Case Study

The Python project, titled "EMI Calculator," has been developed to offer a glimpse into the monthly and yearly EMI (Equated Monthly Installment) calculations based on user-provided data. While a few examples have been included in the context to illustrate the functionality of the project, it is designed to work seamlessly with any user-provided data, as it is dynamic in nature. In this case, four problem statements have been taken into consideration, which are as follows:

1. Let's calculate the Home Loan EMI now using Python code. Principal Amount 50Lakhs, Rate of interest 8%, and Loan repayment tenure is 15 years. Find the EMI to be paid?

2. If the interest rate increases to 10%, and you cannot pay more than 30,000 as EMI, find the maximum amount of Loan you can take/afford for the same period?

3. For the Q1., what is the total interest paid by you year-wise (from the 1st year to the 15th year). Also, what is the total cumulative interest paid by you in 15 years?

4. For the Q1., in how many months would you have paid at least 50% of the principal amount.

Project Details

First numpy & pandas package has been imported as np, pd in the current working notebook.

For the first problem statement, i.e.,

1. Let's calculate the Home Loan EMI now using Python code. Principal Amount 50Lakhs, Rate of interest 8%, and Loan repayment tenure is 15 years. Find the EMI to be paid?

p = Principal Amount (eg: 5000000) | r = Yearly Interest Rate (eg: 8%) | n = Total Tenure in Years (eg: 15Yrs)

Now the formula for calculating monthly EMI is:

$$\text{EMI} = \frac{p * \text{irm} * (1+\text{irm})^{\text{nmy}}}{((1+\text{irm})^{\text{nmy}} - 1)}$$

{where, irm $= \frac{r}{12*100}$ i.e., monthly interest rate & nmy = 12*n i.e., tenure in months}

Hence, for the first problem statement, using the above EMI formula the output received as 47782.60 rupees, i.e., the monthly emi is 47782.60 rupees.

For the second problem statement, i.e.,

2. If the interest rate increases to 10%, and you cannot pay more than 30,000 as EMI, find the maximum amount of Loan you can take/afford for the same period?

p = Unknown? | r = Yearly Interest Rate (eg: 10%) | n = Total Tenure in Years (eg: 15Yrs) | EMI = 30000

Hence, from the traditional EMI formula the maximum amount of loan can be calculated as,

$$p = EMI * \frac{((1+irm)^{nmy} - 1)}{(irm * (1+irm)^{nmy})}$$

{where, $irm = \frac{r}{12*100}$ i.e., monthly interest rate & $nmy = 12*n$ i.e., tenure in months}

For the second problem statement, using the above formula of the output as the maximum amount of loan can be possible with the given conditions are 2791723.16 rupees.

Now, for the third problem statement a separate library package named numpy_financial has been imported to the current working notebook. This package has several other financial functions can be very useful to do such kind of calculations. Hence, the third problem statement is;

3. For the Q1., what is the total interest paid by you year-wise (from the 1st year to the 15th year). Also, what is the total cumulative interest paid by you in 15 years?

In the last two cases, we considered the monthly emi, but for this problem the tenure will be considered as yearly wise, so the tenure range will be 1 to 15 as the respective tenure is for 15 years.

The npf.ipmt function will provide the yearly total interest paid by the user... hence for the 15 years the data will be...

No.	Year	Yearly Total Instalment Amount
0	1	400000.00
1	2	385268.18
2	3	369357.82
3	4	352174.63
4	5	333616.78
5	6	313574.30
6	7	291928.43
7	8	268550.89
8	9	243303.14
9	10	216035.57
10	11	186586.60
11	12	154781.71
12	13	120432.43
13	14	83335.20
14	15	43270.20

For the second part this problem statement, the tenure has been considered again on monthly basis, i.e., the range has again changed to 1 to 180. This time npf.ipmt function is providing the

monthly interest amount of the emi. And the np.cumsum function is providing the total cumulative sum of the interests amount paid by the user for the 15 years, and the respective amount is 3600868.76 rupees.

For the fourth problem statement;
4. For the Q1., in how many months would you have paid at least 50% of the principal amount.

This particular problem is a bit tricky; at first glance, it may appear that 50% of the principal stands for 2,500,000 rupees. However, technically, it does not. The fact that this problem statement is addressing is how many months it will take for the PPMT value to cover 50% of the principal value. In other words,

EMI consists of two components:

$$EMI = PPMT + IPMT$$

{As per the rules, over time, the PPMT amount increases while the IPMT amount decreases, ultimately keeping the EMI amount unchanged, only if the interest rate remains unaffected.}

The calculation shows that, after making EMI payments for 115 months, the user would be able to repay 50% of the principal amount.

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