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## [1] 4.7
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## [1] 4.7
## [1] 4.5
## [1] 4
```

Завдання 2

```
# Файли для завантаження
ukr <- "API_UKR_DS2_en_csv_v2_1625998.csv"
pol <- "API_POL_DS2_en_csv_v2_1626986.csv"
rus <- "API_RUS_DS2_en_csv_v2_1630272.csv"

# Завантажуємо та друкуємо розмір
data_ukr <- read.csv(ukr, skip = 4)
paste0("Loaded: ", ukr, "(", nrow(data_ukr), ", ", ncol(data_ukr), ")")
```

```
## [1] "Loaded: API_UKR_DS2_en_csv_v2_1625998.csv(1440, 66)"
```

```
data_pol <- read.csv(pol, skip = 4)
paste0("Loaded: ", pol, "(", nrow(data_pol), ", ", ncol(data_pol), ")")
```

```
## [1] "Loaded: API_POL_DS2_en_csv_v2_1626986.csv(1440, 66)"
```

```
data_rus <- read.csv(rus, skip = 4)
paste0("Loaded: ", rus, "(", nrow(data_rus), ", ", ncol(data_rus), ")")
```

```
## [1] "Loaded: API_RUS_DS2_en_csv_v2_1630272.csv(1440, 66)"
```

```r
# Вектор років
years <- 1960:2019
# Вектор імен стовпчиків
col_names <- c("year", "p_ukr", "p_pol", "p_rus",
               "gdp_ukr", "gdp_pol", "gdp_rus")

# Створюємо робочий фрейм із завантажених файлів
data_work <- data.frame(
  years = years,
  p_ukr = t(data_ukr[791, 1:length(years)+4]),
  p_pol = t(data_pol[8, 1:length(years)+4]),
  p_rus = t(data_rus[657, 1:length(years)+4]),
  gdp_ukr = t(data_ukr[1158, 1:length(years)+4]),
  gdp_pol = t(data_pol[263, 1:length(years)+4]),
  gdp_rus = t(data_rus[349, 1:length(years)+4])
)

# Встановлюємо назви стовпчиків
names(data_work) = col_names
```

```r
# Підключаємо пакет dplyr
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
# select та filter

# select - вибираємо стовпчики, filter - фільтруємо рядки
head(select(data_work, year:p_rus))
```

```
##       year    p_ukr    p_pol     p_rus
## X1960 1960 42664652 29637450 119897000
## X1961 1961 43206345 29964000 121236000
## X1962 1962 43752230 30308500 122591000
## X1963 1963 44288608 30712000 123960000
## X1964 1964 44796964 31139450 125345000
## X1965 1965 45264548 31444950 126745000
```

```r
head(select(filter(data_work, !is.na(gdp_ukr)), c(year, gdp_ukr:gdp_rus)))
```

```
##       year  gdp_ukr  gdp_pol  gdp_rus
## X1990 1990 7305.143 6173.862 8027.846
## X1991 1991 6902.486 5913.855 7857.906
## X1992 1992 6356.734 6181.769 6862.463
## X1993 1993 5578.521 6548.119 6419.516
## X1994 1994 4412.745 7027.078 5734.414
## X1995 1995 3987.006 7662.772 5613.281
```

```r
# arrange

# arrange - сортуємо рядки за значеннями стовпчика
head(select(arrange(data_work, p_ukr), year:p_rus))
```

```
##       year    p_ukr    p_pol     p_rus
## X1960 1960 42664652 29637450 119897000
## X1961 1961 43206345 29964000 121236000
## X1962 1962 43752230 30308500 122591000
## X1963 1963 44288608 30712000 123960000
## X2019 2019 44385155 37970874 144373535
## X2018 2018 44622518 37974750 144477860
```

```r
tail(select(arrange(filter(data_work, !is.na(gdp_ukr)), gdp_ukr), c(year, gdp_ukr:gdp_rus)))
```

```
##       year  gdp_ukr  gdp_pol  gdp_rus
## X2013 2013 10691.76 24719.25 26073.87
## X2014 2014 10743.59 25612.26 25761.65
## X2016 2016 11148.20 28283.70 24125.40
## X2017 2017 11871.12 30152.74 26005.98
## X2018 2018 12629.14 31834.41 28763.52
## X2019 2019 13341.21 34217.72 29181.36
```

```r
# rename

# rename - перейменовуємо назви стовпчиків
data_population <- select(data_work, year:p_rus)
head(data_population)
```

```
##       year    p_ukr    p_pol     p_rus
## X1960 1960 42664652 29637450 119897000
## X1961 1961 43206345 29964000 121236000
## X1962 1962 43752230 30308500 122591000
## X1963 1963 44288608 30712000 123960000
## X1964 1964 44796964 31139450 125345000
## X1965 1965 45264548 31444950 126745000
```

```r
data_population <- rename(data_population, ukr=p_ukr, pol=p_pol, rus=p_rus)
head(data_population)
```

```
##       year      ukr      pol       rus
## X1960 1960 42664652 29637450 119897000
## X1961 1961 43206345 29964000 121236000
## X1962 1962 43752230 30308500 122591000
## X1963 1963 44288608 30712000 123960000
## X1964 1964 44796964 31139450 125345000
## X1965 1965 45264548 31444950 126745000
```

```r
# mutate

# mutate - створюємо та обчислюємо нові стовпчики
data_gdp_val <- select(
  mutate(filter(data_work, !is.na(gdp_ukr)),
    gdp_v_ukr=p_ukr*gdp_ukr,
    gdp_v_pol=p_pol*gdp_pol,
    gdp_v_rus=p_rus*gdp_rus
  ),
```

```
  c(year, gdp_v_ukr:gdp_v_rus)
)
head(data_gdp_val)
```

```
##   year    gdp_v_ukr    gdp_v_pol    gdp_v_rus
## 1 1990 379074118450 235290724467 1.187876e+12
## 2 1991 358932714023 226182435709 1.166068e+12
## 3 1992 331506229263 237155323465 1.019338e+12
## 4 1993 291082747688 251849872467 9.530336e+11
## 5 1994 229115901051 270842221199 8.510324e+11
## 6 1995 205381825714 295744653467 8.328749e+11
```

```
# group_by

# створюємо стовпчик зі знвченнями річних декад
data_pop_d <- mutate(data_population,
  decade=as.integer(year/10)*10
)
# group_by - групуємо по декадах та  рахуємо середнє за декаду
summarize(group_by(data_pop_d, decade),
  mean(ukr), mean(pol), mean(rus)
)
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 6 x 4
##   decade `mean(ukr)` `mean(pol)` `mean(rus)`
##    <dbl>       <dbl>       <dbl>       <dbl>
## 1   1960   44888265.   31171746   125403000
## 2   1970   48523216.   33881292.  134010300
## 3   1980   50848987.   36929122.  143342500
## 4   1990   51312660    38491748.  148110535.
## 5   2000   47401978.   38182850.  144149706.
## 6   2010   45192949.   38009809.  143812616.
```

```
# %>%

# те саме, що попереднє, але через пайп
data_population %>%
  mutate(decade=as.integer(year/10)*10) %>%
  group_by(decade) %>%
  summarize(mean(ukr), mean(pol), mean(rus))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 6 x 4
##   decade `mean(ukr)` `mean(pol)` `mean(rus)`
##    <dbl>       <dbl>       <dbl>       <dbl>
## 1   1960   44888265.   31171746   125403000
## 2   1970   48523216.   33881292.  134010300
## 3   1980   50848987.   36929122.  143342500
## 4   1990   51312660    38491748.  148110535.
## 5   2000   47401978.   38182850.  144149706.
## 6   2010   45192949.   38009809.  143812616.
```