

Faculty of Computing

Year 2 Semester 1 (2025)

IT2120 - Probability and Statistics

Lab Sheet 06

Lab Exercise 6 (Discrete Probability Distributions)

Before starting the lab sheet, you need to create a folder in your desktop and save all your working inside the folder. Set the working directory to that folder using the following command:

```
setwd("paste the path of the folder")
```

Eg:- `setwd("D:\\2025 - Sem 2\\IT2120\\Lab Sessions\\Lab 06")`

Use R to find the probabilities in the following questions.

1. A company claims that their drug treatment cures 92% of cases of hookworm in children. Suppose that 44 children suffering from hookworm are to be treated with this drug and that the children are regarded as a simple random sample taken from a large population of children suffering from hookworm. Let X denote the number of children cured from a sample of 44 children.
 - i. What is the distribution of X ?

```
##Setting the directory
setwd("D:\\2025 - Sem 2\\IT2120 - New\\Lab Sessions\\Lab 06")

##Question 01
#Part 1
#Binomial Distribution
#Here, random variable X has binomial distribution with n=44 and p=0.92
```

- ii. What is the probability that 40 children are cured?

```
#Part 2
#It asks to find  $P(X=40)$ . Following command gives the density.
#In other words, probability of getting an exact value can be calculated using "dbinom" command.
dbinom(40,44,0.92)
```

- iii. What is the probability that less than or equal to 35 children are cured?

```
#Part 3
#It asks to find  $P(X \leq 35)$ . Following command gives the cumulative
#probability ( $\leq$ ), if "lower.tail" argument equals to "TRUE".
pbinom(35, 44, 0.92, lower.tail = TRUE)
```

- iv. What is the probability that at least 38 children are cured?

```
#Part 4
#It asks to find  $P(X \geq 38)$ . This can find using "pbinom" command as follows.
#You need to rearrange the probability statement as follows.
 $P(X \geq 38) = 1 - P(X < 38) = 1 - P(X \leq 37)$ 
#Then command will be as follows.
1- pbinom(37, 44, 0.92, lower.tail = TRUE)
#Or else following command can also used by keeping argument "lower.tail" as "FALSE".
#Here, when that argument is "FALSE", it means that  $P(X > 37)$  which is same as  $P(X \geq 38)$ .
pbinom(37, 44, 0.92, lower.tail = FALSE)
```

- v. What is the probability that between 40 and 42 (both inclusive) children are cured?

```
#Part 5
#It asks to find  $P(40 \leq X \leq 42)$ . This can find using "pbinom" command as follows.
#You need to rearrange the probability statement as follows.
 $P(40 \leq X \leq 42) = P(X \leq 42) - P(X \leq 39)$ 
#Then command will be as follows.
pbinom(42, 44, 0.92, lower.tail = TRUE) - pbinom(39, 44, 0.92, lower.tail = TRUE)
```

2. Data from the maternity ward in a certain hospital shows that there is a historical average of 5 babies born in this hospital every day.

- i. What is the random variable (X) in the problem?

```
##Question 02
#Part 1
#Number of babies born in a hospital on a given day
```

- ii. What is the distribution of X?

```
#Part 2
#Poisson distribution
#Here, random variable X has poisson distribution with  $\lambda=5$ 
```

- iii. What is the probability that 6 babies will be born in this hospital tomorrow?

```
#Part 3
#It asks to find  $P(X=6)$ . Following command gives the density.
#In other words, probability of getting an exact value can be calculated using "dpois" command.
dpois(6, 5)
```

- iv. What about the probability of more than 6 babies be born in this hospital tomorrow?

```
#Part 4
#It asks to find  $P(X>6)$ . This can find using "ppois" command as follows.
#If you keep "lower.tail" argument as "TRUE", that means  $P(X\leq 6)$ .
#Since we need  $P(X>6)$ , keep the "lower.tail" argument as "FALSE".
ppois(6, 5, lower.tail = FALSE)
```

Exercise

Instructions: Create a folder in your desktop with your registration number (Eg: "IT....."). You need to save the R script file and take screenshots of the command prompt with answers and save it in a word document inside the folder. Save both R script file and word document with your registration number (Eg: "IT....."). After you finish the exercise, zip the folder and upload the zip file to the submission link.

1. An IT company claims that their newly developed learning platform improves student performance in online tests. According to previous data, 85% of students who used the platform passed their online tests. A batch of 50 students is selected at random who have completed the course using this platform. Let X denote the number of students who passed the test out of 50 students.
 - i. What is the distribution of X ?
 - ii. What is the probability that at least 47 students passed the test?
2. A call center receives an average of 12 customer calls per hour.
 - i. What is the random variable (X) for the problem?
 - ii. What is the distribution of X ?
 - iii. What is the probability that exactly 15 calls are received in an hour?