

LLT Component

Unit 1

- 1) A company wants to evaluate the performance of two teams (Team X and Team Y). The performance score is measured on a scale from 1 to 100, and productivity data for 6 employees from each team is provided below.

Data:

Team X: 88, 92, 85, 79, 90, 95

Team Y: 82, 75, 78, 80, 70, 85

(Note : consider it as population data)

Questions:

- i. Calculate the mean, median, and mode (if any) for both teams to understand the central tendency of performance scores.
 - ii. Compute the range, variance, standard deviation , coefficient of variation for both teams to assess the dispersion of performance scores.
 - iii. Based on your analysis, which team shows higher consistency in employee performance? Provide a statistical justification for your conclusion.
 - iv. Find skewness and kurtosis for given data.
- 2) A school psychologist is examining the effects of two factors, "Study Hours" and "Sleep Duration," on students' "Exam Scores." The following data has been collected for 5 students over a specific academic term: (Note : consider it as population data)

Individual	Study Hours	Sleep Duration (hours)	Exam Score (%)
1	10	7	85
2	8	6	78
3	12	5	90
4	6	8	74
5	9	6	80

- a) Compute the mean,median,mode, range, variance, and standard deviation for both independent variables to analyze the dispersion of study hours and sleep duration.
- b) Determine which independent variable (Study Hours or Sleep Duration) has a stronger relationship with Exam Scores. Use statistical techniques to justify your analysis.
- c) Find skewness and kurtosis for all last three columns.
- d) Compute the correlation and coefficient between dependent and independent variables.

Unit 2

- 1) A security system requires users to create a 5-character access code using the letters A-Z (uppercase only). Each character in the code must be a letter, and letters cannot be repeated.
- 2) You are organizing a speaker panel for a conference and need to select 4 speakers from a pool of 10 applicants. The order in which the speakers are selected does not matter.
- 3) A company produces three types of beverages: A, B, and C. The probability of a beverage being defective is as follows: The probability of a beverage being defective for A is 0.02, The probability of a beverage being defective for B is 0.05. The probability of a beverage being defective for C is 0.01, The conditional probabilities that a defective beverage comes from each type are : The probability that a defective beverage is of type A is 0.2, The probability that a defective beverage is of type B is 0.3, The probability that a defective beverage is of type C is 0.35. If a defective beverage is discovered, what is the most likely type of beverage (A, B, or C) that it is?
- 4) A community center offers three types of sports activities: Swimming (S), Volleyball (V), and Table Tennis (TT). The participation data is summarized in the table below, categorized by age groups.

	Swimming (S)	Volleyball (V)	Table Tennis (TT)
Adult	80	50	40
Teen	30	60	20
Child	40	30	70

- i. What is the probability that a randomly chosen participant is enrolled in Volleyball (V)?
- ii. What is the probability that a randomly chosen participant is a Child?
- iii. What is the probability that a randomly chosen participant is an Adult enrolled in Swimming (S)?
- iv. What is the probability that a randomly chosen participant is a Teen enrolled in Table Tennis (TT)?
- v. What is the probability that a participant is an Adult given that the participant is enrolled in Volleyball (V)?
- 5) A traffic safety study examines the effect of seatbelt usage on accident outcomes. In the study, the results show the following: Drivers involved in accidents who were wearing seatbelts and had a minor injury: 15, Drivers involved in accidents who were wearing seatbelts and had a serious injury: 5, Drivers involved in accidents who were not wearing seatbelts and had a minor injury: 10, Drivers involved in accidents who were not wearing seatbelts and had a serious injury: 20.

- i) What are the odds in favor of a driver sustaining a minor injury while wearing a seatbelt compared to sustaining a serious injury?
 - ii) What are the odds against a driver sustaining a minor injury while not wearing a seatbelt?
 - iii) What is the probability of a driver sustaining a minor injury while wearing a seatbelt?
 - iv) Calculate the odds ratio of sustaining a minor injury while wearing a seatbelt compared to the odds of sustaining a minor injury without a seatbelt.
 - v) What does this odds ratio indicate about the effectiveness of wearing a seatbelt in minimizing injury severity during a traffic accident?
- 6) In a volleyball training camp, data was collected on the serving accuracy of a player. From 20 serves, the player successfully hit the target 14 times. Considering the same player, what is the probability that out of 60 serves
- Questions:
- i. Calculate the probability of hitting the target for five serves.
 - ii. Calculate the probability of hitting the target for 45 serves.
 - iii. determine the probability of hitting at most 55 serves will hit the target.
 - iv. Calculate the probability of hitting at least 2 serves
- 7) A local coffee shop receives an average of 15 customer arrivals per hour. The shop manager wants to determine the probabilities associated with customer arrivals to optimize staffing and inventory.
- i) What is the likelihood of receiving exactly 12 customer arrivals in a particular hour?
 - ii) What is the probability of receiving no more than 3 customer arrivals during the same hour?
 - iii) Additionally, the manager is interested in the overall probability of receiving more than 5 customer arrivals during the busiest 2-hour period of the day.
- 8) The yearly salaries of employees at a tech company are assumed to be normally distributed with a mean of \$75,000 and a variance of \$4,000,000.
- I) What is the probability that a randomly selected employee has a salary of more than \$78,000?
 - II) What is the probability that a randomly selected employee has a salary of less than \$73,000?

Unit 3

- 1) In a recent survey conducted to evaluate customer satisfaction at a local retail store, 300 customers were sampled. Among the respondents, 180 reported that they were satisfied with their shopping experience. Calculate the 90%, 95%, 99% confidence interval for the proportion of all customers (assuming a total of 1000 customers) who are satisfied with their shopping experience at the retail store.
- 2) A company claims that the average time employees spend on training is 20 hours per month. A random sample of 36 employees is taken, and it is found that the average time spent on training is 22 hours with a population standard deviation of 6 hours. At a 90%, 95%, 99% confidence level, can we conclude that the average training time for employees is significantly different from 20 hours? Assume data is normally distributed and calculate the confidence interval for the mean training time.
- 3) A researcher wants to assess the effect of a new study method on student performance. He collects test scores from a sample of 15 students who used the new method. The mean score of the sample is 78, and the standard deviation is 10. At a 90%, 95% and 99% confidence level, what is the confidence interval for the average test score of all students using the new study method? Perform the calculation Confident Intervals.

Unit 4

- 1) A beverage company claims that the average sugar content in their new energy drink is 15 grams per can with a standard deviation of 3 grams. A random sample of 50 cans is tested, and the sample mean sugar content is found to be 14 grams. Is there sufficient evidence at the 0.05 significance level to conclude that the mean sugar content is different from 15 grams? Use the critical region technique, p-value technique, and confidence interval technique to test the claim.
- 2) An electronics manufacturer claims that the average battery life of their latest smartphone model is at least 20 hours. A random sample of 30 smartphones shows a mean battery life of 18 hours with a standard deviation of 4 hours. At a significance level of 0.05, is there enough evidence to support the claim that the average battery life is less than 20 hours? Test this claim using the critical region technique, p-value technique, and confidence interval technique.
- 3) A health organization states that the average daily intake of water for adults should be at least 3 liters. However, in a study of 40 adults, the average daily intake was found to be 2.5 liters with a standard deviation of 0.8 liters. At a significance level of 0.01, can we conclude that the average daily intake of water is less than the recommended 3 liters? Use the critical region technique, p-value technique, and confidence interval technique to support your answer.
- 4) A bakery claims that their average weight of a dozen cookies is 300 grams. To test this claim, a quality control manager randomly weighs 20 batches of cookies and finds that the mean weight is 295 grams with a standard deviation of 10 grams. At a 0.05 significance level, is there evidence to suggest that the average weight of the cookies is the same as 300 grams? . Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 5) A manufacturer of light bulbs claims that their bulbs last at least 1000 hours on average. To test this claim, an inspector randomly tests 15 bulbs and records a mean lifespan of 950 hours with a standard deviation of 50 hours. At a significance level of 0.01, is there sufficient evidence to conclude that the average lifespan of the bulbs is less than 1000 hours? Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 6) A new fitness program claims that participants lose an average of at least 4 kg over a month. An independent study tests 12 participants, finding that the average weight loss is 5.5 kg with a standard deviation of 1.5 kg. At a 0.05 significance level, is there enough evidence to support the claim that the average weight loss is greater than 4 kg? Conduct a right-tailed t-test to evaluate this. Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.

- 7) A school claims that at least 30% of its students participate in extracurricular activities. A random sample of 200 students shows that 50 students participate in extracurricular activities. At a 0.01 significance level, is there sufficient evidence to conclude that the proportion of students participating in extracurricular activities is less than 30%?. Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 8) A recent survey found that 60% of people prefer coffee over tea. To test this claim, a market researcher randomly samples 150 people and finds that 70 of them prefer coffee. At a 0.05 significance level, is there evidence to suggest that the proportion of people who prefer coffee is different from 60%?. Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 9) A health department claims that more than 25% of adults in a city are physically active. A study surveyed 400 adults and found that 120 of them reported being physically active. At a significance level of 0.05, is there enough evidence to support the claim that the proportion of physically active adults is greater than 25%?. Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 10) A manufacturer produces two types of batteries and claims that the new battery (Battery A) lasts longer than the older version (Battery B). A random sample of 50 Battery A units shows a mean lifespan of 280 hours with a standard deviation of 20 hours. For Battery B, a sample of 40 units shows a mean lifespan of 260 hours with a standard deviation of 25 hours. At a significance level of 0.05, is there enough evidence to support the claim that Battery A lasts longer than Battery B?. Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 11) A nutritional study is conducted to compare the average sugar content in two different brands of cereal. A sample of 30 boxes of Brand X shows a mean sugar content of 12 grams with a standard deviation of 3 grams, while a sample of 25 boxes of Brand Y shows a mean sugar content of 10 grams with a standard deviation of 4 grams. At a 0.01 significance level, is there evidence to suggest that the average sugar content is different between Brand X and Brand Y? Use the (critical region technique, p-value technique, and confidence interval) any one technique to support your answer.
- 12) A company wants to compare the effectiveness of two different promotional strategies on sales. The sales figures (in thousands) from the first strategy were reported as: 45, 50, 55, 40, and 60, while the sales figures from the second strategy were: 55, 60, 65, 57, and 62. At a 0.01 significance level, is there sufficient evidence to support the claim that one promotional strategy leads to higher average sales than the other? Use the critical region technique to support your answer.

- 13) A researcher is testing the effectiveness of a new study technique. She records the test scores of 15 students before and after they use the new technique:

Before: 70, 75, 80, 85, 90, 65, 75, 80, 85, 78, 88, 92, 84, 76, 82

After: 78, 80, 85, 90, 94, 70, 80, 84, 89, 82, 90, 95, 88, 80, 86

At a significance level of 0.01, is there sufficient evidence to conclude that the new study technique improves students' test scores? Use the critical region technique to support your answer.

- 14) A health program is designed to help participants reduce their weight. Ten participants' weights are measured before and after the program, yielding the following results (in kg):

Before: 80, 75, 90, 85, 70, 95, 88, 82, 77, 92

After: 78, 74, 85, 82, 68, 91, 86, 80, 75, 90

At a 0.05 significance level, is there enough evidence to suggest that the health program has resulted in a significant weight loss? Conduct a paired sample t-test to analyze the results.

- 15) A local health department claims that the proportion of smokers in City A is higher than in City B. A survey conducted in City A finds that out of 200 residents, 80 are smokers. In City B, a survey of 250 residents shows that 50 are smokers. At a 0.05 significance level, is there enough evidence to support the claim that the proportion of smokers in City A is higher than in City B?. Use the critical region technique to support your answer.

- 16) A local health department claims that the proportion of smokers in City A is higher than in City B. A survey conducted in City A finds that out of 200 residents, 80 are smokers. In City B, a survey of 250 residents shows that 50 are smokers. At a 0.05 significance level, is there enough evidence to support the claim that the proportion of smokers in City A is higher than in City B?. Use the pvalue technique to support your answer.

- 17) A new marketing campaign is launched in two different regions to promote a new product. In Region 1, out of 500 individuals surveyed, 150 expressed a positive opinion about the product. In Region 2, out of 600 individuals surveyed, 180 reported a positive opinion. At a significance level of 0.01, is there evidence to suggest that the proportions of individuals expressing a positive opinion about the product differ between the two regions?. Use the pvalue technique to support your answer.
