



Assignment, Winter 2024

Part A

CSE 1101: Structured Programming Language

Instructors: Md. Mamun Hossain, Assistant Professor

Problem Set 01

Problem Set 02

Please write your solutions in A4/Letter size paper and provide the handwritten or printed hardcopy in the department. Aim for concise solutions; convoluted and obtuse descriptions might receive low marks, even when they are correct. Direct copy from internet or friends may produce an F grade in this course which may force you to retake the course in the next semester.

This Lab Report is meant to be an evaluation of your individual understanding, analyzing and programming capability into the course and should be completed without collaboration or outside help.

Submission Deadline: April 20, 2024

(Answer any 150 points; At least 20 points from each Section)

Section 1. [60 points]: Print Pyramids, Patterns or Structures

Write C Program to display the following Pyramids, Patterns or Structures.

<pre> * ** *** **** ***** *****</pre>	<pre> 1 2 3 3 4 5 4 3 4 5 6 7 6 5 4 5 6 7 8 9 8 7 6 5</pre>	<pre>***** ***** ***** ***** *****</pre>
i. Stars Pyramid	ii. Numbers Pyramid	i. Inverted Stars Pyramid
<pre> 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1</pre>	<pre> 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21</pre>	<pre> 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21</pre>
iv. Pascal's Triangle	v. Floyd's Triangle	vi. Floyd's Pyramid

Rubric:

- 1 points for indentation
- 1 points for documentation
- 1 points for coherence
- 2 points for logical integrity
- 5 points for correct output
- Partial credit may be awarded



Section 2. [80 points]: Selection (if-else or switch)

- i. Write a program that takes a character as input and prints out one of the following sentences as appropriate:
- Vowel in capital letter
 - Vowel in small letter
 - Consonant in capital letter
 - Consonant in small letter
 - Neither a vowel nor a consonant

- ii. Leap years are years where an extra day is added to the end of the shortest month, February. This so-called intercalary day, February 29, is commonly referred to as leap day. Leap years have 366 days instead of the usual 365 days and occur almost every four years.

A leap year is exactly divisible by 4 except for century years (years ending with 00). The century year is a leap year only if it is perfectly divisible by 400. For example,

- 1999 is not a leap year
- 2000 is a leap year
- 2004 is a leap year

Now, write a C Program to check whether the year entered by the user is a leap year or not.

- iii. Write a program in C that will ask the user to enter the total shopping amount purchased in the shop and then apply the discount as per the following discount criteria, then find and print the final amount that has to be paid by the customer after subtracting the discount amount:
- If the user has purchased something that costs from \$101 to \$200, the discount will be 5%.
 - If the user has purchased something that costs from \$201 to \$400, the discount will be 10%.
 - If the user has purchased something that costs from \$401 to \$800, the discount will be 20%.
 - And if the user has purchased something that costs more than \$800, the total discount that will be applied to the whole purchase amount is 25%.
- iv. Let BAUST admission test is subjected to the following conditions :
- Marks in Mathematics ≥ 60
 - Marks in Physics ≥ 50
 - Marks in Chemistry ≥ 40
 - Total marks in all three subjects ≥ 200 or Total in Mathematics and Physics ≥ 150

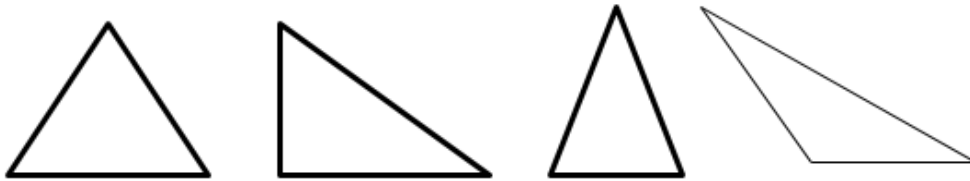
Given the marks in three subjects, write a program to process the application to check the eligible candidates.

- v. You are given the unit price of some commodities as follows. For first 100 units, the rate is 1.0 taka/ unit. For the next 100 units, it is 1.25 taka/ unit. Then onward, the price is 1.5 taka/unit. Write a program that takes an integer n as input. N represents the number of units bought by the customer. The program should output a floating point number, up to 2 decimal digits, representing the total price.
- vi. Write an appropriate control structure that will examine the value of a floating-point variable called temp and print one of the following messages, depending on the value assigned to temp. (a) ICE, if the value of temp is less than 0. (b) WATER, if the value of temp lies

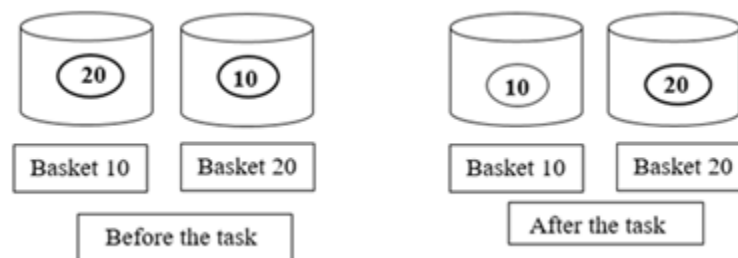


between 0 and 100. (c) STEAM, if the value of temp exceeds 100. Can a switch statement be used in this instance?

- vii. Write a switch statement that will examine the value of a char-type variable called color and print one of the following messages, depending on the character assigned to color. (a) RED, if either r or R is assigned to color, (b) GREEN, if either g or G is assigned to color, (c) BLUE, if either b or B is assigned to color, (d) BLACK, if color is assigned any other character.
- viii. We know, there is a rule for valid triangle and there are various types of triangles in terms of their angle and sides' length.



- a. Present a C program to check whether a triangle is valid or not if sides are given.
b. Compile a C program to check whether a triangle is equilateral, scalene or isosceles.
- ix. Consider the following scenarios, you are given two baskets, one basket is labelled as 10 number and another one is labelled as 20 number. In label 10 basket, there is a ball which is labelled as number 20, and in another basket, label 10 number ball is present. Now, your task is to keep those two balls in those two baskets so that the baskets and balls label number match.



- a) Write a C program for your assigned task.
b) Write an alternative C program for this assigned task.

Section 3. [50 points]: Control Statement (while, do while and for)

- i. Write a loop that will calculate the sum of every third integer, beginning with $i = 2$ (i.e. calculate the sum $2 + 5 + 8 + 11 + \dots$) for all values of that are less than 100. Write the loop in three different ways.
- a. Using a *while* statement.
b. Using a *do - while* statement.
c. Using a *for* statement.



- ii. The Fibonacci sequence is a sequence where the next term is the sum of the previous two terms. The first two terms of the Fibonacci sequence are 0 followed by 1. Now, write a C Program to display the Fibonacci sequence of first n numbers where n is a positive integer less than 100.
- iii. A prime number is a whole number greater than 1 whose only factors are 1 and itself. A factor is a whole number that can be divided evenly into another number. The first few prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23 and 29. Numbers that have more than two factors are called composite numbers. Now,
 - a. Write a C Program that will check whether a given number is prime or composite.
 - b. Write a C Program that will print all the prime number up to a positive integer n.
- iv. An Armstrong number is one whose sum of digits raised to the power three equals the number itself. 371, for example, is an Armstrong number because $3^3 + 7^3 + 1^3 = 371$. Now, write a C Program to Display Armstrong Number between Two Intervals.

Section 4. [150 points] Array [Traverse, Insert, Delete, Merge, Searching, Sorting]

A. Write a C Program to perform the following operation on a 1D Array.

- i. Traverse an Array
- ii. Reverse an array using an additional array or using swapping or by using a function.
- iii. Insert an element to an array [1st position (Beginning) , Last Position, nth position)
- iv. Delete an item from an array
- v. Merge the elements of two array
- vi. Find the largest or smallest element from an unsorted array
- vii. Search an item from an sorted array(Binary Search)
- viii. Search an item from an unsorted array(linear binary)
- ix. Sort a given array

B. Write a C Program to perform the following operation on a 2D Array.

- i. Traverse a 2D array (Matrix)
- ii. Transpose a 2D array (Matrix)
- iii. Calculate the sum of element of a 2D array (Matrix)
- iv. Calculate the diagonal sum of a 2D array (Matrix)
- v. Add two 2D array (Matrix)
- vi. Multiply two 2D array (Matrix)

C. Problem – Solution

- i. In any n credit theory course of BAUST you have to attend in n CTs and of them best n-1 CTs will be counted. Now write a program that shows the average of best n-1 CTs marks out of n CTs.

Sample input:

Enter the value of n: 4

- i. 1st CT Marks: 15
- ii. 2nd CT Marks: 10
- iii. 3rd CT Marks: 15
- iv. 4th CT Marks: 15



Sample Output:

Average of best 3 CT marks: 15

Section 5. [40 points]: String

- i. Write a program to perform lexicographical comparison between two strings.
- ii. C program to reverse a string that a user inputs. If the string is "hello" then, the output is "olleh."
C program to reverse a string using `strrev`, without using `strrev`, recursion and pointers.
- iii. A palindromic number (also known as a numeral palindrome or a numeric palindrome) is a number (such as 16461) that remains the same when its digits are reversed. In other words, it has reflectional symmetry across a vertical axis. Now, write a C program to check whether a number is palindrome or not.
- iv. C program to sort a string in alphabetic order: For example, if a user inputs a string "programming," then the output will be "aggimnopr", so output string will contain characters in alphabetical order. We assume input string contains only lower case alphabets. We count how many times characters 'a' to 'z' appear in the input string and then create another string that contains characters 'a' to 'z' as many times as they appear in the input string.

Section 6. [60 points]: Functions and Recursion

- i. Write a C program to explain *call by value* and *call by reference*
- ii. Write a C program to pass an array into a function as parameter
- iii. Write a recursive function to calculate the factorial of an small integer number. Do not use loops, static or global variables. The prototype of the function must be:

long int Fact(int n); Here x is the positive integer.

After implementing the function, write a simple main function to demonstrate how you would make the initial call to the recursive function.

Sample input: 5

Sample Output:120

- iv. Write a recursive function to find and return the largest element in an array of integers. Do not use loops, static or global variables. The prototype of the function must be:

`int largest (int x [], int n)`

Here x is the array of integers, while n represents the number of integers in the array.

After implementing the function, write a simple main function to demonstrate how you would make the initial call to the recursive function.

Sample input:

Number of elements: 5

Enter 5 integer values: 10 2 5 7 8 9

Sample Output:

Largest element is 10



- v. Write a function to calculate and return the length of a string. The string is passed to the function as a parameter. Do not use string.h header file.
- vi. Write a recursive function to find and return the largest element in an array of integers. Do not use loops, static or global variables. The prototype of the function must be:

int largest (int x [], int n);

Here x is the array of integers, while n represents the number of integers in the array. After implementing the function, write a simple main function to demonstrate how you would make the initial call to the recursive function.

Section 7. [50 points]: Dynamic Memory Allocation

- i. Write a program to take as input height of several students in centimeters. Read from console the number of students (integer), then as many real values. You must allocate memory dynamically. After storing the heights, find and print the height difference between the tallest and the shortest student. Then free the allocated memory.
Sample Input :
Enter the number of students: 5
Enter height of student 5 (in cm): 3.2 3.1 3.5 3.3 3.6
Sample Output:
The height difference between the tallest and the shortest student is: 0.50 cm
- ii. Using a pointer to pointer and appropriate dynamic memory allocation, write a program to store a matrix of integers and then print the average of the integers in each column of the matrix. The input starts with 2 integers representing the number of rows (r) and columns (c) respectively. Then the numbers in the matrix are given in a row major order (i.e. the first c integers represent the first row, the next c integers represent the second row and so on). Before the program exits, you must appropriately free the dynamically allocated memory.
- iii. Write a program to take as input height of several students in centimeters. Read from console the number of students (integer), then as many real values. You must allocate memory dynamically. After storing the heights, find and print the height difference between the tallest and the shortest student. Then free the allocated memory.
- iv. Find an item from a given array with function & dynamic allocation.
- v. Sort a given array with function & dynamic allocation.

Section 8. [50 points]: File Programming

- i. Write a program in C create a file, write into a file and read from the file
- ii. Write a program in C that will read the content from an existing file (in.txt) and display the content into a file (out.txt) as well as on the screen.
- iii. Write a program in C that search for a specific pattern or string in a file (File Search Program).
- iv. Write a program in C that count the number of lines in a file (File Search Program).
- v. Write a C program that reads two integer numbers from an input file, adds them together, and then writes the result to an output file.



Rubric:

- -1 point for each wrong answer
- 5 points for correct answer
- 5 points for description
- Partial credit may be awarded if there is work shown of a correct approach that does not yield the correct solution.