

# CSE102 – Computer Programming

## Homework #2

### Functions and Selection

**Due Date: 29/03/2023**

**Hand in:** A student with number 20180000001 should hand in a zip file named 20180000001.zip for this homework.

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**Homework Description:** You will write a C file with the main function with three additional functions described below. Your program will start calling part1, part2, and part3 functions in that order. For each part, you will receive the inputs from the user and print the output to the console. Details of the parts are further discussed below. Please pay attention to the output format. Any deviation from the shared format may be penalized regardless of the correct execution.

#### Part 1. [30pts] Leap Year Problem

A leap year is a year that has 366 days instead of the usual 365 days. It occurs once every four years to keep the calendar year synchronized with the astronomical year, which is the time it takes the Earth to orbit the sun.

In a leap year, an extra day, February 29th, is added to the calendar year. This extra day is needed because the Earth's orbit around the sun is approximately 365.24 days, and by adding an extra day to the calendar every four years, the calendar year is brought closer in alignment with the astronomical year. Some examples of leap years include 2020, 2016, 2012, 2008, and 2004.

Write a C function that prompts the user to enter a year, and then uses a function to determine and print whether the year is a leap year or not. Use if statements to check whether the year is leap year.

Expected Output:

```
*****
Please enter a year: 2012
2012 is a leap year
*****
Please enter a year: 2006
2006 is not a leap year |
```

**Part 2. [40pts] Enhanced Calculator**

Write a C function that prompts the user to enter two numbers and an operator (+, -, \*, /, ^, %). Before enter two numbers and operator, you need to enter format of output(result). There are 2 outputs for the enhanced calculator: "S" and "I".

S: S means Scientific format. If user enters "S" as input, you need to ask to user 2 more integer inputs, which are "m" and "n". "m" is number of total digits of result and "n" is number of digits after decimal point(Warn user if  $n > m$ ).

Example: m=8, n=4, Result: 12340000, Expected Output: 0000.1234e8 ( $1234 \times 10^4$ )

m=6, n=4, Result: 23, Expected Output: 00.0023e4 ( $23.0000 \times 10^1$  Add zeros if it is necessary)

m=7, n=1, Result: 7.35, Expected output: 000073.5e-1 ( $73.5 \times 10^{-1}$  Add zeros if it is necessary)

I: I means integer only format. If user enters "I" as input, the result will be shown in integer format.

Example: 3, 2 and 7 (3 different output)

"!" sign stands for factorial calculation(for ex  $5! = 120$ ). "^" sign stands for exponential operation(for ex:  $3^2 = 9$ ) and "%" sing represents remainder operation(for ex:  $7 \% 3 = 1$ ). You can use factorial calculation code from your book. Use a switch statement to determine the appropriate operation, and then use a function to perform the calculation and print the result.

If the user enters an invalid operator, print an error message.

Expected Output:

```
*****
Enter the format of output (S or I): S
Enter m and n values: 4 2
Enter the operation(+, -, /, *, %, ^, !, ^): !
Enter the operand: 5
5! =00.12e3
*****

Enter the format of output (S or I): S
Enter m and n values: 8 4
Enter the operation(+, -, /, *, %, ^, !, ^): *
Enter the first operand: 1234
Enter the second operand: 1000
1234*1000= 0000.1234e7
*****

Enter the format of output (S or I): I
Enter the operation(+, -, /, *, %, ^, !, ^): +
Enter the first operand: 5
Enter the second operand: 9
5+9=14
```

**Part3. [30pts] Grade Calculator**

Write a C function that prompts the user to enter the grades for three exams (out of 100) and two assignments (out of 100), and then uses a function to calculate and print the final grade (out of 100) according to the following formula:

$$\text{Final Grade} = (\text{Exam1} + \text{Exam2} + \text{Exam3}) / 3 * 0.6 + (\text{Assignment1} + \text{Assignment2}) / 2 * 0.4$$

Use an if statement to check whether the final grade is above or below 60, and print an appropriate message(Failed or Passed).

Expected Output:

```
*****
Enter 3 exam grades of student: 60 70 80
Enter 2 assignment grades of student: 50 50
Final Grade: 62.0 Passed!
*****
Enter 3 exam grades of student: 30 40 50
Enter 2 assignment grades of student: 60 60
Final Grade: 48.0 Failed!
```

**Note:** Make sure to include appropriate comments and variable names in your code to make it easy to understand.

**\*\*Attach the photos of the outputs of the code to your file.**

**\*\*Do not forget to prepare a makefile (-50 points)**

**General Rules:**

1. We do not give you any function prototypes. We expect that you are experienced enough to understand when to use methods and name them. These will also be graded.
2. The program must be developed on given version of OS and must be compiled with GCC compiler, any problem which rises due to using another OS or compiler won't be tolerated.
3. Note that if any part of your program is not working as expected, then you can get zero from the related part, even it is working partially.
4. Zip your homework files before uploading them to MS Teams. The zip file must contain the C file with your solution and screenshots of the valid outputs of the program.
5. You can ask any question about the homework by sending an email to [barisozcan@gtu.edu.tr](mailto:barisozcan@gtu.edu.tr) or by using the homework channel on MS Teams page of the course.