FEEG6002 Advanced Computational Methods 1:

Laboratory-Assignment 2

Contents

Prerequisites: C program skeleton, printf, int, float, for-loop

1 Training: Fahrenheit/Celsius table

1. Write a C program (saved in celsius.c) that prints a table showing in the left hand column integer numbers starting from -30, increasing in steps of 2 and going up to (and including) +30. These represent temperature values in degree Celsius. For each value, compute and print the same temperature expressed in degree Fahrenheit.

   Use T_Fahrenheit = T_Celsius*9/5+32.

2. Format the output exactly as shown below for the first ten lines, including the alignment of numbers in different rows.

   We also provide sample programs in Python and Matlab:

   Python:

   ```
   for Celsius in range(-30, 31, 2):
       Fahrenheit = Celsius * 9 / 5. + 32
       print "%3d = %5.1f" % (Celsius, Fahrenheit)
   ```

   Matlab:

   ```
   for Celsius=-30:30:2
    Fahrenheit = Celsius*9/5+32;
    fprintf('%3d = %5.1f\n', Celsius, Fahrenheit);
   end
   ```

   First 10 lines of output (Matlab and Python identical)

   -30 = -22.0
   -28 = -18.4
   -26 = -14.8
   -24 = -11.2
   -22 = -7.6
   -20 = -4.0
   -18 = -0.4

```
-16 =  3.2
-14 =  6.8
```

When your program works, ask yourself:

- Have you used appropriate variable names? Well chosen variable names can reduce the amount of required documentation. Is your function document appropriately?

Submit your file celsius.c by email to feeg6002@soton.ac.uk with subject line training 2. This is a training exercise. You can submit repeatedly, until your code passes all tests.

2   Laboratory: Computing interest

Assume we borrow s=1000 pounds (the currency does not matter but we might as well imagine we are dealing with pound sterling) and that we are charged interest at 3% per month. We like to know how exactly our debt grows from initially s=1000 pounds over 24 months.

1. Translate the Matlab/Python programs shown below to a C program interest.c to produce the same output.

    Matlab:

    ```
    s = 1000;              % sum borrowed, in GBP
    debt = s;              % actual debt
    rate = 0.03;            % interest rate, i.e. 3%
    for month = 1:24        % loop over 24 months
       interest = debt * rate;  % interest in this month
       debt = debt + interest;
       fprintf('month %2d: debt=%7.2f\n', month, debt);
    ```

    Python:

    ```
    s = 1000             # sum borrowed, in GBP
    debt = s             # actual debt
    rate = 0.03            # interest rate, i.e. 3%
    for month in range(1, 25):  # loop over 24 months
       interest = debt * rate  # interest in this months
       debt = debt + interest
       print("month %2d: debt=%7.2f" % (month,debt))
    ```

    First 10 lines of output (Matlab and Python identical):

    ```
    month  1: debt=1030.00
    month  2: debt=1060.90
    month  3: debt=1092.73
    month  4: debt=1125.51
    ```

month 5: debt=1159.27
month 6: debt=1194.05
month 7: debt=1229.87
month 8: debt=1266.77
month 9: debt=1304.77

2. Extend the program to also print (for every month)
   - o the amount of interest to be paid for this month (interest) and
   - o the total amount of interest up to and including this month (total_interest).

   Add a another column that shows for every month

   - o the ratio of the total interest we have paid up to this month (i.e. total_interest) to the amount we have borrowed initially (i.e. s) and call it frac. Express this number in percentage (i.e. multiply with 100 and add the % sign in the output). To output the % character with printf, you need to put %% into your C-code, i.e. printf("%%").

   The first few lines of the output should look like this:

   month 1: debt=1030.00, interest=30.00, total_interest= 30.00, frac= 3.00%
   month 2: debt=1060.90, interest=30.90, total_interest= 60.90, frac= 6.09%
   month 3: debt=1092.73, interest=31.83, total_interest= 92.73, frac= 9.27%

   and the last line:

   month 24: debt=2032.79, interest=59.21, total_interest=1032.79, frac=103.28%

   Choose width and precision specifiers appropriately to produce the output shown above.

Submit your file interest.c by email to feeg6002@soton.ac.uk with subject line lab 2.