Programming Fundamentals (CS 1002)
Cybersecurity Department
Fall 2022 ASSIGNMENT # 1

Due Date: Friday, September 23, 2022 (11:59 pm)

Instructions

1. Assignments are to be done individually. You must complete this assignment by yourself. You cannot work with anyone else in the class or with someone outside of the class. The code you write must be your own and you must understand each part of your code. You are encouraged to get help from the instructional staff through google classroom/Piazza.

2. Use appropriate data types and operations for each problem. You cannot use advanced topics not covered so far.

3. Your code must be **generic** i.e. it should work for different inputs where inputs are required.

4. The output should be properly displayed and well presented. 5% marks will be deducted in each question if appropriate comments and indentation not done in source code.

5. **Plagiarism:** Plagiarism of any kind (copying from others, copying from the internet, etc) is not allowed. If found plagiarized, you will be awarded zero marks in the assignment. Repeating such an act can lead to strict disciplinary actions and failure in the course.

6. **Submission Guidelines**: Dear students, we will be using auto-grading tools, so failure to submit according to the below format would result in zero marks in the relevant evaluation instrument.
    a. Run and test your program on a lab machine before submission. If there is a syntax error, zero marks will be awarded in that specific question.
    b. For each question in your assignment, make a separate .cpp file e.g. for question 1, make ROLL-NUM_SECTION_q1.cpp, and so on (e.g. **22i-0001_A_q1.cpp, 22i-0001_A_q2.cpp, 22i-0001_A_q3.cpp** and so on).
    c. In every .cpp file that you create (every question), you must write your name, student-id, and assignment # on the top of the file in the comments.
    d. Combine all your work (all questions files) in one folder. The folder must contain only .cpp files (no binaries, no exe files etc.,). If we unable to download your submission due to any reason you will be awarded zero mark.
    e. Rename the folder as ROLL-NUM_SECTION (e.g. 22i-0001_A) and compress the folder as a zip file. (e.g. **22i-0001_A.zip**). Only zip file will be acceptable.
    f. Submit the .zip file on Google Classroom within the deadline. Make sure that you have submitted the correct file.
    g. Submission other than Google classroom (e.g. email etc.) will not be accepted.
    h. The student is solely responsible to check the final zip files for issues like corrupt files, viruses in the file, mistakenly exe sent. If we cannot download the file from Google classroom due to any reason it will lead to zero marks in the assignment.

7. **Late submission:** 10% marks will be deducted for every hour of late submission, i.e. assignments submitted 10 hours late will get zero marks. 10% will be deducted with the start of hour so both submissions on 10:01 and 10:59 will get same deduction of 10%.

Problem 1: An egg distribution company uses different sizes of packings for eggs, that is, 30 eggs packing, 24 eggs packing, 18 eggs packing, 12 eggs packing and 6 eggs packing. Write a program which prompts user to enter total number of eggs to be packed and then calculate how many packings of each size will be possible. Also tell if there will be any eggs left to be packed.

Problem 2: Write a C++ program to implement the following algebraic expressions to calculate and display the values of a,z,y,g,c. Other variables in the program will be input by the user:

$$a = 12x$$

$$z = 5x + 14y + 6k$$

$$y = x^4$$

$$g = \frac{b + 12}{4k}$$

$$c = \frac{a^3}{b^2 k^4}$$

Problem 3: Write a program which asks user to enter a 5-digit number. Your program should then reverse the order of digits and make a new number such that each digit of the new number is half of the reversed digit (use only integer division). For example, 87549 will be reversed to 94578 and then each digit is halved i.e. 9->4, 4->2, 5->2, 7->3, 8->4. Same run of this input is shown below:

```
Enter a 5-digit number: 87549
Modified number: 43224
```

Problem 4: Write a program which asks user to enter a word of any 8 random letters in small case. The program then converts the word in capital case and displays the new word. Hint: use cin.get() function so that you don't need to press ENTER every time (your program run should be similar to the sample run below). Use ASCII table to find out how small letter can be changed to capital letter. You cannot use string or arrays. Only use character variables.

```
Enter an 8 letter word: mudasssar
Your entered word in capital case is MUDASSAR
```

Problem 5: Write a program that takes five integer numbers (range 0 to 10). And display horizontal bar chart. Also get scale input from the user to scale the bars size accordingly. For example, if N2 is 5 and scale is 2 then the bar will be of 5x2=10 asterisks. Do not use loops. You can use <iomanip> header file for printing bar chat.

```
Input Five integer numbers:
N1=1
N2=5
N3=9
N4=0
N5=2
Enter Scale: 2
BAR CHART OUTPUT
**
**********
******************

****
```

Problem 6: You are required to write a program for a Point-of-Sale cash counter. Suppose a customer buys 5 items from the shop; your program should be able to get price of each item as data entry. The program should then create an invoice which shows the price of each item, sales tax on that item and total price of that item after adding tax. Finally, a total payable amount should be printed, with and without, sales tax. Sales Tax rate is 17%. Price and Total Price must always be displayed with accuracy of 2 decimal points whereas Sales Tax should be displayed with precision of 3 decimal points. Furthermore, all amounts should be right aligned.

```
Price of item 1 = $15.95
Price of item 2 = $24.95
Price of item 3 = $6.95
Price of item 4 = $12.95
Price of item 5 = $3.95
******************************************************************
ITEM      PRICE      SALES TAX (@17%)    TOTAL PRICE

1         15.95            2.712            18.66

2         12.00            2.040            14.04

3         52.60            8.942            61.54

4         13.40            2.278            15.68

5          0.70            0.119             0.82

Total     94.65           16.091           110.74
```

Problem 7: To get the average of a series of values, you add the values up and then divide the sum by the number of values. Write a program that asks user to enter five values and show sum and average. Your program should not have more than 2 variables, one for getting user input and other for keeping the sum.

Problem 8: The courses of first two semesters of a BS Cybersecurity student in FAST are shown below. Write a program to get marks of a student in each of these subjects and calculate his/her semester GPA (SGPA) and Cumulative GPA (CGPA). Your program should also get student name, registration number and section to show in the detailed transcript. Transcript should be displayed semester-wise. Note that subject names and their credit hours are constants.

Sr. No	Course Name	Crdt Hrs.
Semester 1		
1	Introduction to ICT	0+1
2	Programming Fundamentals	3+1
3	Linear Algebra	3+0
4	Calculus & Analytical Geometry	3+0
5	Pakistan Studies	3+0
6	English Composition & Comprehension	2+1

Sr. No	Course Name	Crdt Hrs.
Semester 2		
1	Object Oriented Programming	3+1
2	Digital Logic Design	3+1
3	Differential Equations	3+0
4	Islamic Studies/Ethics	3+0
5	Communication & Presentation Skills	2+1

Problem 9: A copy of OGRA notification of petroleum prices is given below (also available at https://ogra.org.pk/download/8080). See all details in the bill carefully. Your task is to write a program to calculate MOGAS Max Ex-Depot Sale Price. Please note that **OMC margin** and **Dealers Commission** and **IFEM** are fixed at Rs. 3.68, Rs. 7.00 and Rs. 4.76 respectively. Currently, Petroleum levy is 20.487% and is calculated on the PSO Cost of Supply; this can change later. Government is not charging sales tax in the current fortnight but they might charge it later. Your program should have calculation for that i.e. 0% sales tax for now on the PSO Cost of Supply. See sample run of the program below.

Annex-III

OIL & GAS REGULATORY AUTORITY
E-10 Gasoline Ex- depot Sale price Calculation
Prices Effective September 01, 2022

		Rs/Liter		
A	MOGAS PSO Weighted Average cost of supply		183.04	
B	Ethanol Ex-Distillary price announced by PSO		72.00	
C	10% part Ethanol Ex-Distillary price (10% of B)		7.20	
D	90 % part Mogas Ex-Refinery price (90% of A)	183.04	164.74	
E	E-10 Base Price (C + D)		171.94	

	Max. Ex-Depot Sale Price	**MOGAS**	**E-10 Gasoline**	
		Retail	Retail	Direct
F	PSO Cost of Supply / E-10 Base Price	183.04	171.94	171.94
G	IFEM	4.76	0.54	0.54
H	Subtotal (F + G)	187.80	172.48	172.48
I	Price Differential Claim	-	-	-
J	Subtotal (H + I)	187.80	172.48	172.48
K	OMC's Margin	3.68	3.68	3.68
L	Dealers Commission	7.00	7.00	
M	Petroleum Levy as notified by Federal Govt.	37.50	16.40	23.40
N	Subtotal (J + K + L + M)	235.98	199.56	199.56
O	Sales Tax	-	33.93	33.93
P	Max Ex-Depot Sale Price (N + O)	235.98	233.49	233.49

Difference between MOGAS and E10 (Rs/Liter)	(2.49)	-
E-10 Cheaper by %age		1.06%

Enter MOGAS PSO Weighted Average cost of supply: 183.04
Petroleum levy %: 20.487
Sales Tax %: 0
Max Ex-Depot Sale Price = Rs. 235.98

Problem 10: Amazon has different types of EC2 virtual machines which can be hosted in the AWS Cloud. The pricing model for each type of machine is different which is given in Table 1.

EC2 Machine Type	Hourly rate
On-demand	$3
Reserved	$2
Spot	$0.5

Table 1. Pricing Model of AWS EC2 Machines

Write a program which asks user to enter details of his all virtual machines hosted in the AWS Cloud. For each type of machine, user will be required to enter number of such machines such that monthly bill of the user can be calculated and displayed. Note that hourly rates are constants. Sample program run is show below. Make sure that you have exactly same output and text alignments.

```
                        AWS Cloud Cost Calculator
                        **********************

How many On-demand machines you own:    2
How many Reserved machines you own:     5
How many Spot machines your own:        4

Cost of On-demand instances:            $4320
Cost of Reserved instances:             $7200
Cost of Spot instances:                 $1440

Total Monthly Cost of AWS Machines:     $12960
```