DATA 405 Assignment 2

Rin Meng 51940633

Question 1

a).

```
X <- c(0.5, 0.3, 0.2)
cumsum.X <- cumsum(X)
cumsum.X
```

```
## [1] 0.5 0.8 1.0
```

b).

```
pX <- function (x){
  return(cumsum.X[x+1])
}
```

c).

```
rX <- function(x){
  U <- runif(x)
  X <- numeric(x)
  x <- 0
  for (x in 0:6) {
    X[U >= pX(x)] <- x + 1
    x <- x+1
  }
  return(X)
}
rX(10)
```

```
##  [1] 2 2 1 0 1 0 0 1 2 1
```

d).

```
myX <- rX(1000)
```

e).

```
table(myX)
```

```
## myX
##   0   1   2
## 503 290 207
```

No these values do not differ from what we would have expected, because for $n = 1000$, we can say that $E[0] = 0.5 \times 1000 = 500$ and $E[1] = 0.3 \times 1000 = 300$ and also, $E[2] = 0.2 \times 1000 = 200$, where as our values observed, is relatively close to those values.

f).

```
barplot(table(myX), xlab = "Probability of getting X = x", ylab="Occurance Frequency",ylim = c(0,500), 
```

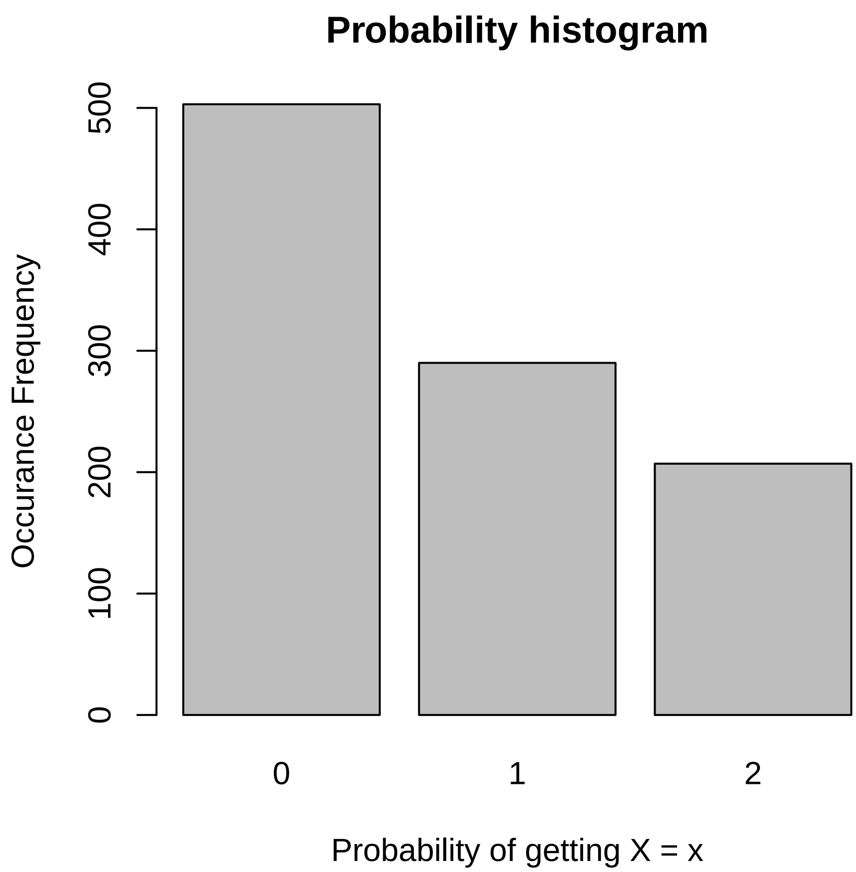

Figure 1: Probability histogram of myX

Question 2

```
binsim <- rbinom(1000, size = 20, prob = 0.3)
```

a).

```r
mean(binsim <= 5)
```

```
## [1] 0.43
```

b).

```r
mean(binsim == 5)
```

```
## [1] 0.197
```

c).

```r
mean(binsim)
```

```
## [1] 5.943
```

d).

```r
var(binsim)
```

```
## [1] 4.055807
```

Question 3

```r
P1 <- rpois(10000, lambda = 5)
P2 <- rpois(10000, lambda = 25)
P3 <- rpois(10000, lambda = 125)
P4 <- rpois(10000, lambda = 625)
```

a).

```r
cat("default", mean(P1), mean(P2), mean(P3), mean(P4))
```

```
## default 5.0414 24.9004 125.1214 625.0205
```

```r
cat("\n sqrt: ", mean(sqrt(P1)), mean(sqrt(P2)), mean(sqrt(P3)), mean(sqrt(P4)))
```

```
##
##  sqrt:  2.180381 4.964595 11.17415 24.99542
```

```r
cat("\n var sqrt: ", var(sqrt(P1)), var(sqrt(P2)), var(sqrt(P3)), var(sqrt(P4)))
```

```
##
##  var sqrt:  0.2873689 0.2532268 0.2598723 0.2497051
```

```r
cat("\n var: ", var(P1), var(P2), var(P3), var(P4))
```

```
##
##  var:  5.014788 24.85997 129.5418 623.8241
```

b). The effect of taking the square root of X on the relationship between variance and the mean is that when square rooting, we reduce the amount of how much variance depends on the mean, making the variance in this observation more stabilized. Based on our result, we see that the variance square rooted seems to stay at a constant rate of around 0.25.