# Homework 1

## Problem 1 (using ITM)

### Bernoulli(1/2)

```
n = 1e4 ##no. of observations
probability=1/2
q=1-probability;

Bernoulli <- numeric(n)
for(i in 1:1e4){
  Uniform = runif(1,min=0.0,max=1.0)
  if(Uniform<=q){
    Bernoulli[i]<-0
  }
  else{
    Bernoulli[i]<-1
  }
}


mean(Bernoulli) ##sample meam
```

```
[1] 0.4934
```

```
var(Bernoulli)  ##sample variance
```

```
[1] 0.2499814
```

```
population_mean = probability #0.5
population_variance = probability*q #0.25
```

### Poisson(4)

```
lambda = 4;
Poisson <- numeric(1e4)

for(i in 1:1e4){
  j=0;
  p=exp(-lambda)
  F=0
  U = runif(1,min=0.0,max=1.0)
  while(TRUE){
    F=F+p;
    if(U<=F){
```

```
      Poisson[i]<-j
      break
    }
    j=j+1
    p=lambda*p/j
  }
}

mean(Poisson)
```

```
[1] 4.0035
```

```
var(Poisson)
```

```
[1] 4.031891
```

```
population_mean = lambda #4
population_variance = lambda #4
```

## Binomial(10,1/3)

```
binoms <- numeric(11)
a<-0
p<-1/3
Binomial <- numeric(1e4)
for(j in 0:10){
  a <- a + choose(10,j)*(p^j)*((1-p)^(10-j))
  binoms[j+1] <- a
}

for(i in 1:1e4){
  U <- runif(1,min=0.0,max=1.0)
  for(j in 0:10){
    if(U<=binoms[j+1]){
      Binomial[i] <- j
      break
    }
  }
}

mean(Binomial)
```

```
[1] 3.3459
```

```
var(Binomial)
```

```
[1] 2.275881
```

```
population_mean = n*p #3.33
population_variance = n*p*q #2.22
```

## Problem 2

```
p = 1/3
N <- numeric(1e4)
for(i in 1:1e4){
  U = runif(1,min=0.0,max=1.0)
  N[i] <-  floor(log(U)/log(1-p))
}
mean(N)
```

```
[1] 1.9953
```

```
var(N)
```

```
[1] 5.866665
```