Lab7

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First , let's look at exponential distribution:

P.d.f (Probability density function):

$$f(x) = \lambda e^{-\lambda x}$$

C.d.f (Cumulative distribution function):

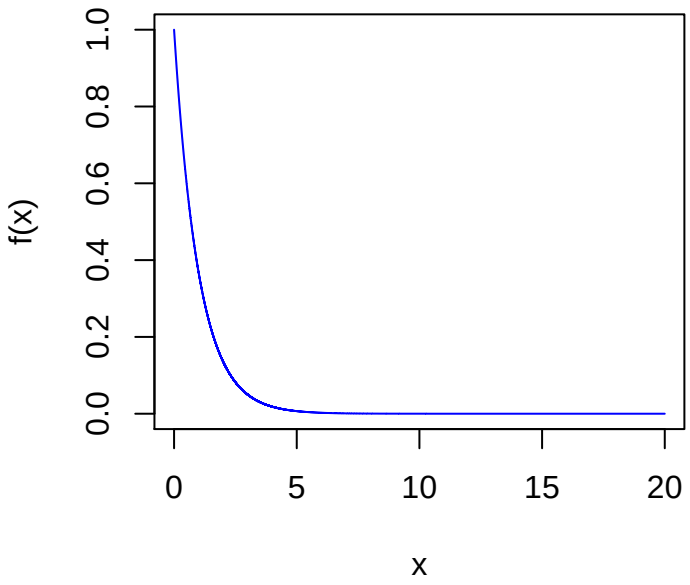
$$F(X) = Pr(x \leq X) = 1 - e^{-\lambda X}$$

when $\lambda = 1$ (That is when mean = 1):

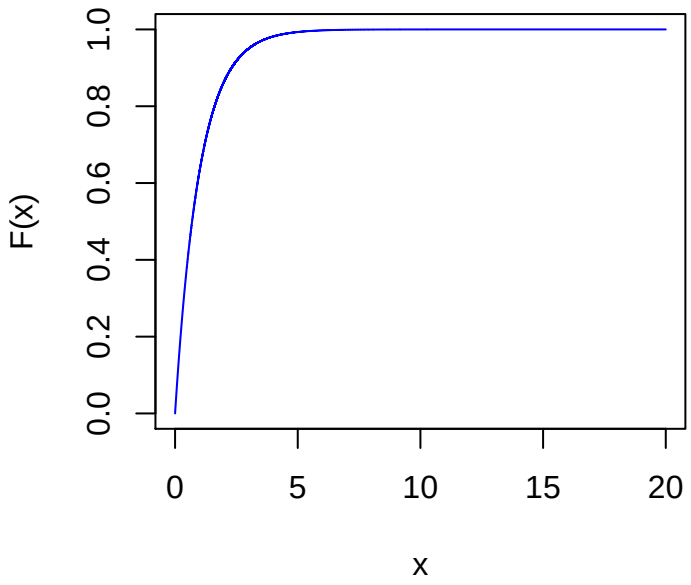
```
lambda = 1

# create a sequence from 0 to 100 with distance 0.01
x = seq(0,20, by= 0.0001)

# create the p.d.f function of exponential for x
f = function(x){lambda*exp(-lambda * x)}
# plot f(x), p.d.f of x
plot(x,f(x),type = "l",col = "blue")
```



```r
# create the C.d.f function for x
F = function(x){1 - exp(-lambda * x)}
# plot F(x), C.d.f of x
plot(x,F(x),type = "l",col = "blue")
```



Exponential distribution are usually used to model waiting time between independent events. Such as waiting time for passenger entering airport, waiting time to call customer service. Also , some material have an exponential decay.

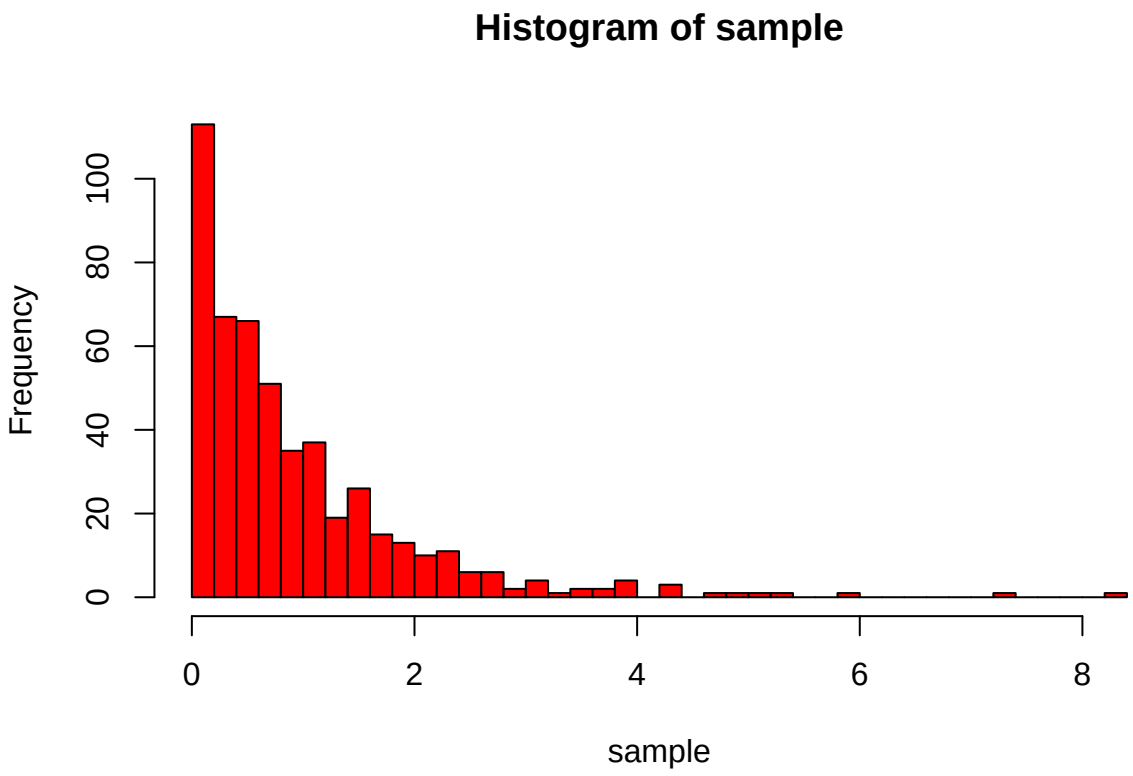
simulate 500 exponential distribution

```r
lambda = 1

# define sample to be a vector
sample = c()

# a for loop, repeat 500 times
for(i in 1:500){
  # here we used the rexp function to generate 1 exponential distribution
  b = rexp( n = 1, rate = lambda)
  # save our sample mean ( append value of b to our sample)
  sample = c(sample , b)
}

# generate a histgram for the sample ( with 30 seperate bars)
hist(sample, breaks =  30 , col = "red")
```




```
# get mean of sample
mean(sample)
```

```
## [1] 0.9326583
```

```
# get standard deviation of sample
sd(sample)
```

```
## [1] 1.037139
```

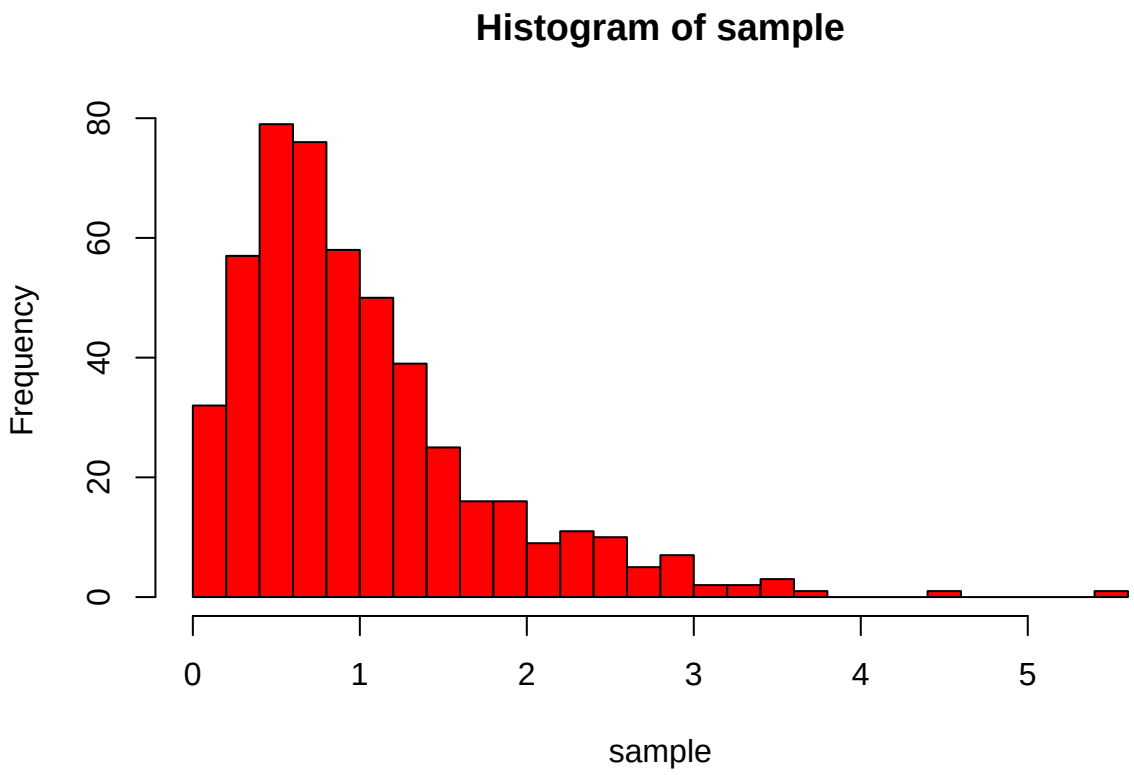
if we generate n = 2 exponential distribution each time, and look at the distribution of the mean

```
lambda = 1

# define sample to be a vector
sample = c()

# a for loop, repeat 500 times
for(i in 1:500){
  # generate 2 exponential distribution
  a = rexp( n = 2, rate = lambda)
  # take the average of them
  b = mean(a)
  # save our sample mean ( append value of b to our sample)
  sample = c(sample , b)
}
```

```r
# generate a histgram for the sample ( with 30 seperate bars)
hist(sample, breaks =  30 , col = "red")
```




```r
# get mean of sample
mean(sample)
```

```
## [1] 1.010472
```

```r
# get standard deviation of sample
sd(sample)
```

```
## [1] 0.7455415
```

First, try get the average n = 30 on your own, finish table 7.1

Second, try uniform and finish table 7.2

use runif(n=500,min = 0 , max = 1) to generate 500 uniform distribution with a = 0 and b = 1

Third, try normal and finish table 7.2

use rnorm(n=500,mean = 0 , sd = 1) to generate 500 standard normal distribution with mean = 0 and standard deviation = 1

Finish all discussion questions