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ROLL NUMBER-102003251

Probability and Statistics (UCS410)

Experiment 5

(Continuous Probability Distributions)

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, and
   (b) waiting time lies between 20 and 30 minutes.

Code:

```
#Q1Gomsi
a1 = punif(15, min = 0, max = 60)
print(a1)
b1 = punif(45, min=0, max=60,lower.tail = FALSE)
print(b1)
d = punif(30, min=0, max=60)-punif(20, min=0, max=60)
print(d)
```

INPUT:-

```
#Q1Gomsi
a1 = punif(15, min = 0, max = 60)
print(a1)
b1 = punif(45, min=0, max=60,lower.tail = FALSE)
print(b1)
d = punif(30, min=0, max=60)-punif(20, min=0, max=60)
print(d)
```

OUTPUT:-

```
[Workspace loaded from ~/.RData]

> #Q1Gomsi
> a1 = punif(15, min = 0, max = 60)
> print(a1)
[1] 0.25
> b1 = punif(45, min=0, max=60,lower.tail = FALSE)
> print(b1)
[1] 0.25
> d = punif(30, min=0, max=60)-punif(20, min=0, max=60)
> print(d)
[1] 0.1666667
```

2. The time (in hours) required to repair a machine is an exponential distributed random variable with parameter λ = 1/2.

   (a) Find the value of density function at x = 3.
   (b) Plot the graph of exponential probability distribution for 0 ≤ x ≤ 5.
   (c) Find the probability that a repair time takes at most 3 hours.
   (d) Plot the graph of cumulative exponential probabilities for 0 ≤ x ≤ 5.
   (e) Simulate 1000 exponential distributed random numbers with λ = ½ and plot the simulated data.

Code:

```
#Q2Gomsi
m = dexp(3, rate = 1/2)
print(m)
x <- seq(0,5, by = 0.02)
px <- dexp(x, rate = 1/2)
plot(x, px, xlab = "x", ylab = "f(x)",
    main = "PDF of Exp. dist. at lambda = 1/2")
c2 = pexp(3, rate = 1/2)
print(c2)
Fx <- pexp(x, rate = 1/2)
plot(x, Fx, xlab = "x", ylab = "f(x)",main="CDF of Exp. dist. at lambda = 1/2")
n <- 1000
x_sim <- rexp(n, rate = 1/2)
plot(density(x_sim), xlab = "Simulated x", ylab = "density",
    main = "Simulated data from exp. dist. at lambda = 1/2")
```

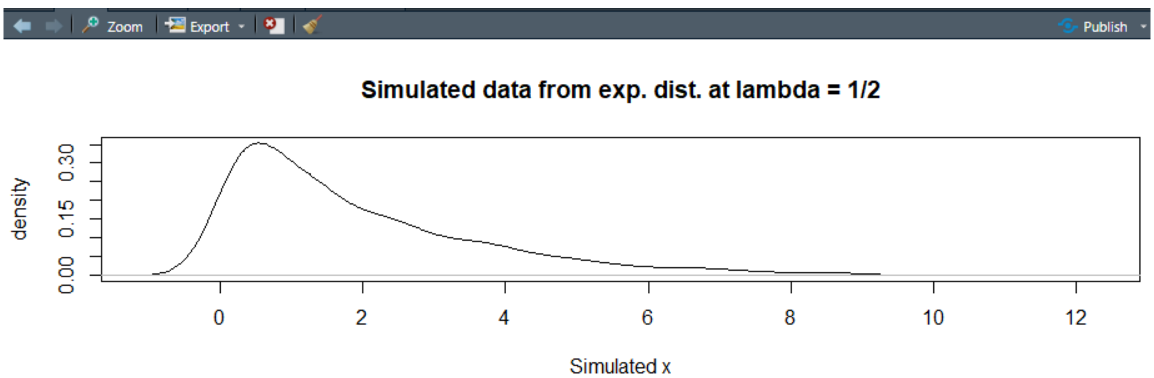
INPUT:-

```
#Q2Gomsi
m = dexp(3, rate = 1/2)
print(m)
x <- seq(0,5, by = 0.02)
px <- dexp(x, rate = 1/2)
plot(x, px, xlab = "x", ylab = "f(x)",
     main = "PDF of Exp. dist. at lambda = 1/2")
c2 = pexp(3, rate = 1/2)
print(c2)
Fx <- pexp(x, rate = 1/2)
plot(x, Fx, xlab = "x", ylab = "f(x)",main="CDF of Exp. dist. at lambda = 1/2")
n <- 1000
x_sim <- rexp(n, rate = 1/2)
plot(density(x_sim), xlab = "Simulated x", ylab = "density",
     main = "Simulated data from exp. dist. at lambda = 1/2")
```

OUTPUT:-

```
> #Q2Gomsi
> m = dexp(3, rate = 1/2)
> print(m)
[1] 0.1115651
> x <- seq(0,5, by = 0.02)
> px <- dexp(x, rate = 1/2)
> plot(x, px, xlab = "x", ylab = "f(x)",
+      main = "PDF of Exp. dist. at lambda = 1/2")
> c2 = pexp(3, rate = 1/2)
> print(c2)
[1] 0.7768698
> Fx <- pexp(x, rate = 1/2)
> plot(x, Fx, xlab = "x", ylab = "f(x)",main="CDF of Exp. dist. at lambda = 1/2"
> n <- 1000
> x_sim <- rexp(n, rate = 1/2)
> plot(density(x_sim), xlab = "Simulated x", ylab = "density",
+      main = "Simulated data from exp. dist. at lambda = 1/2")
>
```

GRAPH



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())

Code:-

```
#Q3Gomsi
alpha <- 2
beta <- 1/3
a3_1 <- dgamma(3, shape = alpha, scale = beta)
print(a3_1)
a3_2 <- pgamma(1, shape = alpha, scale = beta, lower.tail = FALSE)
print(a3_2)

prob <- 0.70
b3 <- qgamma(0.70, shape = alpha, scale = beta)
print(b3)
```

INPUT:-

```r
#Q3Gomsi
alpha <- 2
beta <- 1/3
a3_1 <- dgamma(3, shape = alpha, scale = beta)
print(a3_1)
a3_2 <- pgamma(1, shape = alpha, scale = beta, lower.tail = FALSE)
print(a3_2)

prob <- 0.70
b3 <- qgamma(0.70, shape = alpha, scale = beta)
print(b3)
```

OUTPUT:-

```
> #Q3Gomsi
> alpha <- 2
> beta <- 1/3
> a3_1 <- dgamma(3, shape = alpha, scale = beta)
> print(a3_1)
[1] 0.003332065
> a3_2 <- pgamma(1, shape = alpha, scale = beta, lower.tail = FALSE)
> print(a3_2)
[1] 0.1991483
>
> prob <- 0.70
> b3 <- qgamma(0.70, shape = alpha, scale = beta)
> print(b3)
[1] 0.8130722
>
```