NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES
ISLAMABAD
Programming Fundamentals (CS 1002)
FALL 2021 ASSIGNMENT # 2

Due Date: Saturday, October 16, 2021 (11:59 pm)

Instructions

Submission: Please follow the following submission instructions. Failure to submit according to the above format would result in deduction of 10% marks. Submissions on the email will not be accepted. Combine all your work (solution folder) in one .zip file. Use proper naming convention for your submission file. Name the .zip file as **SECTION_ROLL-NUM_04.zip** (**e.g. A_21i0412_04.zip**). Your zip file should only contain ***.cpp*** files, each file should correspond to its question/problem number. Submit .zip file on Google Classroom within the deadline.

Plagiarism: Plagiarism cases will be dealt with strictly. If found plagiarized, both the involved parties will be awarded zero marks in this assignment, all of the remaining assignments, or even an **F grade** in the course. Copying from the internet is the easiest way to get caught!

Deadline: The deadline to submit the assignment is **16th October 2021 at 11:59 PM**. Late submission with marks deduction will be accepted. Correct and timely submission of the assignment is the responsibility of every student; hence no relaxation will be given to anyone.

Modular code: Divide your code in user defined functions where appropriate. All problems solved with just the main function will be awarded zero marks.

Note: Start early so that you can finish it on time

Problem 1: The diameter of a cycle wheel is ***D***. Given that, the cycle travels at an average speed of ***X*** km/h, find the number of revolutions made by the wheel per minute, giving your answer to the nearest whole number (assume PI = 3.142). Write a C++ function to calculate revolutions per minute.

Problem 2: A passenger train travels at a speed of 72 km/h. A man on the passenger train observes a goods train travelling at a speed of 54 km/h in the opposite direction. If the good train passes him in ***X*** seconds, write a C++ function to find the length of the goods train.

Problem 3: Find and display the values of both sides of the following mathematical series expression and an absolute difference of both sides. User can input either of angles in degree 90, 60, 30 etc.

$$sin(x) = 1 - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!}$$

Once the user enters the angle in degrees. Your program should do the following (Write separate functions for a, b, c, and d)

a) LHS Result
b) RHS Result
c) Difference
d) First term, series of two terms, series of three terms, series of four terms, series of five terms.

Problem 4: A car completes its journey in three parts. It travels the first ***X*** km of its journey at an average speed of ***x_Speed*** m/s and the next ***Y*** km at an average speed of ***y_Speed*** km/h. The car completes the last part of its journey at an average speed of ***z_Speed*** km/h in ***z_Minutes*** minutes. Here *X, x_Speed, Y, y_Speed, z_Speed,* and *z_Minutes* are all variables whose values you will have to take as an input from the user. Find the average speed for its entire journey, giving your answer in km/h.

$$speed = \frac{distance}{time}$$

Hint*: First try to solve this problem by assuming / assigning different values to these variables. Make sure that you consider units mentioned with these variables.*

Problem 5: Lets create your first cipher!!! Cipher is an algorithm that you can use to encrypt and decrypt sensitive information. In an information system, sensitive information is stored in a 16-bit unsigned number, where bit-wise information is stored in following format, 9-bits are reserved for account number and 7-bits are reserved for customer ID.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
C	C	C	C	C	C	C	A	A	A	A	A	A	A	A	A

a) Using bit wise operators, write a function to extract customer ID
b) Another function to extract account number.
c) Due to security concerns, you have been given a task to create a cipher. Write a function to encrypt the 16-bit number (X) using the following expression.

$y = aX + b$, consider *a* = 5 and *b* = 233

d) Write another function to decrypt the number and display the original number.