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A – 2 / 16014022050

Tutorial 4: Probability Distribution (16 / 02 / 2024)

1. If X is Binomial Distribution $B(n, p)$, where $n = 20$, $p = 0.65$. Write R-program to evaluate and print the following -

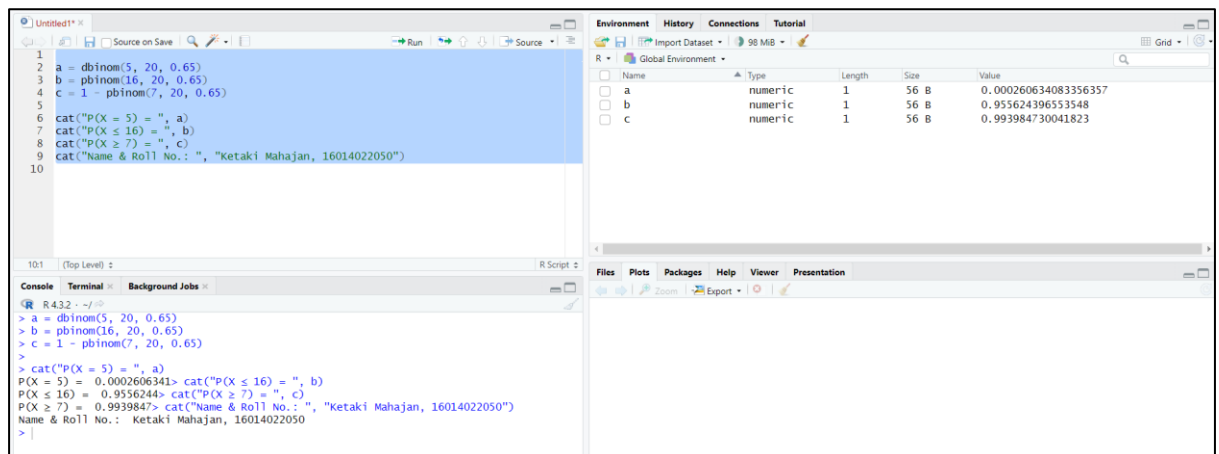
- a. $P(X = 5)$
- b. $P(X \leq 16)$
- c. $P(X \geq 7)$

Code –

```
a = dbinom(5, 20, 0.65)
b = pbinom(16, 20, 0.65)
c = 1 - pbinom(7, 20, 0.65)
```

```
cat("P(X = 5) = ", a)
cat("P(X ≤ 16) = ", b)
cat("P(X ≥ 7) = ", c)
cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
```

Output –



The screenshot shows the RStudio interface. The script editor on the left contains the following code:

```
1 a = dbinom(5, 20, 0.65)
2 b = pbinom(16, 20, 0.65)
3 c = 1 - pbinom(7, 20, 0.65)
4
5
6 cat("P(X = 5) = ", a)
7 cat("P(X ≤ 16) = ", b)
8 cat("P(X ≥ 7) = ", c)
9 cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
10
```

The console on the bottom left shows the output of the script:

```
R 4.3.2 ~ /~/
> a = dbinom(5, 20, 0.65)
> b = pbinom(16, 20, 0.65)
> c = 1 - pbinom(7, 20, 0.65)
>
> cat("P(X = 5) = ", a)
P(X = 5) = 0.0002606341> cat("P(X ≤ 16) = ", b)
P(X ≤ 16) = 0.9556244> cat("P(X ≥ 7) = ", c)
P(X ≥ 7) = 0.9939847> cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
Name & Roll No.: Ketaki Mahajan, 16014022050
> |
```

The Environment pane on the right shows the variables created:

Name	Type	Length	Size	Value
a	numeric	1	56 B	0.000260634083356357
b	numeric	1	56 B	0.955624396553548
c	numeric	1	56 B	0.993984730041823

2. If X is Poisson Distribution with mean 0.05, write R-program to evaluate and print the following -
- $P(X = 10)$
 - $P(X \leq 5)$
 - $P(12 \leq X \leq 25)$

Code –

```
m = 0.05
```

```
a = dpois(10, m)
```

```
b = ppois(5, m)
```

```
c = ppois(25, m) - ppois(11, m)
```

```
cat("P(X = 10) = ", a)
```

```
cat("P(X ≤ 5) = ", b)
```

```
cat("P(12 ≤ X ≤ 25) = ", c)
```

```
cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
```

Output –

The screenshot shows the R Studio environment with the following components:

- Source Editor:** Contains the R script code from the previous blocks, numbered 1 to 13.
- Environment:** A table showing the objects created in the global environment.
- Console:** Displays the output of the R script execution.

Name	Type	Length	Size	Value
a	numeric	1	56 B	2.55989579162252e-20
b	numeric	1	56 B	0.999999999979209
c	numeric	1	56 B	0
m	numeric	1	56 B	0.05

```
> m = 0.05
> a = dpois(10, m)
> b = ppois(5, m)
> c = ppois(25, m) - ppois(11, m)
> cat("P(X = 10) = ", a)
P(X = 10) = 2.559896e-20> cat("P(X ≤ 5) = ", b)
P(X ≤ 5) = 1> cat("P(12 ≤ X ≤ 25) = ", c)
P(12 ≤ X ≤ 25) = 0>
> cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
```

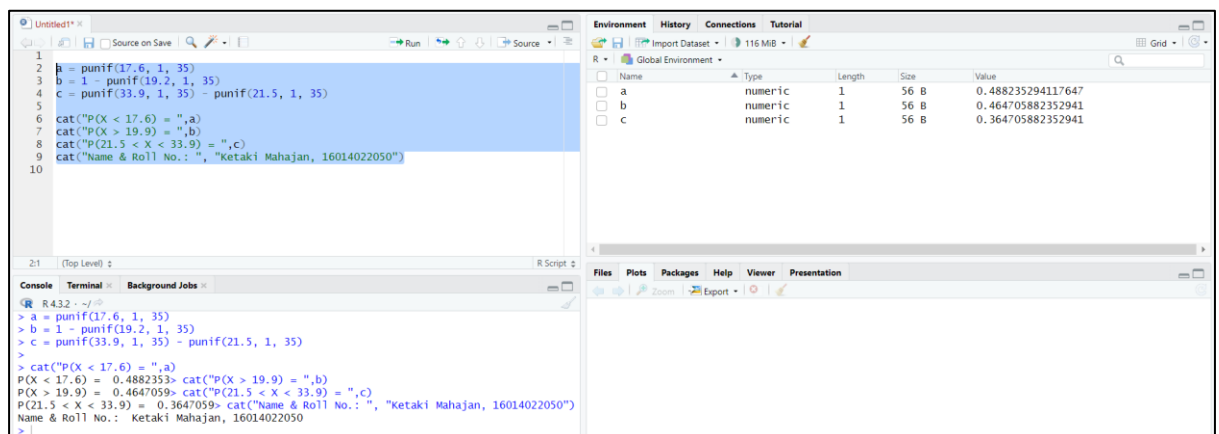
3. If X is Uniform Distribution over the range (1, 35), write R-program to evaluate and print the following -
- $P(X < 17.6)$
 - $P(X > 19.2)$
 - $P(21.5 < X < 33.9)$

Code –

```
a = punif(17.6, 1, 35)
b = 1 - punif(19.2, 1, 35)
c = punif(33.9, 1, 35) - punif(21.5, 1, 35)

cat("P(X < 17.6) = ",a)
cat("P(X > 19.2) = ",b)
cat("P(21.5 < X < 33.9) = ",c)
cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
```

Output –



The screenshot shows the RStudio interface. The script editor on the left contains the R code. The console on the bottom left shows the output of the code. The environment pane on the right shows the variables 'a', 'b', and 'c' with their respective values.

```
R 4.3.2 ~ /
> a = punif(17.6, 1, 35)
> b = 1 - punif(19.2, 1, 35)
> c = punif(33.9, 1, 35) - punif(21.5, 1, 35)
>
> cat("P(X < 17.6) = ",a)
P(X < 17.6) = 0.4882353> cat("P(X > 19.2) = ",b)
P(X > 19.2) = 0.4647059> cat("P(21.5 < X < 33.9) = ",c)
P(21.5 < X < 33.9) = 0.3647059> cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
Name & Roll No.: Ketaki Mahajan, 16014022050
> |
```

Name	Type	Length	Size	Value
a	numeric	1	56 B	0.488235294117647
b	numeric	1	56 B	0.464705882352941
c	numeric	1	56 B	0.364705882352941

4. If X is Exponential Distribution with mean 60, write R-program to evaluate and print the following -
- $P(X < 45)$
 - $P(X > 50)$
 - $P(5 < X < 75)$
 - Find value of k such that $P(X < k) = 0.7$

Code –

```
pa = 1/60
```

```
a = pexp(45, pa)
```

```
b = 1 - pexp(50, pa)
```

```
c = pexp(75, pa) - pexp(5, pa)
```

```
k = qexp(0.7, pa)
```

```
cat("P(X < 45) = ", a)
```

```
cat("P(X > 50) = ", b)
```

```
cat("P(5 < X < 75) = ", c)
```

```
cat("The value of k is ", k)
```

```
cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
```

Output –

The screenshot shows the R Studio environment with the following components:

- Source Editor:** Contains the R script code from the previous block.
- Environment:** A table showing the objects created in the global environment.
- Console:** Displays the output of the script execution.

Name	Type	Length	Size	Value
a	numeric	1	56 B	0.527633447258985
b	numeric	1	56 B	0.434598208507078
c	numeric	1	56 B	0.633539617769133
k	numeric	1	56 B	72.2383682595562
pa	numeric	1	56 B	0.0166666666666667

```
R 4.3.2 ~ />  
> pa = 1/60  
>  
> a = pexp(45, pa)  
> b = 1 - pexp(50, pa)  
> c = pexp(75, pa) - pexp(5, pa)  
> k = qexp(0.7, pa)  
>  
> cat("P(X < 5) = ", a)  
P(X < 5) = 0.527633447258985  
> cat("P(X > 3) = ", b)  
P(X > 3) = 0.434598208507078  
> cat("P(4 < X < 6) = ", c)  
P(4 < X < 6) = 0.633539617769133  
> cat("The value of k is ", k)  
The value of k is 72.2383682595562  
> cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")  
Name & Roll No.: Ketaki Mahajan, 16014022050  
>
```

5. If X is Normal Distribution with mean 20 and standard deviation 5, write R-program to evaluate and print the following -
- $P(X < 28)$
 - $P(X > 15)$
 - $P(10 < X < 35)$
 - Find value of k_1 such that $P(X < k_1) = 0.3$
 - Find value of k_2 such that $P(X > k_2) = 0.04$

Code –

```
a = pnorm(28, 20, 5)
b = 1 - pnorm(15, 20, 5)
c = pnorm(35, 20, 5) - pnorm(10, 20, 5)

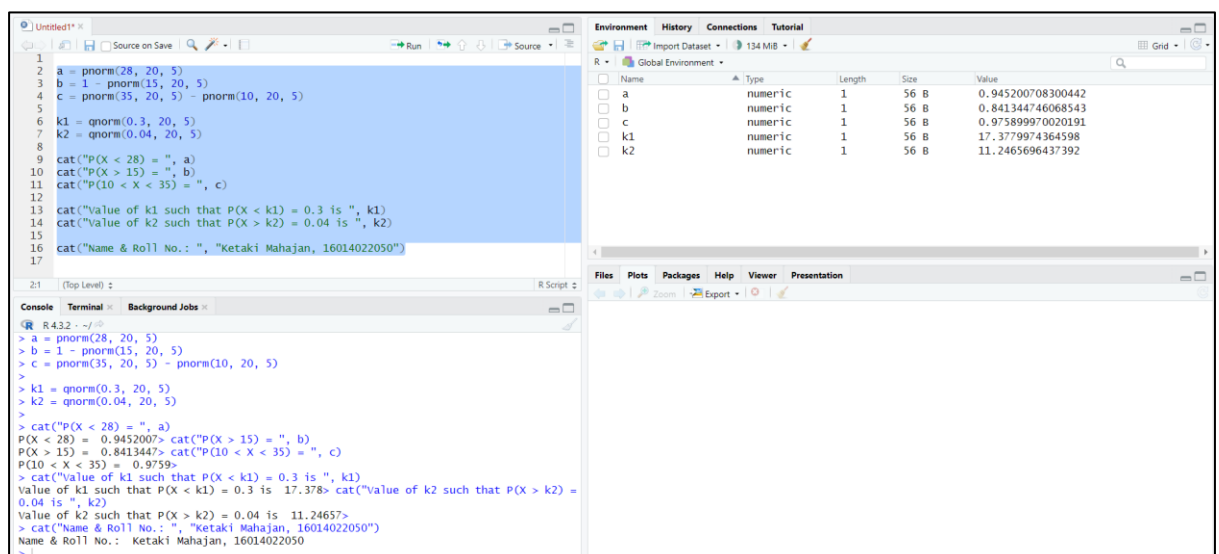
k1 = qnorm(0.3, 20, 5)
k2 = qnorm(0.04, 20, 5)

cat("P(X < 28) = ", a)
cat("P(X > 15) = ", b)
cat("P(10 < X < 35) = ", c)

cat("Value of k1 such that P(X < k1) = 0.3 is ", k1)
cat("Value of k2 such that P(X > k2) = 0.04 is ", k2)

cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
```

Output –



The screenshot shows the RStudio interface. The script editor on the left contains the R code from the previous block. The console on the right shows the output of the code execution. The output includes the values of a, b, c, k1, and k2, and the name and roll number of the student.

```
R 4.3.2 ~/>
> a = pnorm(28, 20, 5)
> b = 1 - pnorm(15, 20, 5)
> c = pnorm(35, 20, 5) - pnorm(10, 20, 5)
>
> k1 = qnorm(0.3, 20, 5)
> k2 = qnorm(0.04, 20, 5)
>
> cat("P(X < 28) = ", a)
P(X < 28) = 0.9452007> cat("P(X > 15) = ", b)
P(X > 15) = 0.8413447> cat("P(10 < X < 35) = ", c)
P(10 < X < 35) = 0.97599>
> cat("Value of k1 such that P(X < k1) = 0.3 is ", k1)
Value of k1 such that P(X < k1) = 0.3 is 17.378> cat("Value of k2 such that P(X > k2) = 0.04 is ", k2)
Value of k2 such that P(X > k2) = 0.04 is 11.24657>
> cat("Name & Roll No.: ", "Ketaki Mahajan, 16014022050")
Name & Roll No.: Ketaki Mahajan, 16014022050
>
```