CS 171 - Programming Assignment 1

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1 Overview

The goal of this assignment is to compare three different types of student loans. Develop a program that asks the user for the amount they want to borrow. Show information about each loan to help the user decide which is best.

2 Loan Calculations

2.1 Subsidized Federal Direct Loans

Federal Subsidized Loans do not start accruing interest until after graduation from college. There are a few values that are needed to compute information about the loan.

Name	Explanation
P	**P**rinciple: The amount of money loaned.
y	The number of **y**ears the loan is for.
t	The **t**imes per year interest is compounded. For this assignment, t=12.
i	The **i**nterest rate as a decimal number.
f	The **f**ee rate for the loan.

The monthly payment is computed using the following formula.

$$M = \frac{P * i}{t * \left(1 - \left(1 + \frac{i}{t}\right)^{-y*t}\right)} \tag{1}$$

For example, someone borrows $\$4,000.00$ at 3.4% interest for 10 years. Their monthly payment is be computed as

$$P = 4000 \tag{2}$$
$$i = 0.034 \tag{3}$$
$$y = 10 \tag{4}$$
$$t = 12 \tag{5}$$
$$M = \frac{4000 * 0.034}{12\left(1 - \left(1 + \frac{0.034}{12}\right)^{-10*12}\right)} \tag{6}$$
$$= \frac{136}{3.454648520} \tag{7}$$
$$= 39.36724 \tag{8}$$

The monthly payment is \$39.37.

To compute the total amount paid over the course of the loan, multiply this amount by the number of payments. Math should be done with the exact number, do not rounded the value.

$$\text{Balance} = M * t * y \tag{9}$$
$$= 39.36724 * 12 * 10 \tag{10}$$
$$= 4724.06880 \tag{11}$$

The total amount paid on the loan is $\$4,724.07$.

The amount of interest paid is the total paid minus the principle.

$$\text{Interest Paid} = \text{Balance} - P \tag{12}$$
$$= 4724.06880 - 4000 \tag{13}$$
$$= 724.06880 \tag{14}$$

The interest paid on this loan is \$724.07.

When a loan is taken out, there is also a fee charged. The fee is based only on the principle. On this loan, the fee is 1.051%.

$$\text{Fee} = P * f \tag{15}$$
$$= 4000 * 0.01051 \tag{16}$$
$$= 42.04 \tag{17}$$

The total extra cost of the loan is the fee plus the interest paid. A summary of the loan information is provided below for a Subsidized Federal Loan.

Principle	$4,000.00
Interest Rate	3.4%
Years	10
Monthly Payment	$39.37
Total Paid on Loan	$4,724.07
Total Interest Paid	$724.07
Additional Fees Paid	$42.04
Total Costs Over Principle	$766.11

2.2 Unsubsidized Federal Direct Loans

Unsubsidized Federal Loans and PLUS loans work in a similar way. The main difference is that interest accumulates while in school. This means, the starting principle balance will be higher then the amount taken out. The current interest rate for an unsubsidized loan is 6.8%. If someone borrowed $4,000 on a ten year loan, they are adding interest to their principle throughout college.

The amount of principle the student will be paying after 4 years is computed using the following formula.

$$\begin{aligned} \text{New Principle} &= P * (1 + i * 4.25) && (18)\\ &= 4000 * (1 + 0.068 * 4.25) && (19)\\ &= 5156.00 && (20) \end{aligned}$$

To compute the monthly payments for the loan, we need to start with $5,156.00 as the principle instead of $4,000. This accounts for all the extra interest the student gained during their education. Notice the number 4.25 is used. Loan repayments don't start the day of graduation. This means interest is gained for a little over 4 years.

Once we know the balance when payment starts, the remaining calculations are the same as in the previous part. A summary chart is provided below.

Principle	$4,000.00
Interest Rate	6.8%
Years	10
Monthly Payment	$59.34
Total Paid on Loan	$7,120.25
Total Interest Paid	$3,120.25
Additional Fees Paid	$42.04
Total Costs Over Principle	$3,162.29

3 Programming Project

Develop a Python program student_loans.py. The program should ask the user for two inputs. First, ask for the total amount of principle borrowed. Next, ask

for the number of years on the loan. Assume all loans make 12 payments per year.

Your program will then compute all the following values for three different types of loans.

Principle
Interest Rate
Years
Monthly Payment
Total Paid on Loan
Total Interest Paid
Additional Fees Paid
Total Costs Over Principle

Compare the Following three types of loans.

Loan Type	Interest Rate	Fee Rate
Subsidized Federal Direct	3.4%	1.051%
Unsubsidized Federal Direct	6.8%	1.051%
Unsubsidized PLUS Loan	7.9%	4.204%

You can check your answers using the Student Loan Comparison Calculator linked below.

`https://bigfuture.collegeboard.org/pay-for-college/loans`

4 Example Execution Trace

You are not required to exactly match the below layout, but your content and results must be the same.

```
 Weclome to the Student Loan Calculator
Enter the amount of the loan in dollars with (no commas):
4000
Enter the number of years the loan will be for:
10
-----------------------------------------
Subsidized Federal Direct Loan
Principle: 4000
Interest Rate: 3.4
Years: 10
Monthly Payment 39.37
Total Paid on Loan: 4724.07
Total Interest Paid: 724.07
Additional Fees Paid: 42.04
Total Costs Over Principle: 766.11
-----------------------------------------
```

```
Unsubsidized Federal Direct Loan
Principle: 4000
Interest Rate: 6.8
Years: 10
Monthly Payment 59.34
Total Paid on Loan: 7120.25
Total Interest Paid: 3120.25
Additional Fees Paid: 42.04
Total Costs Over Principle: 3162.29
```

```
Unsubsidized Federal Direct Loan
Principle: 4000
Interest Rate: 7.9
Years: 10
Monthly Payment 64.54
Total Paid on Loan: 7745.2
Total Interest Paid: 3745.2
Additional Fees Paid: 168.16
Total Costs Over Principle: 3913.36
```

5 Extra Credit

15 points

Most Drexel Students stay for 5 years. Make a second version of your script drexel_loan.py that asks how many years the student will be in school. Use this number instead of 4.25 for unsubsidized loans.

Example:

```
Weclome to the Drexel Student Loan Calculator
Enter the amount of the loan in dollars with (no commas):
1000
Enter the number of years the loan will be for:
10
How many years do you plan to attend college?
5
```

```
Subsidized Federal Direct Loan
Principle: 1000
Interest Rate: 3.4
Years: 10
Monthly Payment 9.84
Total Paid on Loan: 1181.02
Total Interest Paid: 181.02
Additional Fees Paid: 10.51
Total Costs Over Principle: 191.53
```

```
-----------------------------------
Unsubsidized Federal Direct Loan
Principle: 1000
Interest Rate: 6.8
Years: 10
Monthly Payment 15.62
Total Paid on Loan: 1873.97
Total Interest Paid: 873.97
Additional Fees Paid: 10.51
Total Costs Over Principle: 884.48
-----------------------------------
Federal Plus Loan
Principle: 1000
Interest Rate: 7.9
Years: 10
Monthly Payment 17.09
Total Paid on Loan: 2050.82
Total Interest Paid: 1050.82
Additional Fees Paid: 42.04
Total Costs Over Principle: 1092.86
```

6 Grading

There are no strict guidelines for how to write your code or develop your user interface. You will be graded on the quality of your design and execution.

- Program's Output is clear and easy to understand: 15 points
- Program takes two inputs from user: 10 points
- Calculations Correct for Subsidized Loan: 15 points
- Calculations Correct for Unsubsidized Loan: 15 points
- Calculations Correct for PLUS Loan: 15 points
- Calculations Correct for Fees: 9 points
- Name and Section number in comments: 1 point
- Code is well commented: 10 points
- Variables are used: 5 points
- Variables names are not confusing: 5 points

If you code has any errors, a 50% deduction will be taken. Only portions of the code that execute without errors will be graded.

7 Resources

You can learn more about the calculations at these websites.

`http://mathforum.org/dr.math/faq/faq.interest.html`
`https://www.calculatorsoup.com/calculators/financial`