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- ⌚ Exam Type: Theory + Practical
 - ⌚ Duration: 6 Hours
 - 📦 Dataset: A gigantic CSV dataset: loan_applications.csv (Generate from an AI tool)
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Project Problem Statement:

You are provided with a dataset (loan_applications.csv) containing ~5000 records with the following fields:

- Customer_ID
- Age
- Income
- Loan_Amount
- Credit_Score
- Loan_Term (months)
- Default_Status (Yes/No)

Your goal is to explain key statistical concepts in theory and then apply Python-based statistical & probability analysis to evaluate loan default risk.

Exam Tasks

Part A – Theory (Short Questions)

1. Explain Mean, Median, Mode in the context of customer income.
2. Differentiate between Standard Deviation and Variance using loan amounts.
3. What is a Random Variable? Give one example from the dataset.
4. Explain Conditional Probability in terms of loan defaults.
5. Define Bayes Theorem and mention how banks can apply it.
6. Differentiate between Empirical Probability and Theoretical Probability with examples.
7. What is a Poisson Distribution? Give a business example.

8. Write a short note on Eigenvalues and Eigenvectors in data analysis.
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Part B – Practical (Python Programming)

Step 1: Central Tendency & Dispersion

- Find mean, median, and mode of Income.
- Calculate range, variance, and standard deviation of Loan_Amount.

Step 2: Probability & Events

- Compute probability of loan default.
- Create a contingency table between Default_Status and Credit_Score (categorized into ranges).
- Compute conditional probability: $P(\text{Default} | \text{Credit_Score} < 600)$.

Step 3: Distributions & Visualization

- Plot a Histogram of Credit_Score with a Gaussian curve.
- Check Skewness and Kurtosis of Loan_Amount.
- Draw a Q-Q Plot for Income.

Step 4: Linear Algebra Application

Take the first 5 customers' [Income, Loan_Amount] as vectors.

- Perform dot product between two customer vectors.
 - Find Norm 2 of a customer's financial vector.
 - Calculate the angle between two customers' vectors.
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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 insights (e.g., “Customers with Credit Score < 600 have 65% chance of default”).
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Practical Exam Mathematics & Advanced Statistics

BRING ON YOUR CODING ATTITUDE