STAT 260 R Assignment 2

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P(X = 2) -> dbinom(2, size=18, prob=0.171) P(X ≤ 3) -> pbinom(3, size=18, prob=0.171)

Question 1

```
lambda = 4.5 * 7.5 #seconds * duration
```

Section a P(X <= 35) i.e cdf

```
  ppois(q = 35, lambda = lambda)
```

```
## [1] 0.6282507
```

Section b

P(X = 33) i.e pmf (discrete) or pdf (continuous)

```
  dpois(33, lambda)
```

```
## [1] 0.06869264
```

Section c P(30 <= X <= 36) = P(X <= 36) - P(X <= 29) scale down to sample space

```
ppois(36, lambda) - ppois(29, lambda)
```

```
## [1] 0.4536192
```

Question 2

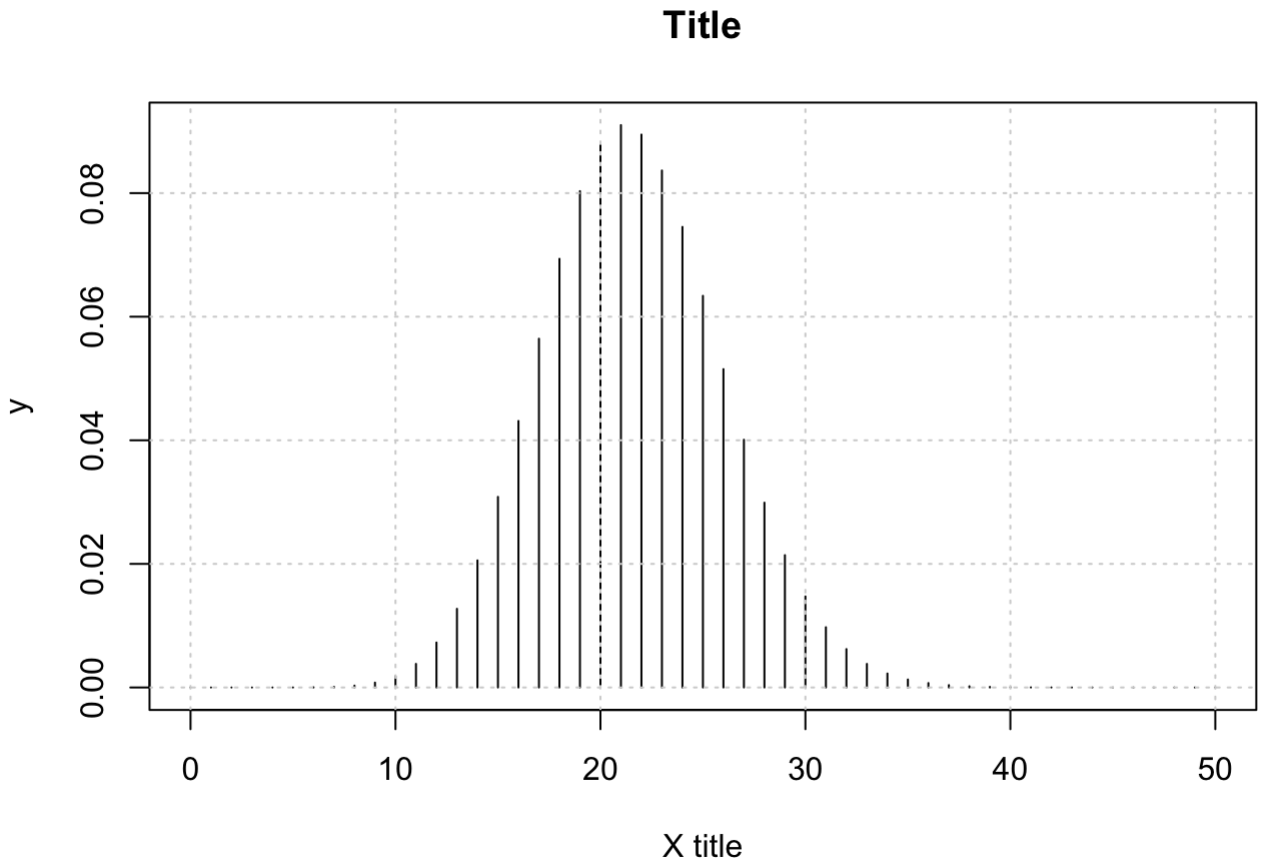
```
  blades_total = 196
  blades_prob = 0.11
```

Section a

```
  # P(X >= 20) = 1 - P(X <= 19)

  at_least_20 = 1 - pbinom(19, size = blades_total, prob = blades_prob)

  #P(X = 20)
  equals_20 = dbinom(20, size = blades_total, prob = at_least_20)
```

Section b

```
x = seq(0,50, by = 1)
y = dbinom(x, size = blades_total, prob = 0.11)

plot(x, y, type = 'h',
     main = 'Title',
     xlab = 'X title'
     )
grid()
```



Section c

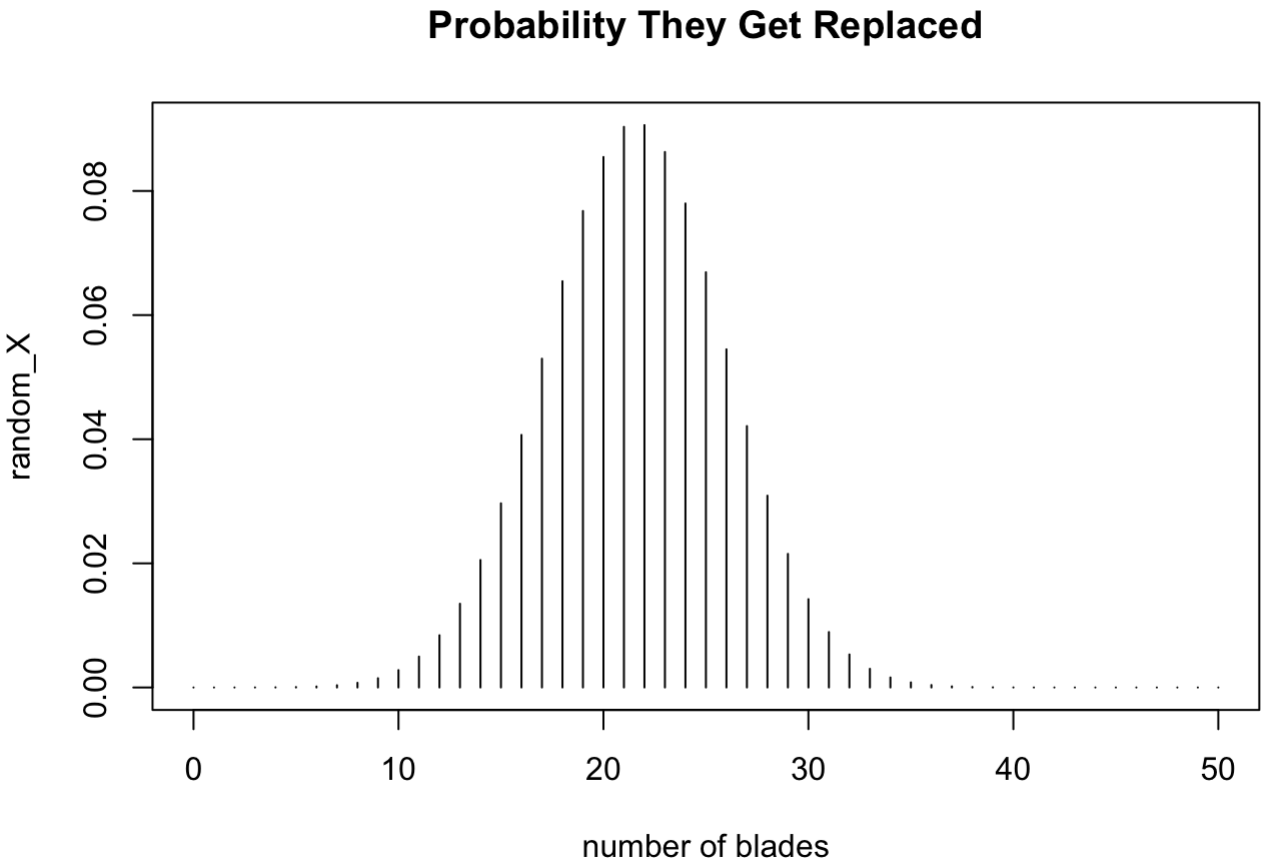
```
  #(P X >= 20) = 1 - P(X >= 19)

  s = sqrt(blades_total * blades_prob * (1 - blades_prob)) # sqrt(npq)
  mu = blades_total * blades_prob

  approximation = 1 - pnorm(19, mean = mu, sd = s)
  approximation
```

```
## [1] 0.7205291
```

```
  #1 - pbinom(19, size = blades_total, prob = blades_prob)
```

Section d

```
random_X = dnorm(x, mean = mu, sd = s)
plot(x, random_X, type = 'h',
 main = 'Probability They Get Replaced',
 xlab = 'number of blades')
```



Question 3

Section a

P(23.7 <= X <= 30.4) = P(X <= 30.4) - P(X <= 23.7) note self: continuous is inclusive P(X <= 23.7)

```
mean = 28.3
sd = 2.39
x =  23.7

pnorm(30.4, mean = mean, sd = sd) - pnorm(x, mean = mean, sd = sd)
```

```
## [1] 0.7830732
```

Section b

P(X >= 27.4) = 1- P(X <= 27.3)

```
1 - pnorm(27.4, mean = mean, sd = sd)
```

```
## [1] 0.646753
```

Section c

P(25 <= X <= 31.6) = P(X <= 31.6) - P(X <= 25)

```
  pnorm(31.6, mean = mean, sd = sd) - pnorm(25, mean = mean, sd = sd)
```

```
## [1] 0.8326451
```

Section d

```
  qnorm(0.35, mean = mean, sd = sd)
```

```
## [1] 27.37908
```

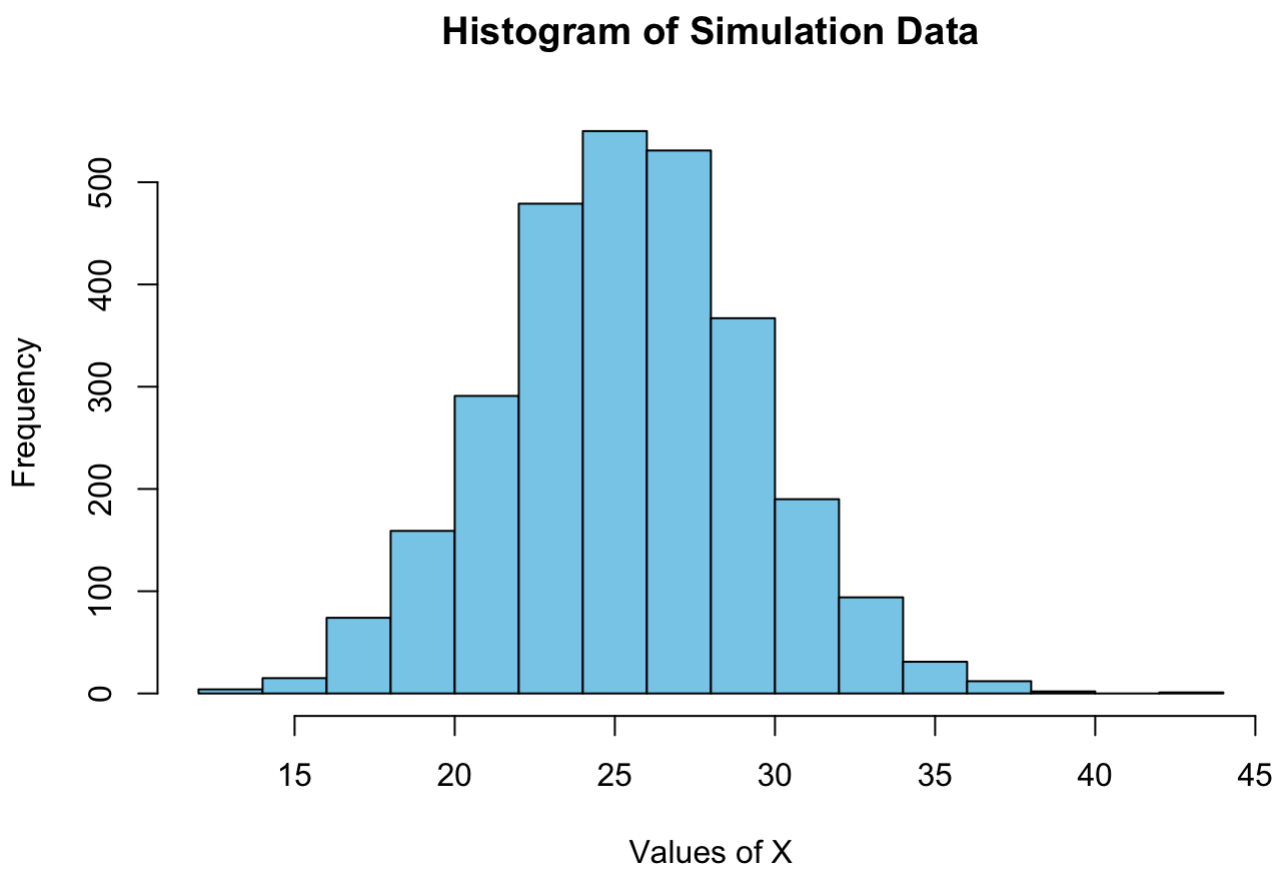
Question 4

Section a

```
  set.seed(111)
  simulation.data = rbinom(2800, size = 72, prob = 0.36)
```

Section b

```
  hist(simulation.data,
     main = "Histogram of Simulation Data",
     xlab = "Values of X",
     ylab = "Frequency",
     col = "skyblue",
     breaks = 20)
```



Histogram is normally distributed with a slight right skew.

Section c

```
  mean(simulation.data)
```

```
## [1] 25.87071
```

The simulation is very close to the expected value indicating that the sample mean is a reliable estimate of the population mean.