ICA11

2022-10-11

Contents

Question 1

a

```
exp1 <- rexp(1000000,1/3)
exp2 <- rexp(1000000,1/3)

sum12 <- exp1 + exp2

ex1 <- mean(exp1)
ex2 <- mean(exp2)
ex_sum12 <- mean(sum12)
ex_sum12
```

```
## [1] 6.001397
```

```
ex1 + ex2
```

```
## [1] 6.001397
```

We can see they are the same.

b

```
var1 <- var(exp1)
var2 <- var(exp2)
varsum <- var(sum12)

var1+var2
```

```
## [1] 17.98554
```

```
varsum
```

```
## [1] 17.96825
```

We can see they are the same.

Question 2

a

```
library(MASS)
var_x <- 1.5
var_y <- 1.5
cor_xy <- -0.8
Sigma <- cbind(c(var_x,cor_xy*sqrt(var_x)*sqrt(var_y)),c(cor_xy*sqrt(var_x)*sqrt(var_y),var_y))
sim <- MASS::mvrnorm(n = 1000000, mu = c(0,0), Sigma)
x <- sim[,1]
y <- sim[,2]
z <-  x+y
cov(x,y)
```

```
## [1] -1.200008
```

We can see it is close to -1.2.

b

```
mean(z)
```

```
## [1] -0.0003139185
```

```
mean(x) + mean(y)
```

```
## [1] -0.0003139185
```

They are the same.

c

```
var(x) + var(y) + 2*cov(x,y)
```

```
## [1] 0.5996475
```

```
var(z)
```

```
## [1] 0.5996475
```

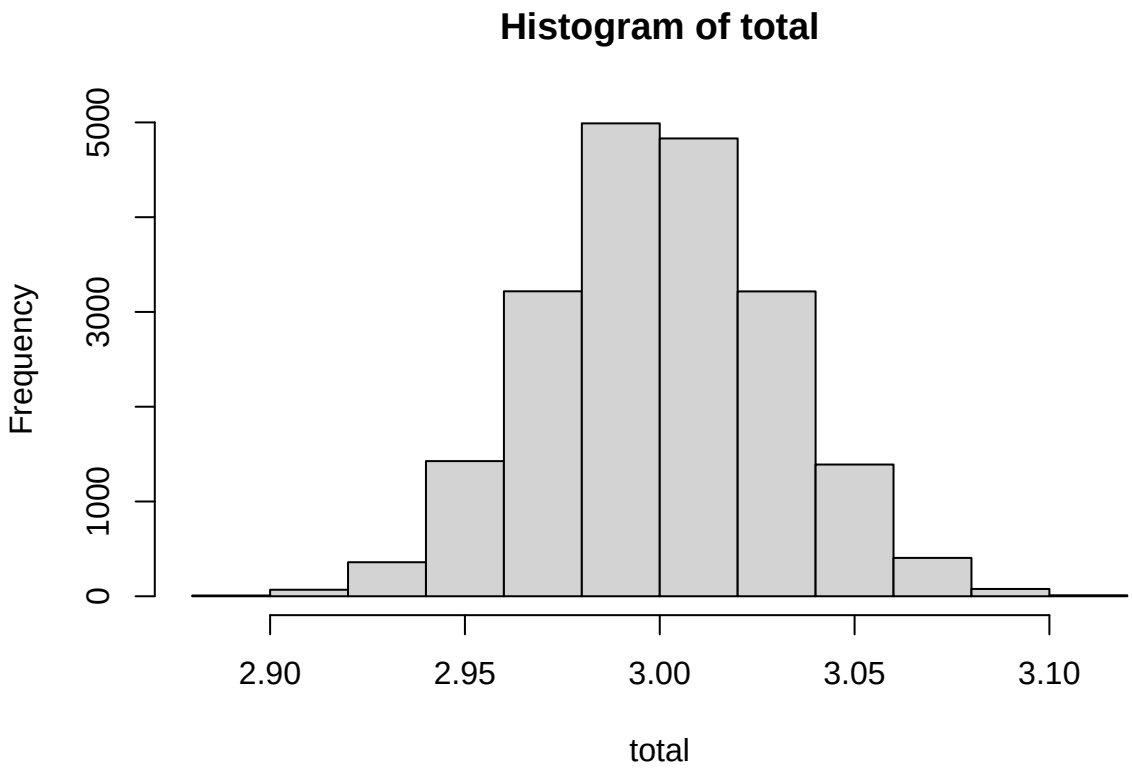
They are the same.

Question 3

a

```
total <- rep(0,20000)
for (i in 1:20000){
  sim <- rexp(10000,1/3)
  total[i] <- mean(sim)
}

hist(total)
```



Yes, the histogram is just like a normal distribution.