miracl Challenge - Senior Software Engineer

Our Problem

The miracl team did it! We managed to improve the conversion rate of our website so much that our mortgage specialists can't keep up with the demand anymore. It's up to you now to build a first version of the Mortgage Engine, which will help mortgage specialists to save time on deciding which bank fits a customer's request best.

Our Data

Max is looking for a mortgage for a house in the 23rd district of Vienna he's looking to purchase. The purchase price of the house is € 300,000 and he has € 50,000 available as down payment which he wants to use to the full extent. His income is high enough for all banks to gladly accept his request - if there is enough security to back the mortgage in case Max goes bankrupt. Of course, Max wants to have as much money as possible available at the end of each month so he's looking to compare monthly rates of each bank offer.

The banks we are cooperating with sent us the following guidelines to evaluate eligibility of incoming customer requests:

- Bank MoneyFull:
    - LTV of up to 90%
    - Interest rate of 1.2% p.a. nominal
    - Runtime of 30 years
    - Financing costs of 3%
- Bank WorthMoney:
    - LTV of up to 87%
    - Interest rate of 1.1% p.a. nominal
    - Runtime of 35 years
    - Financing costs of 2.5%
- Bank PlentyGold:
    - LTV of up to 80%
    - Interest rate of 1% p.a. nominal
    - Runtime of 25 years
    - Financing costs of 3%

Can you help Max get the best mortgage by building a Mortgage Engine that A. tells him which banks he's eligible for and B. what monthly rate they offer?

After you're done, please upload your code to a private repository on GitHub and share it with thomas.taschauer@miracl.at.

Our Terminology

LTV is Loan To Value and is the ratio of the debt amount vs the value of the property (for the sake of simplicity assumed to be equal to the purchase price). It is used to determine eligibility of a customer.
Calculation: *Debt amount / Purchase price*

Debt amount is the amount of money you are borrowed by the bank, including financing costs.
Calculation: *Purchase price - Down payment + Financing costs*

Financing cost is additional costs added by the bank, like a fee to run your account or legal fees. It is calculated based on the payout amount.

Payout amount is the amount of money you are given by the bank.
Calculation: *Purchase price - Down payment*

Monthly rate is what a customer pays the bank each month. It includes interest, paying back the debt and financing costs.
Calculation: [Wikipedia](#)

Your Solution

Here's what we pay attention to when reviewing your result:
- Our Mortgage Engine at miracl is written in TypeScript, so keep that in mind when choosing a programming language. Similar languages are preferred, but feel free to use what you think is best for this task
- Model input and output data format in a way that supports future growth
    - Input data should cover both personal as well as financial data to support according bank guidelines
    - Output data should cover both end-user needs as well as internal needs for mortgage specialists
- Model code architecture in a way that supports future growth
    - Banks offer different interest rates based on runtime, LTV, etc
    - Banks have a wide range of rules to determine if a customer is eligible (e.g. age)
    - Many more banks to come
- Cover critical calculations of the Mortgage Engine with unit tests. To get you started, here are the results of "Bank WorthMoney" to test your implementation with:
    - LTV for Max is 85%
    - Max is eligible
    - Monthly rate is 734.69€

Lacking criteria can be made up by outstanding performance on the other criteria and / or explaining your reasoning in a follow-up meeting.

One more challenge…

The given interest rate does not take financing costs into account. However, customers prefer to compare different offers with all costs included by looking at the "effective interest rate". Given the formula to calculate the monthly rate, you would need to use the payout amount instead of the debt amount and invert the calculation.

For example, the calculated effective interest rate for a debt amount of € 250,000 with total costs of € 348,423.12 (including additional financing costs and interest) over 35 years should be close to 2.25%.

We'll talk about your approach to calculate it during a follow-up meeting.