ECE 175 Computer Programming for Engineering Applications

Homework Assignment 2

Due Date: Tuesday September 14, 2021, 11:59 PM, via D2L Drop-box

Conventions: Name your *C* programs *hw***x***p***y**.*c* where *x* corresponds to the homework number, and *y* corresponds to the problem number. For example, the *C* program for homework 2, problem 1 should be named as *hw***2***p***1**.*c*

Write comments in your programs. Programs with no comments will receive only PARTIAL credit. For each program that you turn in, at least the following info should be included at the top of the *.c* file:

- Author:
- Date created:
- Brief description of the program:
  - input(s):
  - output(s):
  - an algorithm (or description/relationship between inputs and outputs)

Submission Instructions: Use the designated Dropbox on D2L to submit your homework.
Submit only the *.c* files.

Problem 1 (35 points): Julian Day Number

The *Julian Day Number* is often used by astronomers and other scientists to provide an easy method for finding the elapsed number of days between two events. The *Julian Day Number* is the continuous count of days since the beginning of the Julian period, which is January 1, 4713 BC.

We wish to write a *C* program that calculates the Julian Day Number from a user entered date, of the form *mm/dd/yyyy*.

Use the following steps to calculate the Julian Day Number

- If the month is *1* or *2* (for January or February) then
  - Subtract one from the year *yyyy*
  - Add 12 to the month *mm*
- Calculate the **integer variable** $A = \frac{yyyy}{100}$
- Calculate the **integer variable** $B = 2 - A + \frac{A}{4} + dd$
- Calculate the **integer variable** $C = 365.25 \cdot (yyyy + 4716)$. Note that C is integer, so the fractional part of the calculation is intentionally thrown out.
- Calculate the **integer variable** $D = 30.6001 \cdot (mm + 1)$. Note that D is integer, so the fractional part of the calculation is intentionally thrown out.
- Calculate the Julian Day Number **double variable** $JD = B + C + D - 1524.5$

Example: *3/22/1968*

- The month is March. No need to subtract 1 from the year, nor add 12 to the month.
- $A = \frac{1968}{100} = 19$
- $B = 2 - 19 + \frac{19}{4} + 22 = 2 - 19 + 4 + 22 = 9$
- $C = 365.25 \cdot (1968 + 4716) = 2441331$
- $D = 30.6001 \cdot (3 + 1) = 122$
- $JD = 9 + 2441331 + 122 - 1524.5 = 2439937.5$

Example: *2/25/2022*

- The month is February. Subtract 1 from the year, so *yyyy* becomes 2021. Add 12 to the month, so *mm* becomes 14.
- $A = \frac{2022}{100} = 20$
- $B = 2 - 20 + \frac{20}{4} + 22 = 2 - 20 + 5 + 25 = 12$
- $C = 365.25 \cdot (2021 + 4716) = 2460689$
- $D = 30.6001 \cdot (14 + 1) = 459$
- $JD = 12 + 2460689 + 459 - 1524.5 = 2459635.5$

Also, your program must print out the value of the varible *B*.

Sample Code Executions: Red text indicates information entered by the user

```
Enter a date of the form mm/dd/yyyy 9/14/1843
For the date 9/14/1843, the value of B is 2, and the Julian Day Number is 2394457.5

Enter a date of the form mm/dd/yyyy 1/13/1492
For the date 1/13/1492, the value of B is 4, and the Julian Day Number is 2266013.5

Enter a date of the form mm/dd/yyyy 2/29/2020
For the date 2/29/2020, the value of B is 16, and the Julian Day Number is 2458908.5
```

Problem 2 (35 points): Water Bill Write a *C* program that calculates the water bill according to the chart below. The program should let a user enter the user type and the water usage amount and then displays the total cost, both with and without tax. See sample code execution.

Fixed Cost:	Residential – fixed cost	$13.50
	Government – fixed cost	$ 3.75
	Business – fixed cost	$17.25

User	Water Usage (w) In cubic feet (cf)	Cost per cubic foot
Residential	For the first 400 cf, w ≤ 400	0.04
	For the next 300 cf, 400 < w ≤ 700	0.062
	For additional cf above 700 w > 700	0.12
Government		0.035
Business		0.0553

Tax rate is 8.7%

Sample Code Executions: Red text indicates information entered by the user

```
Enter User Type (R for Residential, B for Business, G for Government): M
Enter water usage in cubic feet: 50
Wrong User Type

Enter User Type (R for Residential, B for Business, G for Government): G
Enter water usage in cubic feet: 5000
Total cost before tax is $178.75
Total cost including tax is $194.30

Enter User Type (R for Residential, B for Business, G for Government): B
Enter water usage in cubic feet: 1250
Total cost before tax is $86.38
Total cost including tax is $93.89

Enter User Type (R for Residential, B for Business, G for Government): R
Enter water usage in cubic feet: 120
Total cost before tax is $18.30
Total cost including tax is $19.89

Enter User Type (R for Residential, B for Business, G for Government): R
Enter water usage in cubic feet: 450
Total cost before tax is $32.60
Total cost including tax is $35.44

Enter User Type (R for Residential, B for Business, G for Government): R
Enter water usage in cubic feet: 750
Total cost before tax is $54.10
Total cost including tax is $58.81
```

Lab 2 Assignment (30 points):

You will complete the lab 2 assignment when you attend your lab session after the homework 2 assignment is due.

Submit your .c files named hw2_p1.c hw2_p2.c via D2L dropbox