CS153/453 Fall 2017

HW 9

Due: Monday Nov 6, 2017 11:59pm (before midnight)

Task 1

Consider the chocolate bar problem from HW1. Plot a graph of the average cost per chocolate bar (y-axis) versus the amount of money n (x-axis), for n between \$20 to \$100.

Task 2

Consider the mortgage problem where A is the loan amount, $rate$ is the annual interest rate ($rate = 0.05$ for 5% annual interest rate), and m is the number of months of the loan (m= 360 for a 30-year loan).

For a fixed-rate mortgage, the monthly payment amount is computed by the formula:

$$\frac{A\, r(1+r)^m}{(1+r)^m - 1}$$

where $r = \frac{rate}{12}$ is the monthly interest rate.

Suppose we take out loan of $A = \$200,000$ for a 30-year fixed rate mortage with annual interest rate of 7%.

It is offered to us that one can pay points to get a better interest rate. A point is one percent of the loan amount. We are told that by paying 3.25 points, we can get an interest rate of 5%. That is, one has to pay $0.0325 \times 200000 = \$6500$ for the points. After paying the points, the amount we owe is still \$200,000. But the annual interest rate for the 30-year loan becomes 5%.

For the two loan options, we want to make a plot of the cumulative amount of money paid over the 360 months of payment period. You are asked to print the two plots on the same figure so that we can compare them. That is, the x-axis is the months number ranging from 0 to 360, and the y-axis is the total payment paid up to (and include) a certain month number. If the month number is 2, we plot the sum of the first two payments. Note: It is expected that both plots are linear. You should give title for the figure, label the axes, and give legend for the two plots.

Task 3 (for CS453 only)

We extend Task 2 to allow a third type of 30-year loan with two rates.

If is offered to us that we can have a lower annual interest rate (teaser rate) of 4.5% for the first 48 months (4 year), and after that the annual interest rate will be 9.5% for the rest of remaining 26 years of the loan.

For the first 48 months, the monthly payment is calculated by pretending that the $200,000 loan is taken for a fixed rate 30-year loan of 4.5%.

After 48 months (that is, starting with 49-th month), we need to recalculate the monthly payment: we first calculate the outstanding loan balance A' after the first 48 payments. As there are still 26 years for the loan period, we re-calculate the montly payment for a 26-year fixed loan for the amount of A' and annual interest rate of 9.5%.

You are asked to incorporate into the graph for Task 2 with a third plot for the cumulative amount of money paid for the 2-rate loan that is offered to us.