HW2

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Question 1

a

```
dbinom(15, 30, 0.5)

## [1] 0.1444644
```

The probability that exactly half of the rolls are even numbers is 0.144.

b

```
1-pbinom(20, 30, 0.5)

## [1] 0.02138697
```

The probability that more than 20 of the rolls are even numbers is 0.0214.

c

```
pbinom(4, 30, 1/3)

## [1] 0.01222972
```

The probability that less than 5 of the rolls are greater than 4 is 0.0122.

Question 2

a

```r
ppois(40, 30) - ppois(19, 30)

## [1] 0.945817
```

The probability that the server gets pinged between 20 and 40 times in a particular second is 0.946.

b

```r
sec <- 365 * 24 * 60 * 60
sec

## [1] 31536000
```

There are 31536000 seconds in a year.

c

```r
max(rpois(sec, 30))

## [1] 67
```

The maximum number of pings in a single second over the course of a year is around 66.

d

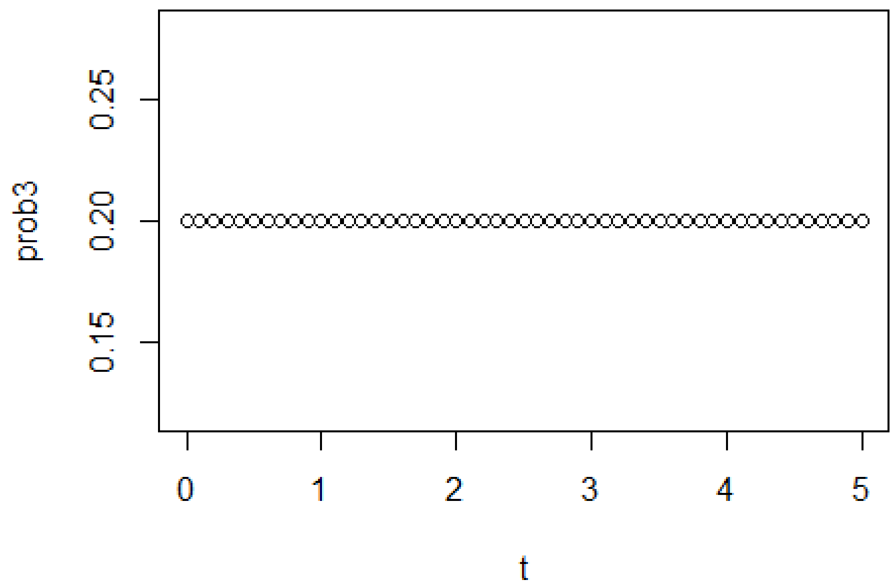
```r
qpois(0.99, 30)

## [1] 43
```

43 should be a good rate, as it is the 99 percent threshood.

Question 3

a

```r
t <-  seq(0, 5, by=0.1)

prob3 <- dunif(t, 0, 5)

plot(t, prob3)
```



The density function are as shown.

b

```
punif(1, 0, 5)

## [1] 0.2
```

The probability that the bus is more than 1 minutes late is 0.2.

c

```
(1-punif(4, 0, 5))/(1-punif(3, 0, 5))

## [1] 0.5
```

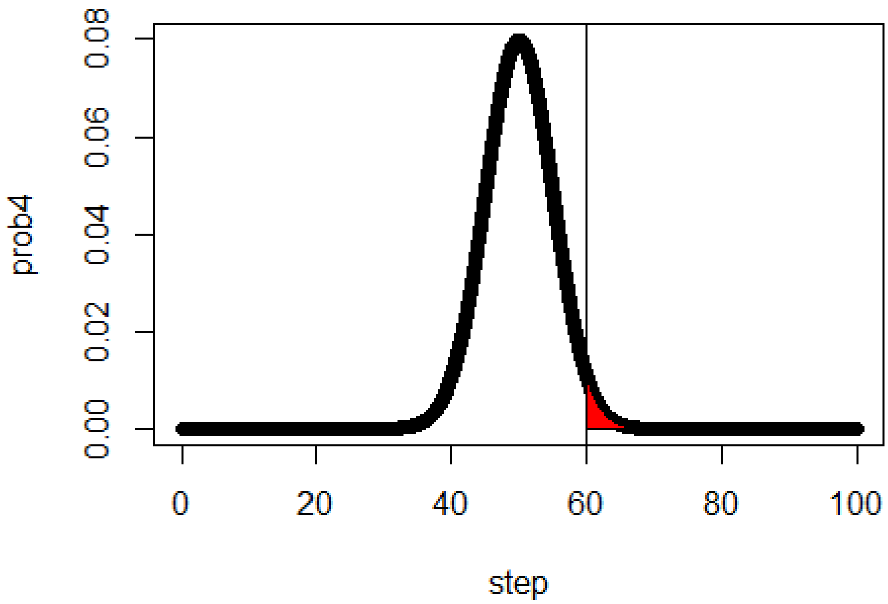
The conditional probability that the bus is more than 4 minutes late, given that it is already 3 minutes late is 0.5.

Question 4

a

```
1 - pnorm(60, 50, 5)

## [1] 0.02275013

step <- seq(0, 100, by=0.01)
prob4 <- dnorm(step, 50, 5)
plot(step, prob4)
abline(v = 60)
```

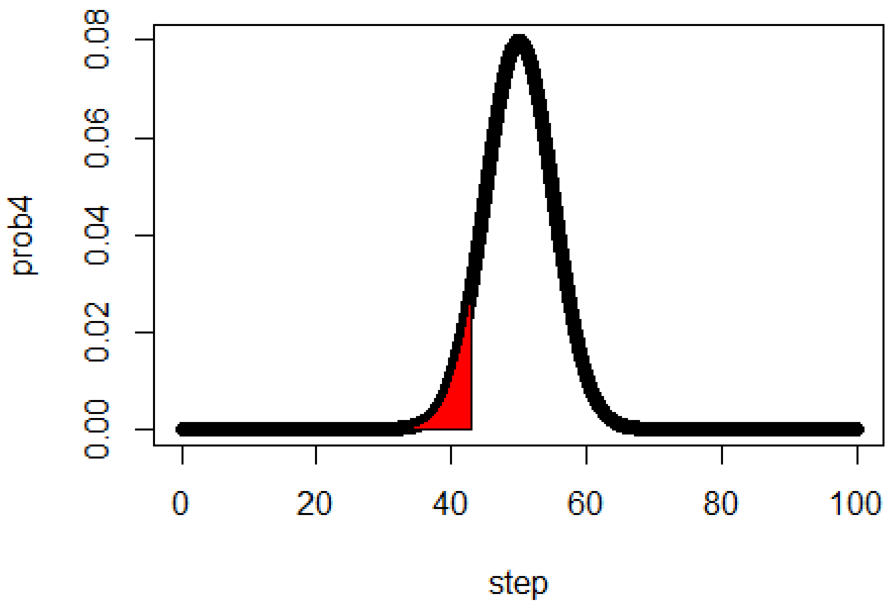
```
polygon(c(step[step>=60], max(step), 60), c(prob4[step>=60],0,0), col="
red")
```



The probability that it is more than 60 cm in length is 0.0227.

b

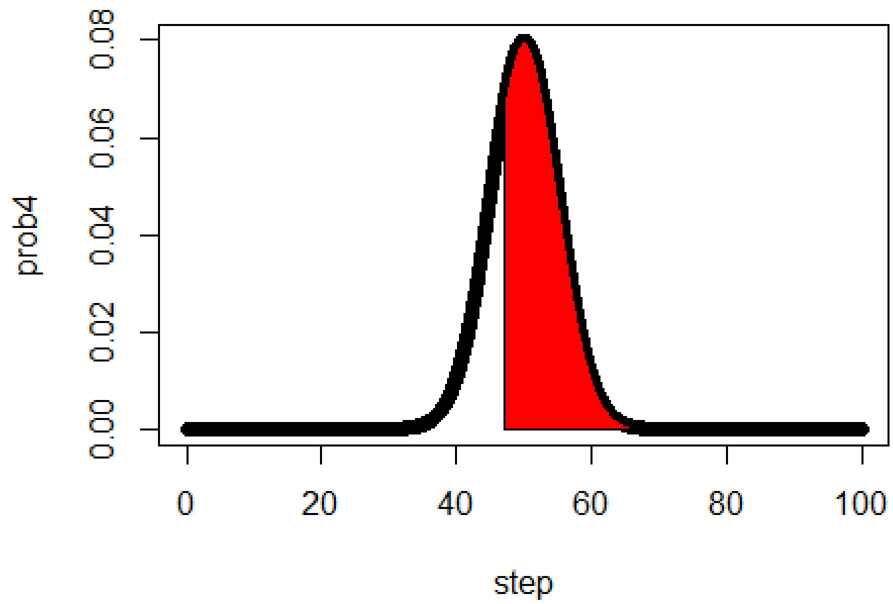
```
qnorm(0.1, 50, 5)

## [1] 43.59224

plot(step, prob4)
polygon(c(step[step<=43],43, 40), c(prob4[step<=43],0,0), col="red")
```



The length is 43.59.

c

```
qnorm(0.3, 50, 5)

## [1] 47.378

plot(step, prob4)
polygon(c(step[step>=47],47, 47), c(prob4[step>=47],0,0), col="red")
```



The length is 47.38.

Question 5

a

```
pnorm(90, 80, 10) - pnorm(70, 80, 10)

## [1] 0.6826895
```

b

```
pnorm(100, 80, 10) - pnorm(60, 80, 10)

## [1] 0.9544997
```

c

```
pnorm(110, 80, 10) - pnorm(50, 80, 10)

## [1] 0.9973002
```

d

```
for (i  in 1:3){
  print(pnorm(0 + i * 1, 0, 1) - pnorm(0 - i * 1, 0, 1))
}

## [1] 0.6826895
## [1] 0.9544997
## [1] 0.9973002
```

Question 6

a

```
pnorm(1.9, 2, 0.05)

## [1] 0.02275013
```

2.27 percent of nails are less than 1.9 inches in length.

b

```
1 - pnorm(2.1, 2, 0.05)

## [1] 0.02275013
```

2.27 percent of nails are longer than 2.1 inches in length.

c

```
qnorm(0.8, 2, 0.05)

## [1] 2.042081
```

Exactly 20% of the nails are longer than 2.04.

d

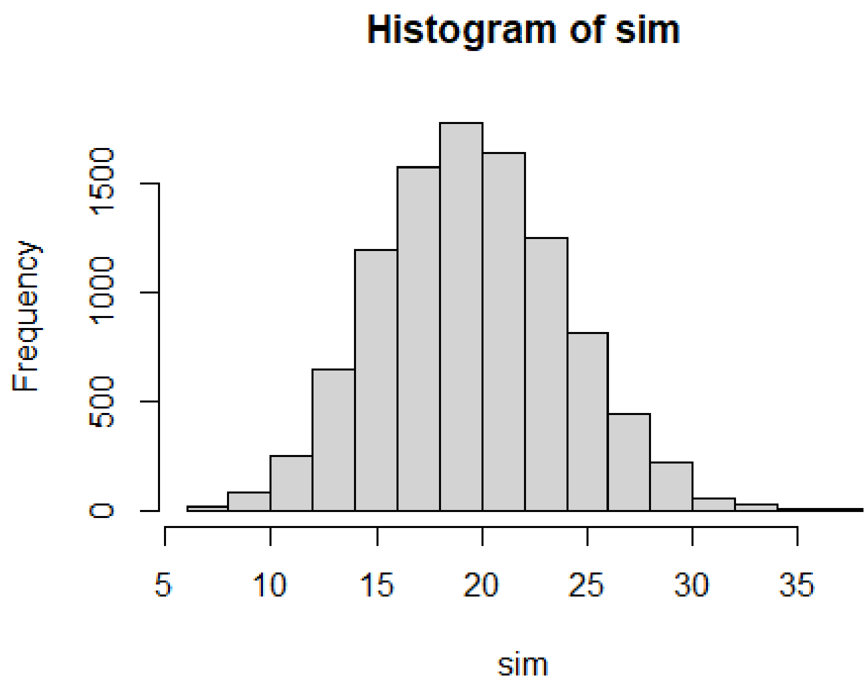
```
qnorm(0.2, 2, 0.05)

## [1] 1.957919
```

Exactly 20% of the nails are shorter than 1.958.

Question 7

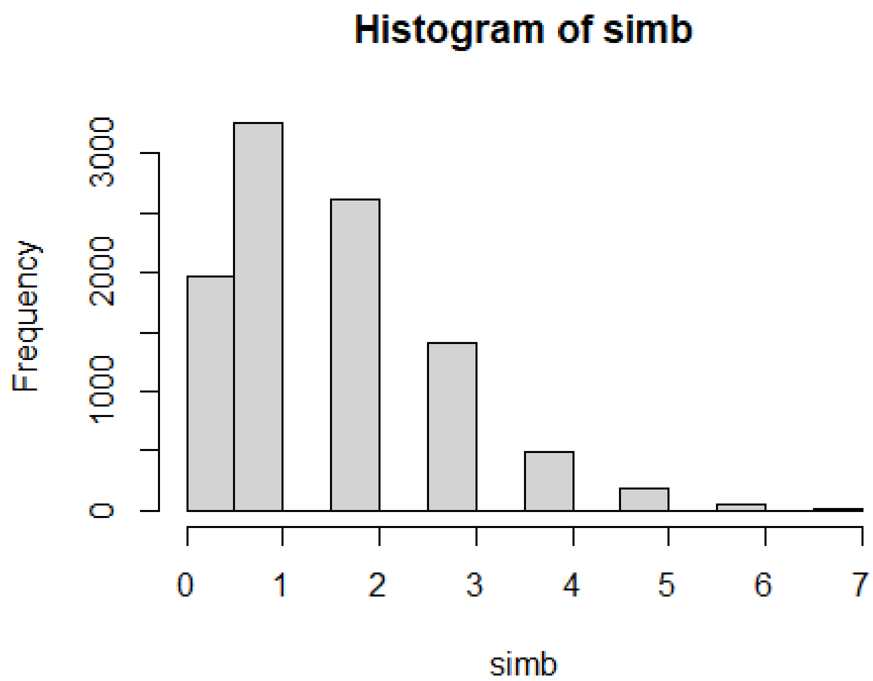
a

```
sim <- rpois(10000, 20)
hist(sim)
```



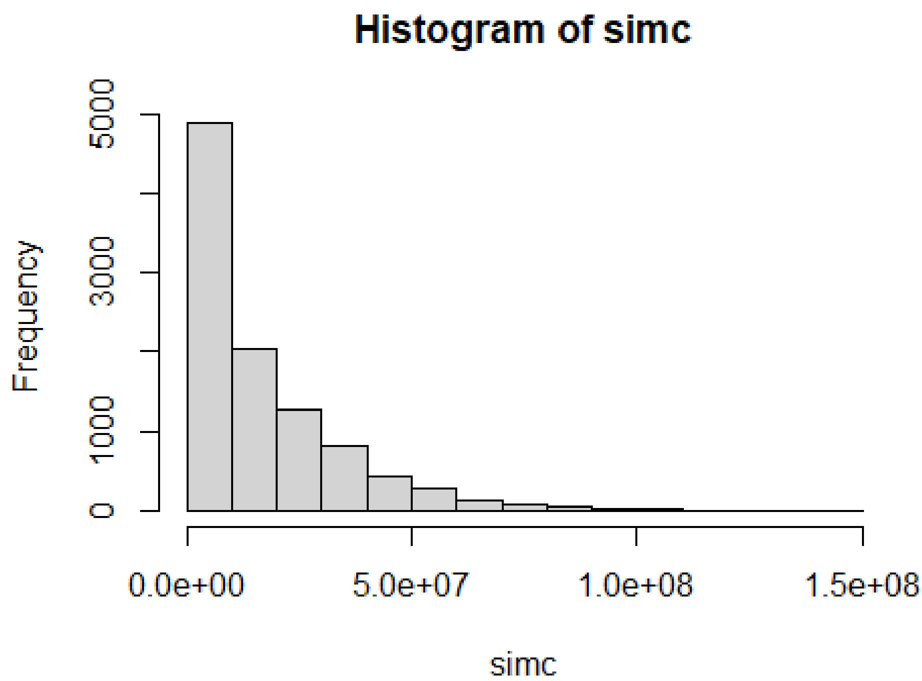
b

```r
simb <- c()
for (i in sim){
  simb <- append(simb, rbinom(1, i, 0.08))
}

hist(simb)
```



c

```
simc <- c()
for (i in simb){
  simc <- append(simc, sum(rexp(i, 1/10000000)))
}
hist(simc)
```



d

```
mean((simc - 26000000) > 0)

## [1] 0.2234
```

About 22.76 percent of the simulation makes a profit.

e

```
sim_RD <- rpois(10000, 24)
rt_RD <- c()
for(i in sim_RD){
  rt_RD <- append(rt_RD, rbinom(1, i, 0.08))
}
rev_RD <- c()
for(j in rt_RD){
  rev_RD <- append(rev_RD, sum(rexp(j, 1/10000000)))
}
mean(rev_RD)

## [1] 19163167

rev_market <- c()
for (k in simb){
  rev_market <- append(rev_market, sum(rexp(k, 1/12000000)))
}
mean(rev_market)
```

```
## [1] 19237686
```

With different runs the result are different, sometimes one is higher sometimes the other one is higher. But most of the time marketing revenue is higher, Thus I conclude that spend money on marketing will yield higher revenue.