STA237 - Tutorial 3

1. (a) We can calculate the probability of getting a sequence of four heads by either calculating the probability mass function $f(X = 4)$ for 20 throws.
Using R, we have:

```
> theory_result = dbinom(4, 20, 0.5)  # probability mass function
> paste0("Theoretical Result: ", theory_result)
[1] "Theoretical Result: 0.00462055206298827"
```

(b)

```
> check.condition = function(n, r) {
+ simulation = sample(0:1, n, replace=TRUE)
+
+ if (sum(simulation) == r) {
+     return(1)
+ }
+ else {
+     return(0)
+     }
+ }
```

(c)

```
> simulation = function(n, r, N) {
+   count = 0
+
+   for (i in 1:N) {
+     check = check.condition(n, r)
+     count = count + check
+   }
+
+   return(count/N)
+ }
```

(d)

```
> simulated_result = simulation(20, 4, 10000)
> paste0("Simulated Result: ", simulated_result)
[1] "Simulated Result: 0.0059"

> difference = abs(simulated_result - theory_result)
> paste0("Difference between theoretical and simulation results: ", difference)
[1] "Difference between theoretical and simulation results: 0.00127944793701173"
```