Arsenio Pena
CSC 217
R Assignments
Professor Elahe Vahdani

R Assignment 1

Exercise 1

#number of heads in 100 tosses of 10 unfair coins
rbinom(100,10,0.3)

The most common number of heads from each toss is between 1-2. Since the probability is 30%, it is likely that the number of heads we get during most of our trials will be small.

```
> #Exercise 1
> rbinom(100,10,0.3)
  [1] 1 1 2 6 7 3 4 4 2 4 3 4 4 3 2 1 2 3 3 1 3 4 4 3 4 3 4 3 5 4 5 4 2 3 2 2 5 3 3 2 4 3
 [43] 1 6 4 3 4 2 5 3 2 2 5 3 3 2 5 3 4 7 5 3 5 7 2 4 2 3 3 3 4 2 1 3 3 4 2 0 3 2 5 5 3 3
 [85] 4 3 1 3 5 2 4 4 3 3 3 2 1 3 2 2
> rbinom(100,10,0.3)
  [1] 1 2 2 1 1 2 4 2 2 4 3 3 1 2 0 5 3 3 1 2 3 2 2 5 3 3 2 2 1 4 3 2 5 2 3 1 3 4 2 1 5 3
 [43] 4 5 5 7 1 3 2 4 4 2 4 3 3 1 1 5 3 4 2 3 4 5 2 0 2 3 1 3 3 4 2 2 1 2 2 3 2 3 3 4 0 3
 [85] 2 0 3 4 5 1 2 6 4 0 2 0 5 3 2 4
```

Exercise 2

flips <-rbinom(100000,10,.3)
mean(flips==2)
dbinom(2,10,0.3)

The exact calculation returns the same value, while the simulation's estimation varies when I re-run the program. The result from the simulation is close to our exact calculation's result. If we round to the nearest tenth or hundredth, our results are equal.

```
> dbinom(5,10,0.5)
[1] 0.2460938
> flips <-rbinom(100000,10,.3)
> mean(flips==2)
[1] 0.23299
> dbinom(2,10,0.3)
[1] 0.2334744
> #Exercise 2
> flips <-rbinom(100000,10,.3)
> mean(flips==2)
[1] 0.23134
> dbinom(2,10,0.3)
[1] 0.2334744
```

```
> flips <-rbinom(10000,10,.3)
> mean(flips==2)
[1] 0.2332
```

```
> flips <-rbinom(100000000,10,.3)
> mean(flips==2)
[1] 0.2335145
```

Exercise 3

a) The result is 0.2332.
flips <-rbinom(10000,10,.3)
mean(flips==2)

b) The result is 0.2335145.
flips <-rbinom(100000000,10,.3)
mean(flips==2)

The exact value is 0.2334744. The result from when we do 10 million experiments is closer to the exact value. Our result is more accurate when we run more experiments.

Exercise 4

```
> #Exercise 4
> flips <-rbinom(100000,25,.3)
> mean(flips)
[1] 7.51327
> #E(X) = np
> 25*0.3
[1] 7.5
```

flips <-rbinom(100000,25,.3)
mean(flips)
E(X) = np
25*0.3

The result from the simulation is like the result from the exact calculation. The result from doing 100,000 experiments gives a close estimate to the exact calculation.

Exercise 5

```
> #Exercise 5
> X<-rbinom(100000,25,.3)
> var(X)
[1] 5.220732
> #Var(X)=np(1 -p)
> 25*0.3*(1-0.3)
[1] 5.25
```

```
> X<-rbinom(1000000,25,.3)
> var(X)
[1] 5.253616
```

X<-rbinom(1000000,25,.3)
var(X)
Var(X)=np(1 −p)
25*0.3*(1-0.3)

The result from the simulation with 100,000 experiments is 5.220732 and the result from the exact calculation is 5.25. When I perform 1 million experiments, the result is 5.253616 which is closer to the exact calculation.