Laboratory - Programming for Problem Solving Course

code: ESC-105

Laboratory Outcomes:

1. To formulate the algorithms for simple problems
2. To translate given algorithms to working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs.
6. To be able to declare pointers of different types and use them in defining self referential structures.
7. To be able to create, read and write to and from simple text files.

Lab 1: Problem solving using computers:

1. Familiarisation with programming environment.

Lab 2: Variable types and type conversions:

Simple computational problems using arithmetic expressions:

2. Ramesh's basic salary is input through the keyboard. His dearness allowance is 40% of basic salary, and house rent allowance is 20% of basic salary. Write a program to calculate his gross salary.
   Hint: Gross Salary = Basic Salary + DA + HRA
3. If the marks obtained by a student in three different subjects are input through the keyboard, find out the aggregate marks and percentage marks obtained by the student. Assume that, maximum marks that can be obtained by a student in each subject is 100.
   Hint: Use subjects as Hindi, English and Mathematics.
4. Temperature of a city in Fahrenheit degrees is input through the keyboard. Write a program to convert this temperature into Centigrade degrees.
   Hint: Centigrade = (Fahrenheit – 32) *5/9
5. The length & breadth of a rectangle and radius of a circle are input through the keyboard. Write a program to calculate the area & perimeter of the rectangle, and the area & circumference of the circle.
6. Two numbers are input through the keyboard i.e num1 and num2. Write a program to interchange the contents of num1 and num2 without using third variable and using third variable.
7. If a five-digit number is input through the keyboard, write a program to calculate the sum of its digits.
   Test Case: Num = 12341 Sum = 11

8. If a five-digit number is input through the keyboard, write a program to reverse the number.
   Test Case: Num = 12341 Reverse = 14321.
9. A cashier has currency notes of denominations 10, 50 and 100. If the amount to be withdrawn is input through the keyboard, find the total number of currency notes of each denomination the cashier will have to give to the with drawer.
   Test Case: Amount = Rs 570 Hundred_Note = 5 Fifity_Note = 1 Ten_Note = 2

Lab 3: Branching and logical expressions:

Problems involving if-then-else structures

10. Find the absolute value of a number entered through the keyboard.
    Hint: Absolute value of any negative number id is positive value for example absolute(-5) = 5 and absolute(5) =5.
11. If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit he made or loss he incurred.
12. Any integer is input through the keyboard. Write a program to find out whether it is an odd number or even number.
13. Three angles of the triangle are entered through the keyboard, write a program to check whether a triangle is valid or not. A triangle is valid if the sum of all the three angles is equal to 180 degrees.
14. A four-digit number is entered through the keyboard. Write a program to obtain the reversed number and to determine whether the original and reversed numbers are equal or not. Such a number is also called palindrome number for example Reverse of 1221 is 1221.
15. If the ages of Ram, Shyam and Ajay are input through the keyboard, write a program to determine the youngest of the three.
16. Any year is input through the keyboard. Write a program to determine whether the year is a leap year or not.
17. Any character is entered through the keyboard, write a program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol. The following table shows the range of ASCII values for various characters.

Characters	**ASCII Values**
A – Z	65 – 90
a –z	97 – 122
0 – 9	48 – 57
Special symbols	0 – 47, 58 – 64, 91 – 96, 123 - 127

18. Write a program which reads a character from keyboard and reports whether it is a vowel, consonant or any other non-alphabet. Use the logical operators && and || operator.
19. A library charges per day fine for every book returned late. For first 5 days the fine is 50 paise per day, for 6-10 days fine is one rupee per day and above 10 days and till 30 days fine is 5 rupees per day. If you return the book after 30 days your membership will be cancelled. Write a program to accept the number of days the member is late to return the book and display the fine or appropriate message.

Hint : late_days = 4 fine = Rs 2
late_days = 7 fine = Rs 4.50
late_days = 12 fine = Rs 17.50

Lab 4: Loops, while and for loops:

Iterative problems e.g., sum of series

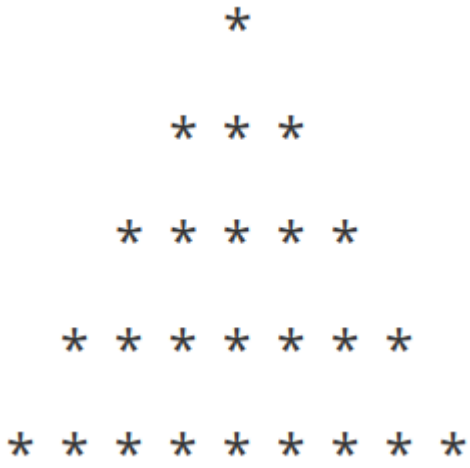
20. Write a program to find the factorial value of any number entered through the keyboard.
21. Write a program to find is a given number is palindrome or not.
22. Write a program to find if the entered 3 digit number is Armstrong or not. Armstrong number is a number in which sum of cube of digits is equal to number.
    Ex: 153 = (1 * 1 * 1) + (5 * 5 * 5) + (3 * 3 * 3)
23. Write a program to find if the entered number is prime or not.
24. Write a program to print Fibonacci series till any entered number. For example the number entered id 50 then the series should be 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, if the entered number is 200 then the series should be 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144.
25. Write a program to enter the size of pattern and produce the following pattern for example if entered size is 5.

```
*

* *

* * *

* * * *

* * * * *

* * * * * *
```

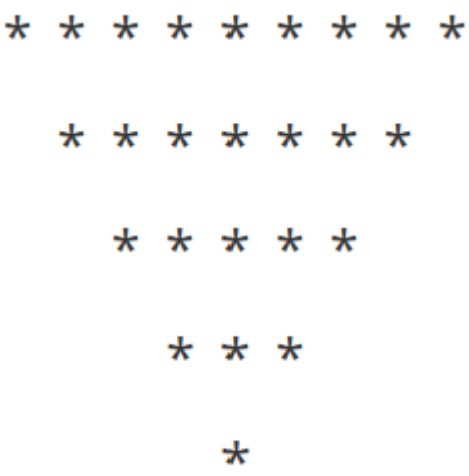
26. Write a program to enter the size of pattern and produce the following pattern for example if entered size is 5.

```
    *

   * *

  * * *

 * * * *

* * * * *
```

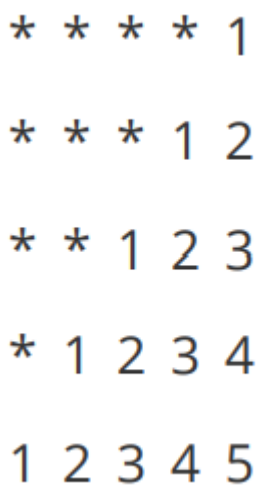
27. Write a program to enter the size of pattern and produce the following pattern for example if entered size is 5.



28. Write a program to enter the size of pattern and produce the following pattern for example if entered size is 5.



29. Write a program to enter the size of pattern and produce the following pattern using only two for loops for example if entered size is 5.



Lab 5: 1D Arrays: searching, sorting:

30. Write a program to find out largest element of an array.
31. Write a program to find out second largest element of an unsorted array.
32. Write a C program to find average and sum of n natural numbers of an array.
33. Write a C program for bubble sort.
34. Write a C program for linear search.
35. Write a C program for binary search.
36. Twenty-five number are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many are negative, how many are odd and how many are even.

Lab 6: 2D arrays and Strings

37. Write a C program for addition of two matrices.
38. Write a C program for multiplication of two matrices.
39. Write a code to use string functions: **strlen:** Computes the length of a string. **strcpy:** Copies one string to another. **strcat:** Concatenates two strings. **strcmp:** Compares two strings.

Lab 7: Functions, call by value:

40. Write a function power(a, b), to calculate the value of a raised to b.
41. Write a function that receives marks obtained by a student in 3 subjects and returns the average and percentage of these marks. Call this function from main( ) and print the results in main( ).
    Hint: Use call by reference to return multiple values
42. Write a code using Call by Value to swap the values of the two variables

Lab 8: Numerical methods (Root finding, numerical differentiation, numerical integration):

43. Write a code to find the roots of quadratic equation use sqrt() function. The standard form of a quadratic equation is: The term $$\left(b^2 - 4ac \right)$$ is known as the discriminant of a quadratic equation. It tells the nature of the roots.

- If the discriminant is greater than 0 , the roots are real and different.
- If the discriminant is equal to 0 , the roots are real and equal.
- If the discriminant is less than 0 , the roots are complex and different.
  $$\left(ax^2 + bx + c = 0 \right)$$, where a, b and c are real numbers and a != 0

Lab 9: Recursion, structure of recursive calls

44. Write a code to create factorial of a number using recursion.
45. Write a recursive function to obtain the first 25 numbers of a Fibonacci sequence. In a Fibonacci sequence the sum of two successive terms gives the third term. Following are the first few terms of the Fibonacci sequence: 1 1 2 3 5 8 13 21 23 55 89.....
46. Write a recursive function to obtain the running sum of first 25 natural numbers.

Lab 10: Pointers, structures and dynamic memory allocation

47. Create a structure called Book with members title , author , and price , declare a variable book1 of type Book , fill in the details (title, author, and price) for book1 and display the details of book1 .
48. Create a structure called Student with members name and id , declare an array students of type Student , allowing for MAX_STUDENTS (here, 3) students, fill in the details (name and id) for each student in the array and display the details of each student using a loop.

Lab 11: File handling:

49. Write a program that writes a line of text to a file.
50. Write a program that reads and displays the contents of a file.