Probability and Statistics (UCS410)

Experiment 5: Continuous Probability Distributions

Name: Ketan Singh Group: 3CO14 Roll no.: 102003349

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1) Consider that X is the time (in minutes) that a person has to wait in order to take a flight. If each flight takes off each hour X ~ U(0, 60). Find the probability that
(a) waiting time is more than 45 minutes.
(b) waiting time lies between 20 and 30 minutes.

```
#(1)
#(a)
punif(45, min=0, max=60, lower.tail=FALSE)
#(b)
punif(30, min=0, max=60, lower.tail=TRUE) - punif(20, min=0, max=60, lower.tail=TRUE)
```

<u>Output:</u>

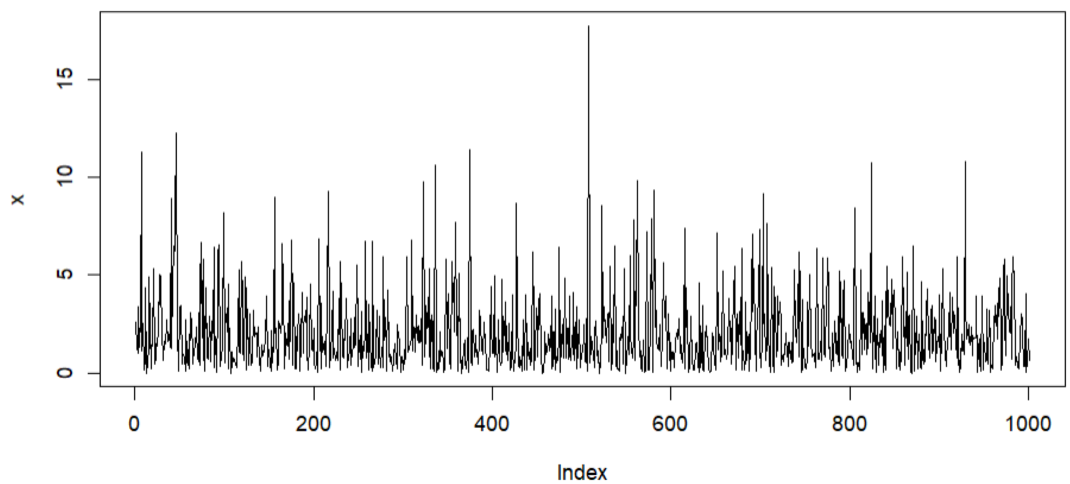
```
> #(1)
> #(a)
> punif(45, min=0, max=60, lower.tail=FALSE)
[1] 0.25
> #(b)
> punif(30, min=0, max=60, lower.tail=TRUE) - punif(20, min=0, max=60, lower.tail=TRUE)
[1] 0.1666667
```

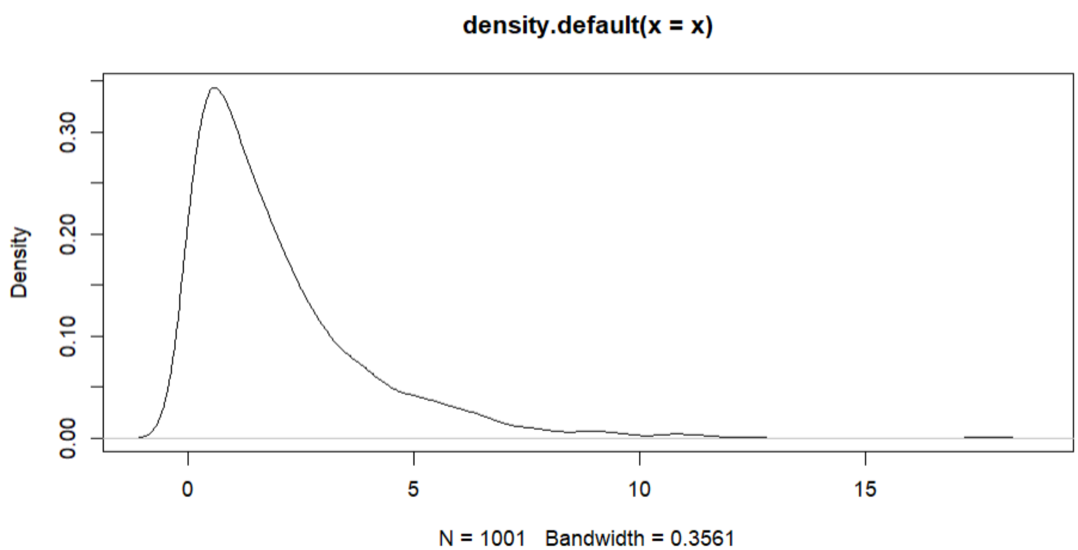
2) The time (in hours) required to repair a machine is an exponential distributed random variable with parameter $\lambda = 1/2$.
(a) Find the value of density function at $x = 3$.
(b) Plot the graph of exponential probability distribution for $0 \le x \le 5$.
(c) Find the probability that a repair time takes at most 3 hours.
(d) Plot the graph of cumulative exponential probabilities for $0 \le x \le 5$.
(e) Simulate 1000 exponential distributed random numbers with $\lambda = ½$ and plot the simulated data.

```
#(2)
#(a)
dexp(3,1/2)
#(b)
dexp(0:5,1/2)
plot(dexp)
#(c)
pexp(3,1/2,lower.tail=TRUE)
#(d)
x<-dexp(0:5,1/2)
plot(x,type='o')
#(e)
n=0:1000
x<-rexp(n,1/2)
plot(x,type='l')
plot(density(x))
```

Output:

```
> #(2)
> #(a)
> dexp(3,1/2)
[1] 0.1115651
> #(b)
> dexp(0:5,1/2)
[1] 0.50000000 0.30326533 0.18393972 0.11156508 0.06766764 0.04104250
> plot(dexp)
> #(c)
> pexp(3,1/2,lower.tail=TRUE)
[1] 0.7768698
> #(d)
> x<-dexp(0:5,1/2)
> plot(x,type='o')
> #(e)
> n=0:1000
> x<-rexp(n,1/2)
> plot(x,type='l')
> plot(density(x))
```





3) The lifetime of certain equipment is described by a random variable X that follows Gamma distribution with parameters $\alpha = 2$ and $\beta = 1/3$.

(a) Find the probability that the lifetime of equipment is (i) 3 units of time, and (ii) at least 1 unit of time.

(b) What is the value of c, if $P(X \leq c) \geq 0.70$? (Hint: try quantile function qgamma())

```r
#(3)
#(a)
#(i)
dgamma(3,shape=2,scale=1/3)
#(ii)
pgamma(1,shape=2,scale=1/3,lower.tail=FALSE)

#(b)
(qgamma(p=0.70, shape=2, scale=1/3))
```

Output:

```
> #(3)
> #(a)
> #(i)
> dgamma(3,shape=2,scale=1/3)
[1] 0.003332065
> #(ii)
> pgamma(1,shape=2,scale=1/3,lower.tail=FALSE)
[1] 0.1991483
> #(b)
> (qgamma(p=0.70, shape=2, scale=1/3))
[1] 0.8130722
```