

Exercise 3

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```
knitr::opts_chunk$set(results = "hold") #, fig.retina = 2)
```

4.1

```
new_scores <- c(66, 75, 72, 71, 55, 56, 72, 93, 73, 72, 72, 73, 91, 66, 71, 56, 59)
sort(table(new_scores), decreasing = TRUE)
cat(" 從上表，我們可以得知 mode 為 72。", fill = TRUE)
cat("median = ", median(new_scores), ", mean = ", mean(new_scores), sep = "", fill = TRUE)
```

```
## new_scores
## 72 56 66 71 73 55 59 75 91 93
##  4  2  2  2  2  1  1  1  1  1
## 從上表，我們可以得知 mode 為 72。
## median = 72, mean = 70.17647
```

4.4

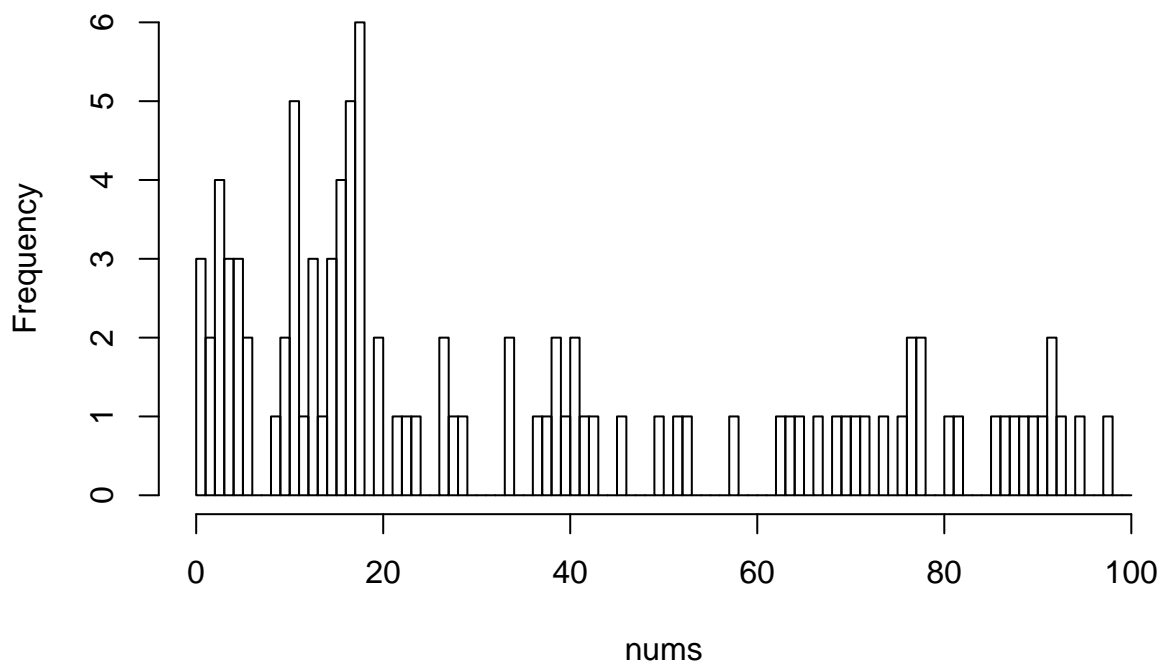
```
set.seed(1830)
nums <- sample(0:100, 10, replace = TRUE)
nums <- c(nums, 2000)
cat(nums, fill = TRUE)
cat("mean = ", mean(nums), ", median = ", median(nums), sep = "", fill = TRUE)
```

```
## 11 40 7 86 84 56 13 55 73 64 2000
## mean = 226.2727, median = 56
```

4.5

```
nums <- sample(1:20, 50, replace = TRUE)
nums <- c(nums, sample(21:100, 50, replace = TRUE))
hist(nums, breaks = seq(from = 0, to = 100, by = 1))
```

Histogram of nums



```
cat("mean = ", mean(nums), ", median = ", median(nums), sep = "", fill = TRUE)
cat("mean 大於 median。", fill = TRUE)
```

```
## mean = 35.81, median = 21
## mean 大於 median。
```

4.8

```
library(purrr)
const <- 5
old_nums <- c(8, 7, 12, 14, 3, 7)
new_nums <- map_dbl(old_nums, ~ . - const)
cat("Original:", old_nums, fill = TRUE)
cat("mean = ", mean(old_nums), ", median = ", median(old_nums), sep = "", fill = TRUE)
cat("New:", new_nums, fill = TRUE)
cat("mean = ", mean(new_nums), ", median = ", median(new_nums), sep = "", fill = TRUE)
```

```
## Original: 8 7 12 14 3 7
## mean = 8.5, median = 7.5
## New: 3 2 7 9 -2 2
## mean = 3.5, median = 2.5
```

4.9

```
old_nums <- c(8, 3, 5, 5, 6, 2)
new_nums <- map_dbl(old_nums, ~ . * const)
cat("Original:", old_nums, fill = TRUE)
cat("mean = ", mean(old_nums), ", median = ", median(old_nums), sep = "", fill = TRUE)
cat("New:", new_nums, fill = TRUE)
cat("mean = ", mean(new_nums), ", median = ", median(new_nums), sep = "", fill = TRUE)
```

```
## Original: 8 3 5 5 6 2
## mean = 4.833333, median = 5
## New: 40 15 25 25 30 10
## mean = 24.16667, median = 25
```

4.17

```
students <- read.table("../week3a/fig3-4.dat", header = TRUE)
skipped <- students$Points[students$Attend == 1]
attended <- students$Points[students$Attend == 2]
cat("Attended Class:", fill = TRUE)
cat("mean = ", mean(attended), ", median = ", median(attended), sep = "", fill = TRUE)
cat("Skipped Class:", fill = TRUE)
cat("mean = ", mean(skipped), ", median = ", median(skipped), sep = "", fill = TRUE)
cat(" 有上課的同學成績較高。", fill = TRUE)
```

```
## Attended Class:
## mean = 276.4167, median = 276
## Skipped Class:
## mean = 248.3333, median = 256
## 有上課的同學成績較高。
```

4.18

```
sort(table(attended), decreasing = TRUE)
cat(" 有上課的同學的成績的 mode 為 264。", fill = TRUE)
sort(table(skipped), decreasing = TRUE)
cat(" 沒上課的同學的成績的 mode 為 256。", fill = TRUE)
```

```
## attended
## 264 254 267 276 278 288 291 296 241 243 246 249 250 252 255 256 261 262
##   3   2   2   2   2   2   2   2   1   1   1   1   1   1   1   1   1   1
## 263 265 270 271 272 273 277 280 281 282 284 290 292 293 294 297 298 310
##   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1
## 320 321 328
##   1   1   1
## 有上課的同學的成績的 mode 為 264。
## skipped
## 256 195 264 270 274 188 225 228 232 233 237 239 240 250 261 268 277 308
##   3   2   2   2   2   1   1   1   1   1   1   1   1   1   1   1   1   1
## 沒上課的同學的成績的 mode 為 256。
```

雖然有上課的同學的成績的 mode 仍然較高，但用 mode 來代表一個群體的成績是不恰當的。假如我的成績分佈是 $(0, 0, 0, 85, 90, 90, 95, 95, 100, 100)$ ，則 mode 會是 0，但顯然 0 不應該被用來代表這群學生的成績。

5.6

```
library(purrr)
const <- 5
old_nums <- c(8, 7, 12, 14, 3, 5, 2)
add_nums <- map_dbl(old_nums, ~ . + const)
sub_nums <- map_dbl(old_nums, ~ . - const)
cat("Original:", old_nums, fill = TRUE)
```

```

cat("stddev = ", sd(old_nums), ", mean = ", mean(old_nums), sep = "", fill = TRUE)
cat("Add 5:", add_nums, fill = TRUE)
cat("stddev = ", sd(add_nums), ", mean = ", mean(add_nums), sep = "", fill = TRUE)
cat("Subtract 5:", sub_nums, fill = TRUE)
cat("stddev = ", sd(sub_nums), ", mean = ", mean(sub_nums), sep = "", fill = TRUE)
cat(" 將所有數值做加 / 減運算，標準差不變，平均值跟著加 / 減。")

```

```

## Original: 8 7 12 14 3 5 2
## stddev = 4.461475, mean = 7.285714
## Add 5: 13 12 17 19 8 10 7
## stddev = 4.461475, mean = 12.28571
## Subtract 5: 3 2 7 9 -2 0 -3
## stddev = 4.461475, mean = 2.285714
## 將所有數值做加 / 減運算，標準差不變，平均值跟著加 / 減。

```

5.7

```

old_nums <- c(8, 7, 12, 14, 3, 5, 2)
mul_nums <- map_dbl(old_nums, ~ . * const)
div_nums <- map_dbl(old_nums, ~ . / const)
cat("Original:", old_nums, fill = TRUE)
cat("stddev = ", sd(old_nums), ", mean = ", mean(old_nums), sep = "", fill = TRUE)
cat("Multiply 5:", mul_nums, fill = TRUE)
cat("stddev = ", sd(mul_nums), ", mean = ", mean(mul_nums), sep = "", fill = TRUE)
cat("Divide 5:", div_nums, fill = TRUE)
cat("stddev = ", sd(div_nums), ", mean = ", mean(div_nums), sep = "", fill = TRUE)
cat(" 將所有數值做乘 / 除運算，標準差、平均值都會跟著乘 / 除。")

```

```

## Original: 8 7 12 14 3 5 2
## stddev = 4.461475, mean = 7.285714
## Multiply 5: 40 35 60 70 15 25 10
## stddev = 22.30738, mean = 36.42857
## Divide 5: 1.6 1.4 2.4 2.8 0.6 1 0.4
## stddev = 0.8922951, mean = 1.457143
## 將所有數值做乘 / 除運算，標準差、平均值都會跟著乘 / 除。

```

5.12

```

new_scores <- c(66, 75, 72, 71, 55, 56, 72, 93, 73, 72, 72, 73, 91, 66, 71, 56, 59)
boxplot(new_scores, ylab = "Score")

```

