

# IE6200: Engineering Probability and Statistics

Assignment: Lab 05

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## Lab Assignment Guidelines

1. Students need to complete the Lab assignment individually.
2. All the Lab assignments are required to be done in RStudio.
3. Provide necessary comments using '#' for better understanding of your script.
4. The lab report needs to include the following sections:
  - **Problem statement:** A brief about your understanding on the assignment questions (maximum 3 lines)
  - **Output:** What were your finding after creating the code and running it in R. This section may include:
    - Graphs/charts/plots
    - Final data frame/vectors for your result
    - Results obtained
  - **Conclusion:** What were the statistical inferences and observations from the results obtained.  
✓ Students are not required to include codes in reports.
5. If you take help from any external source, please mention that in reference. Penalties for cheating and plagiarism may include zero credit on the work.

## Deliverables:

1. Please submit a \*.zip file including the following items
  - i. R script (just 1 file including all your codes)
  - ii. Lab Report: Report with a maximum length of 10 pages including all appendices, tables, and graphs.
2. All of the above mentioned files have to be labeled as: 'Lab # - IE 6200 – Sec # - <Student Name>'
3. Submit your Lab deliverables via blackboard.

For each of the following questions:

- Define the Random Variable, like  $X \equiv R.V. \text{ of number of rejected pistons}$
- Define the distribution, for example, for normal distribution it would be  $X \sim \mathcal{N}(x; \mu = 20.05, \sigma = 0.02)$
- Use the R distribution functions to solve the problems

*For defining random variable and distribution, you can either type it in your report or have them handwritten and submit printed reports.*

**Question 1:** On average, 4 traffic accidents per month occur at a certain intersection. What is the probability that in any given month at this intersection

- (a) exactly 4 accidents will occur?
- (b) fewer than 3 accidents will occur?
- (c) at least 2 accidents will occur?

**Question 2:** The probabilities are 0.4, 0.2, 0.3, and 0.1, respectively, that a delegate to a certain convention arrived by air, bus, automobile, or train.

- (a) What is the probability that among 9 delegates randomly selected at this convention, 3 arrived by air, 3 arrived by bus, 1 arrived by automobile, and 2 arrived by train?
- (b) What is the probability that among 6 delegates randomly selected at this convention, 2 arrived by air, 2 arrived by bus, 1 arrived by automobile, and 1 arrived by train?

**Question 3:** A research scientist reports that mice will live an average of 40 months when their diets are sharply restricted and then enriched with vitamins and proteins. If the lifetimes of such mice are normally distributed with a standard deviation of 6.3 months, find the probability that a given mouse will live

- (a) more than 32 months
- (b) less than 28 months
- (c) between 37 and 49 months

**Question 4:** A large company has an inspection system for the batches of small compressors purchased from vendors. A batch typically contains 15 compressors. In the inspection system, a random sample of 5 is selected and all are tested. Suppose there are 2 faulty compressors in the batch of 15.

- (a) What is the probability that for a given sample there will be 1 faulty compressor?
- (b) What is the probability that inspection will discover both faulty compressors?

**Question 5:** If the probability that a fluorescent light has a useful life of at least 800 hours is 0.9, find the probabilities that among 20 such lights

- (a) exactly 18 will have a useful life of at least 800 hours
- (b) at least 15 will have a useful life of at least 800 hours
- (c) at least 2 will not have a useful life of at least 800 hours

**Question 6:** The time intervals between successive barges passing a certain point on a busy waterway have an exponential distribution with mean 8 minutes.

- (a) Find the probability that the time interval between two successive barges is less than 5 minutes.
- (b) Find the probability that the time interval between two successive barges is between than 4 to 6 minutes.

**Question 7:** The daily amount of coffee, in liters, dispensed by a machine located in an airport lobby is a random variable  $X$  having a continuous uniform distribution with  $A = 7$  and  $B = 10$ . Find the probability that on a given day the amount of coffee dispensed by this machine will be

- (a) at most 8.8 liters
- (b) more than 7.4 liters but less than 9.5 liters
- (c) at least 8.5 liters

**Question 8:** The probability that a student pilot passes the written test for a private pilot's license is 0.7. Find the probability that a given student will pass the test:

- (a) on the third try
- (b) on the first try

**Question 9:** Rate data often follow a lognormal distribution. Average power usage (dB per hour) for a company is studied and is known to have a lognormal distribution with parameters  $\mu = 4$  and  $\sigma = 2$ .

- (a) What is the probability that the company uses more than 270 dB during a particular hour?