SLIIT UNI
THE KNOWLEDGE UNIVERSITY

Faculty of Computing

Year 2 Semester 1 (2025)

IT2120 - Probability and Statistics Lab Sheet 07

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 07")`

Use R to find the probabilities in the following questions.

1. A bus arrives at a bus stop uniformly between 7:00 a.m. and 7:30 a.m. Let the random variable X represent the number of minutes waiting for the bus between 7:00 a.m. and 7:30 a.m.

   i. What is the probability that the bus arrives within the first 10 minutes after 7:00 a.m.?

```
##Setting the directory
setwd("D:\\2025 - Sem 2\\IT2120 - New\\Lab Sessions\\Lab 07")

##Question 01
#Uniform Distribution
#Here, random variable X follows a uniform distribution with a=0 and b=30.

#Part 1
#It asks to find P(X<=10). Following command gives the cumulative
#probability (<=), if ""lower.tail" argument equals to "TRUE".
punif(10,min = 0, max = 30, lower.tail = TRUE)
```

   ii. What is the probability that the bus arrives after 7:20 a.m.?

```
#Part 2
#It asks to find P(X>20). This can find using "punif" command as follows.
#You need to rearrange the probability statement as follows.
#P(X>20) = 1-P(X<=20)
#Then command will be as follows.
1-punif(20,min = 0, max = 30, 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>20).
punif(20,min = 0, max = 30, lower.tail = FALSE)
```

2. The time (in hours) required to repair a machine is an exponentially distributed random variable with parameter $\lambda = \frac{1}{2}$.

   i. Find the probability that a repair time takes at most 3 hours.

```
##Question 02
#Exponential Distribution
#Here, random variable X has exponential distribution with lambda=0.5

#Part 1
#It asks to find P(X<=3). Following command gives the cumulative
#probability (<=), if ""lower.tail" argument equals to "TRUE".
pexp(3,rate = 0.5,lower.tail = TRUE)
```

   ii. Find the probability that a repair time exceeds 4 hours.

```
#Part 2
#It asks to find P(X>4). This can find using "pexp" command as follows.
#You need to rearrange the probability statement as follows.
#P(X>4) = 1-P(X<=4)
#Then command will be as follows.
1-pexp(4,rate = 0.5,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>4).
pexp(4,rate = 0.5,lower.tail = FALSE)
```

   iii. Find the probability that a repair time takes between 2 to 4 hours.

```
#Part 3
#It asks to find P(2<X<4). This can find using "pexp" command as follows.
#You need to rearrange the probability statement as follows.
#P(2<X<4) = P(X<=4)-P(X<=2)
#Then command will be as follows.
pexp(4,rate = 0.5,lower.tail = TRUE)-pexp(2,rate = 0.5,lower.tail = TRUE)
```

3. Assume that human body temperatures are normally distributed with a mean of 36.8C° and a standard deviation of 0.4C°

   i. A hospital uses 37.9C° as the lowest temperature considered to be a fever. What is the probability that randomly selected person would have a fever?

```
##Question 03
#Normal Distribution
#Here, random variable X has normal distribution with mean=36.8 and standard deviation=0.4

#Part 1
#It asks to find P(X>=37.9). Following command gives the cumulative
#probability (<=), if ""lower.tail" argument equals to "TRUE".
#You need to rearrange the probability statement as follows.
#P(X>=37.9) = 1-P(X<37.9)
#Then command will be as follows.
1-pnorm(37.9,mean = 36.8, sd=0.4, lower.tail = TRUE)
```

ii. What is the probability that a randomly selected person would have a temperature between 36.4C° and 36.9C° ?

```
#Part 2
#It asks to find P(36.4<X<36.9). This can find using "pnorm" command as follows.
#You need to rearrange the probability statement as follows.
#P(36.4<X<36.9) = P(X<=36.9)-P(X<=36.4)
#Then command will be as follows.
pnorm(36.9,mean = 36.8, sd=0.4, lower.tail = TRUE)-pnorm(36.4,mean = 36.8, sd=0.4,
                                                         lower.tail = TRUE)
```

iii. Physicians want to decide the maximum temperature which is needed for further medical tests. What should be that temperature, if they want only 1.2% of the people to fall below it?

```
#Part 3
#Let consider that the maximum temperature they want to find is "b".
#Then, P(X<b)= 1.2% = 0.012
#Here, they want to find the value of "b". This can be done using "qnorm" command.
qnorm(0.012,mean = 36.8, sd=0.4, lower.tail = TRUE)
```

iv. Physicians want to decide the minimum temperature which is needed for further medical tests. What should be that temperature, if they want only 1.0% of the people to fall above it?

```
#Part 4
#Let consider that the minimum temperature they want to find is "b".
#Then, P(X>b)= 1.0% = 0.01
#Here, they want to find the value of "b". This can be done using "qnorm" command.
#Here, you need to make the "lower.tail" argument as FALSE.
qnorm(0.01,mean = 36.8, sd=0.4, 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. A train arrives at a station uniformly between 8:00 a.m. and 8:40 a.m. Let the random variable X represent the number of minutes the train arrives after 8:00 a.m. What is the probability that the train arrives between 8:10 a.m. and 8:25 a.m.?
2. The time (in hours) to complete a software update is exponentially distributed with rate $\lambda = \frac{1}{3}$. Find the probability that an update will take at most 2 hours.
3. Suppose IQ scores are normally distributed with a mean of 100 and a standard deviation of 15.
    i. What is the probability that a randomly selected person has an IQ above 130?
    ii. What IQ score represents the 95th percentile?