**Department of Computer Science and Engineering (Data Science)**

**S.Y.B.Tech. Sem: IV**

**Subject:** Computational Methods and Pricing Models Laboratory

**Experiment 1**

**Name: SAP ID:**

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| **Date:** | **Experiment Title:** Loan Payment Calculator and Amortization Schedule |
| Aim | To calculate the EMI for a given loan using the standard mortgage payment formula, generate an amortization schedule, visualize the breakdown of payments, and perform a parametric study on the effects of tenure and interest rate. |
| Software | Python on Google Colab |
| Theory | A **loan amortization schedule** is a structured table that details the periodic payments made on a loan. Each instalment consists of two components:   1. **Principal Repayment** – The portion of the payment that reduces the outstanding loan balance. 2. **Interest Payment** – The cost paid to the lender for borrowing money, which is based on the remaining principal.   The loan payments remain **constant** (EMI stays the same), but the composition changes over time:   * Initially, a larger portion of the EMI goes toward interest, while a smaller portion contributes to the principal. * Gradually, as the outstanding loan balance decreases, the interest portion reduces, and the principal portion increases.   The EMI (Equated Monthly Installment) is calculated using the formula:    Where:   * P = Loan Amount * r = Monthly Interest Rate (Annual Rate / 12 / 100) * n = Total Number of Payments (Term in Months)   The principal and interest components change over time, with a higher portion of the early payments going toward interest. The outstanding loan balance reduces over time as principal payments increase.  A parametric study helps understand how changes in tenure and interest rate affect the total amount paid and interest paid.  **The Impact of Loan Parameters**  **Interest Rate Effect**   * A higher interest rate increases the EMI and the total amount paid over the loan term. * A lower interest rate reduces the EMI and the total cost of the loan.   **Loan Tenure Effect**   * A longer tenure reduces the EMI but increases the total interest paid. * A shorter tenure increases the EMI but decreases the overall interest paid, making the loan more economical.   **Total Interest Paid**   * The total interest paid over the loan duration can be computed as:   Total Interest = (EMI × n) − P   * Loans with longer tenures tend to result in much higher interest payments due to the extended period of borrowing.   **Outstanding Loan Balance**   * The outstanding balance reduces over time as principal payments accumulate. * The formula to calculate the outstanding balance after a given month mmm is: * This helps in understanding how much of the loan is still unpaid at any given time. |
| Implementation | **Step 1: Calculate EMI for the given loan details**   * Define the given loan parameters:   + Loan Amount = Rs. 1 Cr   + Interest Rate = 9% annually   + Term = 20 years (240 months) * Use the mortgage payment formula to compute EMI.   **Step 2: Generate and display the amortization schedule**   * Calculate the monthly interest and principal paid for each month. * Update the remaining loan balance iteratively. * Display the first 10 and last 10 rows of the amortization schedule.   **Step 3: Visualize monthly breakdown of principal and interest**   * Use a bar chart or stacked area plot to show how the principal and interest components change over time.   **Step 4: Visualize loan balance over time**   * Plot the declining loan balance over the repayment period.   **Step 5: Conduct a parametric study**   * Vary the loan tenure (e.g., 10, 15, 25, and 30 years). * Vary the interest rate (e.g., 7%, 8%, 9%, 10%). * Analyze and visualize the effects on:   + EMI   + Total Interest Paid   + Total Amount Paid * Use different graphs to illustrate the findings and discuss conclusions. |
| Conclusion | (Write your conclusions) |