

## **PROGRAMMING IN C AND C++:**

### **Week 1**

1. Introductions
2. Using Dos commands, make a directory: **C:\users\YearOfJoining\Sectionx\USERNAME\CS101**
3. Getting started with Visual C++.
4. Write a program to print a message “Hello World”

### **Week 2 (Basic Techniques)**

1. Write a program to print a message “Hello World”
2. Write a program to swap the contents of two variables.
3. Write a program to find the sum, difference, product, quotient and remainder of two input numbers.

#### **Viva Questions:**

1. Define identifier, variable, constant, keywords.
2. List few Keywords.
3. How do you declare a variable?
4. Write the syntax of printf() and scanf() functions.

### **Week 3 (Arithmetic Operators)**

1. Write a program to compute the area and circumference of a circle given its radius through keyboard.

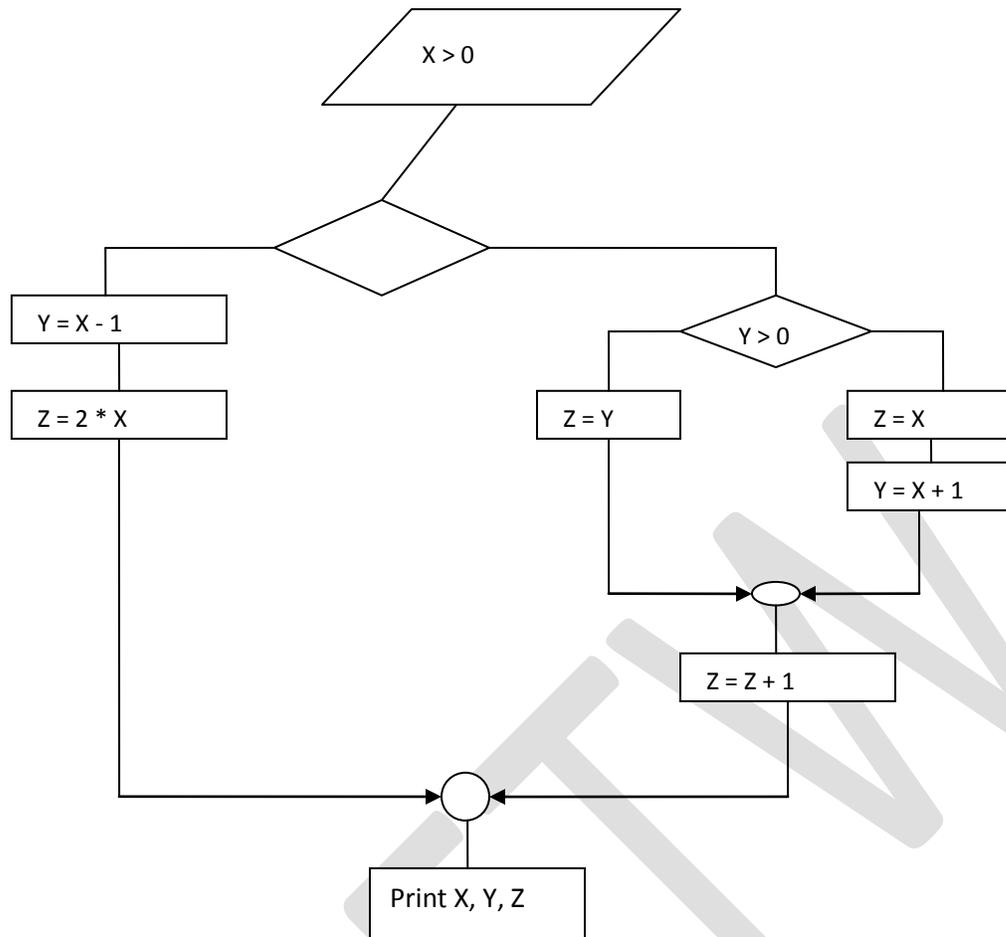
2. Temperature of a city is input through the keyboard. Write a program to convert the temperature given in Fahrenheit degrees to Centigrade degrees.  $C = (5/9) \times (F-32)$
3. Given Principal Amount, Number of years and Interest rate, Calculate Simple interest and Compound interest.  
 $S.I = P * N * R / 100$   
 $C.I = P(1+(R/100))^n$
4. Write a program to calculate the area and perimeter of a triangle given the length of three sides. (Area = square root of  $(s(s-a)(s-b)(s-c))$ , where  $s=(a+b+c)/2$  and Perimeter =  $(a+b+c)$ )
5. If an integer number is input through the keyboard, write a program to extract its unit's digit.
6. Ramesh's basic salary is input through the keyboard. His dearness allowance is 40% of basic salary; house rent allowance is 20 % of basic salary. Write a program to calculate his gross salary.
7. Given a four digit number, write a program to print the number in reverse.

Viva Questions:

1. What are the different operators available in C?
2. What do you understand from unary and binary operators?
3. List any 5 mathematical functions available in C.

**Week 4 (Control Structures-if/else)**

1. Any integer is input through the keyboard. Write a program to find out whether it is an odd or even number.
2. Write code for the flowchart given below. Assume that the variables x and y are integers and z is a float.



3. Given 3 integer numbers, write a program to find the greatest, smallest of them. (use if/else)
4. Write a program to find the greatest and smallest of three given numbers using conditional operator.
5. Write a program to find the given integer number is perfect square or not.
6. Write a program to compute the real roots of a quadratic equation  $ax^2+bx+c=0$   
The roots are given by the equations

$$X1 = \frac{-b + \sqrt{b^2-4ac}}{2a}$$

2a

$$X2 = \frac{-b - \sqrt{b^2-4ac}}{2a}$$

2a

The program should request for the values of the constants a,b and c and print the values of x1 and x2. Use the following rules:

- (a) No solution, if both a and b are zero

- (b) There is only one root, if  $a=0(x=-c/b)$
- (c) There are no real roots, if  $b^2-4ac$  is negative
- (d) Otherwise there are two real roots ( $b^2-4ac \geq 0$ )

Test your program with appropriate data so that all logical paths are working as per your design. Incorporate appropriate output messages.

7. Write a program to display whether the year is leap year or not. Given the year by the user.(We say that a year is a leap year if it is evenly divisible by 400 or if it is evenly divisible by 4 but not by 100).

#### Viva Questions:

1. What are the different control structures in C?
2. Explain the syntax of *if* statement.
3. Write the syntax of conditional operator.

#### Week 5 (Switch, Looping techniques)

1. Write a program to accept a month number and display no. of days in the month Using 'switch'.
2. Using 'switch' statement, write a program to simulate a simple calculator which is used to carry basic operations like addition, subtraction, multiplication and division. The input will be given in infix form. i.e operand1 operator operand2. (eg:  $4 + 5$ ,  $10 - 4$ ,  $12 * 4$ ,  $3 / 5$ )
3. Write a program to print the multiplication table of a number entered by the user. The table should be displayed in the following form:

14 x 1 = 14

14 x 2 = 28

.....

14\*10=140

4. Write a program to find if the number given is a prime or not.

5.If a number is input through the keyboard, write a program to check if the given is palindrome or not. A number is said to be palindrome, if it and its reverse are the same. For example 23132 is a palindrome, as it is same when it is read from right to left as well as from left to right.

6. Write a program to print the following patterns

```

1
2  2
3  3  3
4  4  4  4
5  5  5  5  5

```

```

* * * * *
  * * * *
    * * *
      * *
        *

```

### Viva Questions:

1. Write the syntax of switch statement?
2. Explain the working of switch statement.
3. What is the use of break?
4. Explain the logical operators.
5. Explain the syntax of for, while, do while statements.

### Week 6 (Looping techniques: for, while, do-while)

1. Write a program to find whether a number is an Armstrong number or not. A number is said to be Armstrong number if the sum of the cubes of the digits of the number is equal to the number itself, eg.  $153 = 1^3 + 5^3 + 3^3 = 1 + 125 + 127$ .
2. Write a program to convert a binary number to decimal number.
3. Write a program to convert a decimal number to binary number.
4. Write a program to print Fibonacci series up to  $n$  terms.
5. Write a program to print  $\sin x$  values using series expansion given number of terms( $n$ ) and the angle in degrees( $x$ )(verify the series expansion value with the library function  $\sin(x)$  value).

In the given series we observe that 1<sup>st</sup> term= $x$ ,

2<sup>nd</sup> term= $-x^3/3!$  Can be written as  $(-x^2*x)/3!$  i.e.,  $(-x^2*1^{\text{st}} \text{ term})/2*(2+1)$

....( $n+1$ )th term can be written as  $(-x^2*\text{nth term})/2n(2n+1)$

6. Write a program to print Cosx values using series expansion given number of terms(n) and the angle in degrees(x)(verify the series expansion value with the library function cos(x) value).

In the given series we observe that 1<sup>st</sup> term=1,

2<sup>nd</sup> term= $-x^2/2!$  Can be written as  $(-x^{2*1})/2!$  i.e., $(-x^{2*1^{st}} \text{ term})/2*(2-1)$

.....(n+1)th term can be written as  $(-x^{2*n} \text{ term})/2n(2n-1)$

7. Write a program to count the occurrence of characters and special characters like \n, \t, white spaces in the given text input.

#### Viva Questions:

1. Write the syntax of for, do-while and while and explain the working of each one.
2. What is iteration?
3. What do you mean by looping?
4. What is the difference between break and continue?
5. What is the need of continue?

#### Week 7 (Functions)

1. Write a program that reads three integers and then prints them in order read and reversed. Use three functions, one to read the data, one to print them in the order read and one to print them in the reverse order. (void functions and no arguments)

Write a program to find if the number given is a prime or not.

2. Write a program that creates the following pattern, given the height (no. of rows):  
If height = 6:

\*

\*\*\*

\*\*\*\*\*

\*\*\*\*\*

\*\*\*\*\*

\*\*\*\*\*

(Void function with argument)

3. Write two functions

- a. To count the number of digits in a given integer and returns the count to the main function.  
(eg: The integer 376 has 3 digits)

- b. Write a function to find the sum of all the digits in a given integer and return the sum to the main function. eg:(376 = 3 + 7 + 6 = 16)  
(function returning a value and taking argument)

4. Write a program to calculate  $nPr = \frac{n!}{(n-r)!}$   
Use factorial function to calculate  $n!$  and  $(n-r)!$

### Viva Questions:

1. What is a function? What is the use of function? Give its syntax.
2. What are the different types of functions?
3. List few header files.
4. What is function prototype?
5. What are the different parameter passing techniques?
6. What is the difference between library function & user defined function?

## Week 8 (Functions: Recursion)

1. Write a recursive function to find the factorial of a given number.
2. Write a recursive function to print the given Fibonacci term. (Eg: 3<sup>rd</sup> term is 2, 5<sup>th</sup> term = 3, 8<sup>th</sup> term = 21)
3. Write a recursive function to count the number of digits in a given integer.
4. Write a recursive function to find the sum of digits in a given integer.
5. Write a recursive function to find the GCD/HCF of 2 given integers.
6. Write a program to demonstrate different storage classes. (auto, register, static, global, local)

### Viva Questions:

1. List all the storage classes.
2. Difference between local variable and global variable.
3. Difference between static and auto variable.
4. What is recursive function?
5. What is the difference between recursion and iteration?

## Week 9 (Arrays)

1. Given 'n' integers, write a program to accept the numbers into array,
  - i. Print the numbers in the given order.
  - ii. Print them in the reverse order.
  - iii. Find their sum and average of all the elements and display them.
  - iv. Print the largest element in the array.
  - v. Print the smallest element in the array.
2. Write a program to sort 'n' numbers in an array in ascending order using Selection sort algorithm.
3. Write a program to sort 'n' numbers in an array in ascending order using Bubble sort algorithm.

4. Write a program to search a given element in a given list of integer elements using Linear Search algorithm.

Viva Questions:

1. What is an array? Declare an array of 20 float values.
2. Declare and initialise all the elements in an integer array to zeros.
3. Explain Selection sort and Bubble sort algorithms.
4. Explain Linear Search algorithm.

**Week 10 (Arrays)**

1. Write a program to search a given element in a given list of integer elements using Binary Search algorithm.
2. Write a program to read in a given matrix and to print out the same.
3. Using functions write a program to  
(i) to read      (ii) write      (iii) add      (iv) multiply  
two given matrices.

Viva Questions:

1. Explain Binary Search algorithm.
2. How do you pass an array to function?
3. How do you store a matrix of order 3 x 4?
4. How do you declare a string to store 30 characters?
5. What is a multi-dimensional array? Declare a 3-d array.
6. How many elements are there in array `arr: int arr [2] [3] [4];`
7. In an array of  $n$  integers, Array index starts with \_\_\_\_\_ and ends with \_\_\_\_\_.

## Week 11 (String Manipulations)

1. Write a program to find the length of a given string (Do not use 'strlen' function)
2. Write a program to copy the contents of a given string into another string (Do not use 'strcpy' function)
3. Write a program to reverse a given string and check whether a given string is a palindrome.

## Week 12 (Pointers)

1. Using function and pointers write a program to swap two integer variables.
2. Using function and pointers write a program to find the sum of all the elements of an array.
3. Using Functions and Pointers, write a program to  
(i) to read      (ii) write      (iii) add      (iv) multiply  
two given matrices.

## Viva Questions:

1. What is a pointer?
2. What are pointer operators?
3. What are the arithmetic operations that are allowed and not allowed on pointer variables?
4. What is the relationship between a 1D-array & a pointer?
5. What is the relationship between a 2D-array & a pointer?
6. Using pointer notation how is the element a[3][4] in int a[5][5] accessed?

### Week 13 (Structures)

1. Write a program to generate address labels using structures.
2. A complex number is of the form  $a+ib$ , where  $a$  is the real part and  $b$  is the imaginary part. Define a structure with real part and imaginary part of a complex no as its member data. Write a program to perform the following operations over two complex numbers.
  - a. Addition
  - b. Subtraction

#### Viva Questions:

1. What is a structure? Give the syntax.
2. What is the difference between an array & a structure?
3. What is the difference between a structure & a union?
4. Declare a structure for i) rational number ii) employee record.
5. How do you pass a structure to a function?

### Week 14(File operations)

1. Write a program to
  - i. Create a file with student details
  - ii. Read and Display its contents.
2. Write a program to
  - i. Create a text file
  - ii. Copy the created file into another file.
  - iii. Compare the contents of both the files.

#### Viva Questions:

1. What are the different file operations in C?
2. Explain the syntax of fopen, fprintf, fscanf functions.
3. What are command line arguments?
4. What are pre-processor commands?

## C++

### Week 15 (Introduction to C++: Inline, Function Overloading, Class)

1. Write a program to find the sum and average of two given numbers.
2. Write the following inline functions and call them from main ().
  1. To find the square of a given number.
  2. To find the cube of a given number.
3. Using Function Overloading, write a program to calculate the volume of cube, cylinder, and rectangular box using Function overloading.
4. Write a program that creates a class Rectangle with 2 data members (length and breadth), 2 constructors, and the following member functions
  - a. Default constructor which initializes length and breadth to 0(zero).
  - b. Parameterized Constructor that takes two arguments, length and breadth.
  - c. Copy Constructor
  - d. Sets length and breadth.
  - e. Calculate the area.
  - f. Calculate the perimeter.

#### Viva Questions:

1. What is an inline function?
2. What is function overloading?
3. What is a reference variable? Give its syntax.
4. What are default arguments?
5. What is a class? Give the syntax.
6. What is an object? How do you create an object?
7. What is a constructor, destructor?
8. When are constructor & destructor called?
9. What are the different types of constructors?
10. What is a copy constructor?

## **WEEK-16(CLASSES):**

1. Write a program to create a student class to store the details of the student (Name, Roll no, Marks in 5 subjects)

### **Data members:**

- (a) Name
- (b) Roll no
- (c) Marks in 5 subjects

### **Member functions:**

- (a) To enter the information.
- (b) To display the information.
- (c) To calculate the total marks obtained by the student and display it.
- (d) To calculate the percentage and display it.
- (e) Destructor.

2. Write a program to implement a matrix class to store the elements of a matrix and to add and multiply the matrices.

### **Data members:**

- (a) Rows.
- (b) Columns.
- (c) A 2D matrix.

### **Member functions:**

- (a) To read matrix.
- (b) To print the matrix.
- (c) To add two matrices and return the sum as an object.
- (d) To multiply the matrices and return the product as an object.

Create a class **BankAccount** with

- 1) *account number, name, balance* as data members.
- 2) Use a *static* data member *interestrate* to store the interest rate for each saver.
- 3) Provide the following member functions:
  1. *Constructor* that initializes the data members.
  2. *Showbalance* that displays the current balance of the saver.
  3. *Deposit* function to deposit the amount entered by the user and update the balance.
  4. *Withdraw* function to withdraw the amount entered by the user and update the balance.
  5. *Interest* function to calculate the interest.  
(InterestAmount = balance \* interestrate)
  6. *Modify interest rate* function to modify the interestrate.

Instantiate two different objects (*Ramu and Ravi*) of class **BankAccount** with balances of Rs.3000 and Rs.5000 respectively. Initialize the interest rate to 8 percent. Then calculate monthly interest and print the new balances for each saver. Now modify the interest rate to 9 percent, calculate the monthly interest again and print the new balances for each saver.

Viva Questions:

1. What is a static data member? How is it different from a normal data member?

**Week 18(operator overloading):**

1. Implement a complex class with the following:

Member functions:

- (a) Constructor to initialize the real and imaginary parts of the complex number.
- (b) Display the complex number.
- (c) Overload operator +

(d) Using friend function Overload operator –

**Extra credit:**

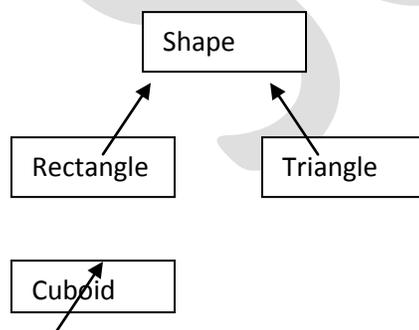
Using friend function overload operator <<

Viva Questions:

1. What is a friend?
2. What are the advantages of friend function?
3. What is operator overloading?
4. What are the operators that cannot be overloaded?
5. Can operator overloading be implemented using friend function?
6. What is this pointer?
7. What is dynamic binding?
8. What are new and delete operators?

**WEEK-19(INHERITANCE AND FUNCTION TEMPLATE):**

1. Implement the shape hierarchy based on the figure.



2. Write a program to find the maximum and minimum numbers in a given list of 3 numbers using template function.

### Viva Questions

1. What is polymorphism?
  2. What is an abstract class?
  3. What is a virtual function?
  4. What is a pure virtual function?
  5. Can a constructor be virtual? Can a destructor be virtual?
  6. What is a function template? Give the syntax.
  7. What is a class template? Give the syntax.
  8. What is dynamic binding?
3. Write a program to count the number of words in the given text.