tut4

Simulation for 1(d):

```
set.seed(1014)
B <- 100000
counts0 <- 0
for (i in 1:B) {
  samp0 <- rexp(30, rate = 1/3)

  means0 <- mean(samp0)

  if (means0 < 2.1){
    counts0 <- counts0 + 1
  }
}

counts0/B
```

```
## [1] 0.03884
```

Thus p-value is 0.0388 for one-sided test.

Simulation for 1(f):

```
set.seed(1014)
B <- 100000
counts1 <- 0
for (i in 1:B) {
  samp1 <- rexp(30, rate = 1/3)

  means1 <- mean(samp1)

  if (means1 < 2.1 | means1 > 3.9){
    counts1 <- counts1 + 1
  }
}

counts1/B
```

```
## [1] 0.09777
```

Thus the resulting p-value is 0.0978 for a two-sided test.

Simulation for 2(b):

```
set.seed(1011)
counts2 <- 0
# B = 100000
for (j in 1:B) {
  simulation2 <- rexp(30, rate = 1/2.7)
  mean_sim2 <- mean(simulation2)

  if(2 > mean_sim2 | mean_sim2 > 4){
    counts2 <- counts2 + 1
  }
}

counts2/100000
```

```
## [1] 0.07547
```

Thus the power is 0.075.

Simulation for 2(c)'s type-I error(as informal reference):

```
set.seed(30)
B <- 100000
counts3 <- 0
for (i in 1:B) {
  samp3 <- rexp(30, rate = 1/3)

  means3 <- mean(samp3)

  if (means3 < 2 | means3 > 4){
    counts3 <- counts3 + 1
  }
}

counts3/B
```

```
## [1] 0.06559
```

Simulation for 2(d); first chunk is for type-I error, second chunk is for type-II error.

```
set.seed(30)
# type-I error
counts4 <- 0
for (i in 1:B) {
  samp4 <- rexp(100, rate = 1/3)

  means4 <- mean(samp4)
    if (means4 < 2.45 | means4 > 3.55){
    counts4 <- counts4 + 1
  }
}
counts4/B
```

```
## [1] 0.06573
```

```
set.seed(1012)
counts5 <- 0
# B = 100000
for (j in 1:B) {
  simulation5 <- rexp(100, rate = 1/2.7)
  mean_sim5 <- mean(simulation5)

  if(2.45 > mean_sim5 | mean_sim5 > 3.55){
    counts5 <- counts5 + 1
  }
}
# power
counts5/100000
```

```
## [1] 0.1791
```

```
#type-II error
1-counts5/100000
```

```
## [1] 0.8209
```

Thus with sample size INCRAESED from 30 to 100, type-I error doesn't change much; however type-II error decreases from 0.92 to 0.8209, and power increases from 0.075 to 0.1791.

Simulation for bonus part: (rejection region:

$$X \leq 1.877$$

)

```
set.seed(1014)
res <- 1.877
counts6 <- 0
# B = 100000
for (j in 1:B) {
  simulation6 <- rexp(30, rate = 1/2.7)
  mean_sim6 <- mean(simulation6)

  if(res > mean_sim6){
    counts6 <- counts6 + 1
  }
}

counts6/100000
```

```
## [1] 0.0362
```

Thus power is 0.0362