

 **Exam Type:** Theory + Practical

 **Duration:** 6 Hours

 **Dataset:** A gigantic CSV dataset: `employee_performance.csv` (Generate from an AI tool)

Project Problem Statement:

You are provided with a dataset (`employee_performance.csv`) containing ~4000 records with the following fields:

- Employee_ID
- Department
- Age
- Salary
- Projects_Completed
- Working_Hours
- Performance_Score (0–100)
- Promotion_Status (Yes/No)

Your goal is to **write short theory explanations** and perform **Python-based analysis** to explore employees' performance and probability of promotion.

Exam Tasks

Part A – Theory (Short Questions)

1. Define **Mean, Median, Mode** with an example in the context of employee salaries.
2. Differentiate between **Range and Variance** with examples.
3. What is the difference between **Normal Distribution** and **Poisson Distribution**?
4. Explain **Skewness** and give one workplace-related example.
5. Define **Conditional Probability** and explain how it applies in promotions.
6. Explain **Independent vs Mutually Exclusive Events** with examples.
7. What does **Bayes Theorem** help us in real-world decision-making?
8. Write a short note on **PCA (Principal Component Analysis)** in simple words.

Part B – Practical (Python Programming)

Step 1: Central Tendency & Dispersion

- Find **mean, median, and mode** of Salary.
- Calculate **variance and standard deviation** of Projects_Completed.

Step 2: Probability & Events

- Find the probability of employees getting promoted.
- Create a **contingency table** between Promotion_Status and Department.
- Compute **conditional probability**: $P(\text{Promotion} \mid \text{Performance_Score} > 80)$.

Step 3: Distributions & Visualization

- Plot a **Histogram** of Performance_Score with a Gaussian curve.
- Check **Skewness and Kurtosis** for Salary.
- Draw a **Q-Q Plot** of Projects_Completed.

Step 4: Linear Algebra Application

Take the first 5 employees' [Projects_Completed, Working_Hours] as **vectors**.

- Perform **dot product** between two employee vectors.
- Find **Norm 1 & Norm 2** of an employee's work vector.
- Compute the **angle** between two employees' work vectors.

Deliverables (to be submitted)

1. **Python file / Jupyter notebook** with all calculations.
2. **PDF/Word report** with:
 - Short theory answers (Part A).
 - Screenshots/outputs of Part B practical tasks.
 - 3–5 key insights (e.g., "Employees with Performance_Score > 80 have 70% chance of promotion").

Practical Exam
Mathematics & Advanced Statistics

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