Programming Assignment #6

Build Your Nest Egg

CS 1428.004, Fall 2011
Instructor: Jill Seaman

Due: in class Friday, 11/11/2011 (upload electronic copy by 9:30am)

Problem:

You've received a windfall and you want to know how much to put aside in an investment in order to build your nest egg to a certain target amount.

Write a program that will ask the user for the amount of an investment goal and the (compounded annually) interest rate.

Then output a table indicating the required initial investment to reach the investment goal after 10, 20, 30, and 40 years of compounded interest at the given rate. The formula to compute the amount you need to invest is called the present value formula:

$$P = F \ / \ (1 + r)^n$$

where P is the present value (the amount needed to deposit up front), F is the future value (or the amount that will have accumulated at the end of the investment period), r is the annual interest rate, and n is the number of years the money will be invested.

F and r are input from the user (investment goal and interest rate, respectively).
You will calculate P for the 4 different values of n (10, 20, 30, and 40).

In addition, you will notify the user how many years it would take to double his/her money at the given interest rate. The formula to calculate this is:

$$n = \log(2) \ / \ \log(1 + r)$$

where log is a function in the cmath library. Note: if the value n has a fractional part (i.e. 12.34 years) it should be rounded up to the next whole number (13 years). The function ceil (for ceiling) in the cmath library will do this.

Input:

Ask the user for the target investment result (the future value) and the interest rate. You should validate the input: the target result should be at least $100, and the interest rate should be between 0 and 100 (with 100 being a valid rate, but NOT 0--the interest

rate should be greater than 0). If the input is out of range, use an informative prompt to ask the user to re-enter valid data until the input is valid.

For the calculations to work properly, you must convert the interest rate which is input as a percent between 0 and 100 (i.e. 3.5%) to a fractional value between 0 and 1 (i.e. 0.035).

Processing: You should use the following 4 functions in your program.

getInput: has two reference parameters to input target investment value and interest rate from the user.

calculatePV: has 3 parameters: future value, interest rate, and years of investment. Returns the calculated present value. Do not do any output from this function.

yearsToDouble: has 1 parameter, the interest rate. Returns the calculated number of years it takes to double the initial investment with the given interest rate. Do not do any output from this function.

outputTable: has 2 parameters: target investment (future value) and interest rate. It outputs the four lines stating the required starting investment to reach the target in 10, 20, 30, and 40 years.

Output: Display the dollar amounts with dollar signs ($) and formatted to 2 decimal places. The year values should be integers. The initial investment required (the present value) should never be less than .01. If the calculated value is less than .01, you should output .01.

Sample output:

```
Enter your investment goal: 1000000
Enter the annual interest rate: 6.7

To earn $1000000.00 in 10 years will require an initial investment of $522824.31
To earn $1000000.00 in 20 years will require an initial investment of $273345.25
To earn $1000000.00 in 30 years will require an initial investment of $142911.55
To earn $1000000.00 in 40 years will require an initial investment of $74717.63

It will take 11 years to double your principal

Would you like to run the calculator again(Y/N)?: y

Enter your investment goal: 10000
Enter the annual interest rate: 2.3

To earn $10000.00 in 10 years will require an initial investment of $7966.06
To earn $10000.00 in 20 years will require an initial investment of $6345.81
To earn $10000.00 in 30 years will require an initial investment of $5055.11
To earn $10000.00 in 40 years will require an initial investment of $4026.93
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It will take 31 years to double your principal

Would you like to run the calculator again(Y/N)?: y

Enter your investment goal: 10000
Enter the annual interest rate: 100

To earn $10000.00 in 10 years will require an initial investment of $9.77
To earn $10000.00 in 20 years will require an initial investment of $0.01
To earn $10000.00 in 30 years will require an initial investment of $0.01
To earn $10000.00 in 40 years will require an initial investment of $0.01

It will take 1 years to double your principal

Would you like to run the calculator again(Y/N)?: n
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Style:

See the Style Guidelines document on the course website. **Especially pay attention to the comments required for functions.** The grader will deduct points if your program violates the style guidelines.

Note:

Some common investment goals are $1,000,000 (one million dollars, commonly for retirement) or could be as small as $10,000 (a down payment on a small house).

Some common interest rates are: 1.15% (Certificates of Deposit), 3.35% (30 year US Treasury Bond), 10% (average for stock mutual funds over 30 year period), 20% (average fo stock mutual funds from 1990 to 1999).

Logistics:

Your program must be free of compiler errors.

Do you not use any features of C++ that we have not yet covered in class (use features from Chapters 1-6 only (arrays are not needed for this program)).

Name your file **assign6_xxxxxxxxx.cpp** where xxxxxxxxx is your 9 character TX state ID number, the one that is on your ID card. It should look something like this: A04123456. If yours is just six digits, then add "A00" to the front.

There are **two** steps to the turn-in process:

1. Submit an **electronic copy** using the following upload link:

http://www.cs.txstate.edu/~js236/homework
(There is a link directly to this page on the course website).

Click on CS1428.004, and log in with your Net ID and follow the directions to upload your file.

2. Submit a **printout** of the file on the day it is due. Please print your name on the front page, and staple if there is more than one page.