3

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```
rm(list=ls()); gc();  gc(); #    r
if (!require("pacman")) install.packages("pacman") #          pacman
pacman::p_load(tidyverse, magrittr)
```

3.1

2 X,Y X Y

1. Var$(X+Y)$

$$\begin{aligned} Var(X+Y) &= Cov(X+Y)(X+Y) \\ &= Cov(X,X)+Cov(Y,Y)+2Cov(X,Y) \\ &= Var(X)+Var(Y) \end{aligned}$$

2. $\mathbf{Var}(X - Y)$

$Z = -Y$

$$Var(Z) = Var(-Y) = (-1)^2 Var(Y) = Var(Y)$$

$$\begin{aligned} Var(X + Z) &= Cov(X + Z)(X + Z) \\ &= Cov(X, X) + Cov(Y, Y) + 2Cov(X, Z) \\ &= Var(X) + Var(Z) \\ &= Var(X) + Var(Y) \end{aligned}$$

3.2

```
tempdata <- read_csv("R_EmpiricalAnalysis_csv/chap03/temperature.csv")
```

1. `temp` 2014

```
tempdata %$%
  mean(temp)
```

```
[1] 16.64065
```

2.

```
sub <- tempdata %>%
  slice(1:100) #slice:
mean(sub$temp)
```

```
[1] 7.204
```

3.

```r
sub2 <- tempdata %>%
  slice_sample(n = 100)
mean(sub2$temp)
```

```
[1] 18.255
```

3.3

```r
icedata <- read_csv("R_EmpiricalAnalysis_csv/chap03/icecream.csv")
```

1

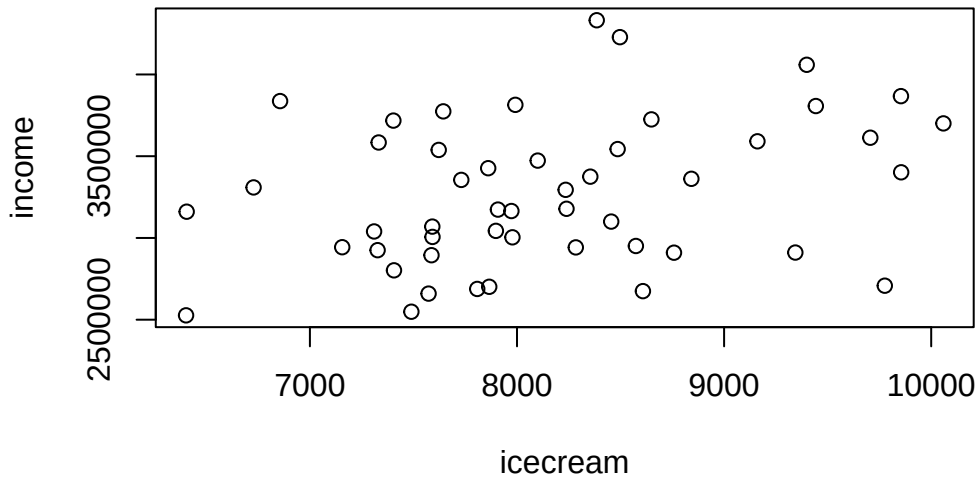
```r
icedata %>%
  dplyr::select(city,icecream) %>%
  arrange(-icecream)
```

```
# A tibble: 49 x 2
   city     icecream
   <chr>       <dbl>
 1         10059
 2          9855
 3          9854
 4         9776
 5         9706
 6          9443
 7          9399
 8          9344
 9         9161
10          8842
# i 39 more rows
```

```r
icedata%$%
  which.max(icecream)
```

```
[1] 17
```

```
icedata %$%
  plot(icecream,income)
```




```
icedata %$%
    cor(icecream,income)
```

```
[1] 0.3113555
```

3.4

1

```
S <- 1000
X <- rnorm(S, 50, 10)
rec <- numeric(S)

for(i in 1:S){
  rec[i] <- (10 < X[i])
}
mean(rec)
```

```
[1] 1
```

2

```r
S <- 1000
X <- rnorm(S, 50, 10)
rec <- numeric(S)

for(i in 1:S){
  rec[i] <- (-10 < X[i]) & (X[i] < 10)
}
mean(rec)
```

```
[1] 0
```

3

```r
S <- 1000
X <- rnorm(S, 50, 10)
Y <- rnorm(S, 50, 10)

rec <- numeric(S)

for(i in 1:S){
  rec[i] <- (Y[i])^2 < X[i]
}
mean(rec)
```

```
[1] 0
```

3.5

```r
S <- 10000
N <- 10000

rec <- numeric(S)

for(i in 1:S){
  X <- rnorm(N,50,10)
  Xbar <- mean(X)
  Vn <- var(X)
  lb <- Xbar - 1.64 * sqrt(Vn / N)
  ub <- Xbar + 1.64 * sqrt(Vn / N)
```

```
  rec[i] <- (lb < 50) & (ub > 50)

}
mean(rec)
```

```
[1] 0.9019
```