Business Problem Statement

HealthCare Plus is a multi-specialty hospital that provides medical consultations, treatments, and diagnostic services. The hospital management wants to use statistical analysis to optimize operations, improve patient care, and make data-driven decisions. To achieve this, HealthCare Plus has collected data on patient admission times, recovery durations, patient satisfaction scores, effectiveness of different treatments, hospital expenses, and staff efficiency. The goal is to analyze this data and provide insights that can help improve hospital operations, enhance patient satisfaction, and reduce unnecessary expenses.
You have been assigned the task of conducting a statistical analysis of the collected data to support hospital management in making informed decisions.

Section A

1.HealthCare Plus recorded the daily number of patient admissions for the past 10 days:

[32, 28, 35, 30, 29, 27, 31, 34, 33, 30]

- Compute the mean, median, and mode of patient admissions.
- Which measure best represents patient admissions?
- If the hospital increases its admission capacity by 10%, how will this affect the measures of central tendency?

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2. The recovery duration (in days) of 10 patients who underwent the same surgery is recorded as follows:

[5, 7, 6, 8, 9, 5, 6, 7, 8, 6]

- Calculate the range, variance, and standard deviation.
- What does the standard deviation indicate about variability in recovery times?
- If two new patients take 4 and 10 days to recover, how will this impact the standard deviation?

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3. Patient satisfaction scores (on a scale of 1 to 10) collected from a hospital survey are:

[8, 9, 7, 8, 10, 7, 9, 6, 10, 8, 7, 9]

- Compute skewness and kurtosis.
- Interpret the results—does the data suggest a normal distribution?
- If the hospital implements a new customer service initiative and satisfaction scores shift higher, what type of skewness change would you expect?

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4. HealthCare Plus wants to analyze the relationship between nurse staffing levels and patient recovery time. Data from 6 hospital departments is provided:

Number of Nurses	Average Recovery Time (days)
10	8
12	7
15	6
18	5
20	4
22	3

- Compute the correlation coefficient between nurse staffing and patient recovery time.
- If the hospital increases the number of nurses by 5 per department, how will this affect the recovery time based on the trend?

Section B

5. The hospital claims that the average patient wait time in the emergency department is 30 minutes. A sample of 10 patient wait times (in minutes) is recorded:

[32, 29, 31, 34, 33, 27, 30, 28, 35, 26]

- Test whether the hospital's claim is valid at a 5% significance level.
- State the null and alternative hypotheses.
- If the wait time significantly exceeds 30 minutes, what changes should the hospital implement to reduce waiting time?

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6. A survey was conducted on hospital cleanliness and patient satisfaction. The following data was collected:

Cleanliness Rating	Satisfied Patients	Unsatisfied Patients
High	90	10
Medium	60	40
Low	30	70

- Perform an analysis to check whether hospital cleanliness and patient satisfaction are dependent.
- If cleanliness ratings improve, how do you expect the distribution of satisfied and unsatisfied patients to change

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7. The hospital tested three different treatment methods (A, B, and C) for managing post-surgery pain. The recovery durations (in days) under each treatment are:

- Treatment A: [5, 6, 7, 5, 6]
- Treatment B: [8, 9, 7, 8, 10]
- Treatment C: [4, 5, 6, 5, 4]
- Conduct an analysis to check if there is a significant difference in recovery times among the treatment methods.
- State the null and alternative hypotheses.

- If the hospital introduces a new treatment (D), what data should be collected before concluding its effectiveness?

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8. The hospital administration time (in minutes) for 12 patients is recorded as:

[12, 15, 14, 16, 18, 13, 14, 17, 15, 19, 16, 14]

- Analyze whether the administration times follow a normal distribution.
- Explain why this analysis is important in healthcare data.
- If emergency cases increase, how would you expect the distribution of administration times to change?

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9. The hospital is studying the distribution of patient arrival times in the emergency department. Historical data suggests that emergency cases arrive at an average rate of 5 per hour.

- Model this scenario using an appropriate probability distribution.
- What is the probability that exactly 3 emergency cases will arrive in the next hour?
- If a major accident occurs in the city, how would this affect the probability distribution of emergency arrivals?

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10. The number of surgeries performed per day in the hospital follows a specific distribution pattern. Historical data shows the following frequencies:

Surgeries Performed	Frequency
0	5
1	12
2	18

3	22
4	15
5	8

- Identify and justify the type of probability distribution that best fits this data.
- Calculate the expected number of surgeries performed per day.
- If a new surgical team is hired, how will this affect the probability distribution of daily surgeries?

Submission Guidelines

- **Submit a Jupyter Notebook containing all answers.**
- **Include proper explanations and step-by-step calculations.**

Submission Instructions:

To submit your assignment, please follow these guidelines:

- Ensure that your assignment is fully completed.
- Push your assignment to a GitHub repository.
- Share the repository link by including it in a text, Word, or PDF file format.
- Submit the file/text containing the repository link via Vlearn.