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Faculty of Engineering (FOE)

**Problem-Solving Using Computers Lab**

|CS 1031 | 1 Credit | 0 0 2 1

**Session:** Jan-May 2024

# Lab Experiments

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| **Week** | **Topics** | **Session Outcome** |
| 1 | Algorithms and Flow Charts | Describe the flowcharts and design of an algorithm |
| 2 | Working with Linux Commands | Use Unix commands to manage files and develop programs, including multi-module programs |
| 3 | Formula-based C Programs | Understand the fundamentals of C programming. |
| 4 | Control Structures: if statement | Choose the decision-making statements to solve the problem. |
| 5 | Control Structures: Switch | Choose the decision-making statements to solve the problem. |
| 6 | Control Structures: Loops | Choose the loop statements to solve the problem |
| 7 | Control Structures: Nested Loops | Choose the loop statements to solve the problem |
| 8 | 1-D Array | Implement different Operations on 1-D arrays. |
| 9 | 2-D Arrays | Implement different Operations on 2-D arrays |
| 10 | Strings | Implementation of different Operations on strings |
| 11 | Functions  21 | Use functions to solve the given Problem |
| 12 | Pointers | Understand and apply the concept of pointers in programming |
| 13 | Structures | Understand and apply the concept of Structure in programming |

# Lab 1. Algorithms and Flowcharts

# 1. To multiply two numbers.

# 2. To divide two numbers.

# 3. To check whether the given number is even or odd.

# 4. To swap two numbers.

# 5. To check whether the given number is lesser than 10 or not.

# 6. To convert Fahrenheit to Celsius.

# 7. To check the greater number in the given two numbers.

# 8. To calculate simple interest.

# 9. To check the greater number in the given two numbers.

# 10. To calculate area of the given rectangle.

# Lab 2. Working with Linux Commands

# A screenshot of a computer Description automatically generated1

|  |  |  |
| --- | --- | --- |
| 22 | clear | Clear terminal |
| 23 | ps | Display the processes in terminal |
| 24 | man | Access manual for all Linux commands |
| 25 | grep | Search for a specific string in an output |
| 26 | echo | Display active processes on the terminal |
| 27 | sort | sort the file content |
| 28 | cal | View Calendar in terminal |
| 29 | df | Check the details of the file system |
| 30 | wc | Check the lines, word count, and characters in a file using different options |

**Lab 3. Formula based C Programs**

1. Write a program to convert the time in seconds to hours, minutes, and seconds. (1 hr = 3600 sec).
2. Write a program to find the sum of the digits of a four-digit number (ex. 1234 sum=10) (without using a loop).
3. Write a program to convert the temperature given in Fahrenheit to Centigrade and Centigrade to Fahrenheit. Hint: C=5/9(F-32)).
4. Write a program for converting distance in mm to cm, inch, feet (1 cm =10mm, 1inch=2.5cm, 1 foot =12 inches).
5. Write a program to find out the distance between two points e.g. (x1, y1) and (x2, y2).

*Hint: Distance=√(x2-x1)2+ (y2-y1)2*

1. Write a program to evaluate the area of the circle Area = Pi \* R2
2. Write a program to interchange the values of two variables using a third variable.
3. Write a program to interchange the values of two variables without using a third variable.

**Lab 4. Control Structures: If statement**

1. Write a program to check whether the given number is odd or even.7
2. Write a program to check whether a given year is a leap year or not.
3. Write a program to find the roots of a quadratic equation
   1. Hint: root = -b +/- sqrt(b2-4ac)/2a
4. Write a program to find the total no. of days for a given number of months counting from January month.

a.Example: m=3, days=31+ (28 0r 29) + 31.

1. Write a program to take two numbers as an input and find whether one number is a multiple of the other or not.
2. Write a program that returns a letter grade based on a quiz score. The input will be the integer score from a ten-point quiz.
   1. The letter grades are assigned by:

b. 9-10“A”7-8“B”5-6“C”3-4“D”<3“F”

1. Write a program that takes three sides of a triangle input and calculates iure area, if these conditions are satisfied a+b>c, b+c>a, a+c>b, calculate area=(a+b+c)/2
2. Write a program to check whether the given character is a vowel, consonant or a digit.

**Lab 5. Control Structures: Switch**

1. c
2. Write a p Write’s cho rogram to remove all the break statements from Ex-1 (with switch-case construct) and try to execute the program with a few inputs. Observe the difference.
3. Write a program to input the number of week’s days (1-7) and translate to its equivalent name of the day of the week (e.g., 1 to Sunday, 2 to Monday)
4. Write a program to calculate a bill for internet browsing. The conditions are given below: Minimum Rs. 200 for up to 100 calls.

Plus, Rs. 0.60 per call for the next 50 calls. Plus, Rs. 0.50 per call for the next 50 calls.

Plus, Rs. 0.40 pe call for any call beyond 200 calls

1. program to calculate the amount of an electricity bill for the following criteria. (Without a Loop)

|  |  |
| --- | --- |
| Units | charge per unit (Rs.) |
| Write First, 1-100 up to | 0 |
| Next, 101-200 up to | 1.5 |
| Next, 201-400 up to | 2.5 |
| 401 onwards | 3.5 |

1. Write a program to calculate the discount in rupees for the following criterion. (Without Loop)

Cost price discount

>=800 25%

500-800 20%

<500 no discount (0%)

**Lab 6. Control Structures: Loops**

* 1. Write a program to take N as input and print the odd numbers in descending order.
  2. Write a program to print the Fibonacci number.

*skibidi: (Fibonacci series is 0, 1, 1, 2, 3, 5, 8,)*

* 1. Write a program to find whether the given number is prime or not.
  2. Write a program to convert the decimal number into binary to decimal. *Ex: 1101 = 1\*2 3 + 1 \* 2 2 + 0 \* 2 1+ 1\* 2 0 =13*
  3. Write a program to convert the decimal number into

Ex: 1234 reverse=4\*10 3 +3 \* 10 2 + 2 \* 10 1 + 1 \* 10 0 =4321

* 1. Write a program to find the sum of n terms of the sin series sin(x) = x - x3 + x5 – x7
  2. Write a program to check whether a given integer no. is palindrome or not.
  3. Write a program to check whether the given number is Armstrong or not. An Armstrong number of three digits is an integer such that the sum of the cubes of its digits is equal to the number itself. For example, 371 is an Armstrong number since 33 + 73 + 13 = 371.

**Lab 7. Control Structures: Nested Loops**

1. Write a program to print different patterns using nested loops.

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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2 | 3 |  |  | | | |  |
|  | 4 | 5 | 6 |  |  | |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |  |
| 1 |  |  |  |  |  |
| 2 | 2 |  |  |  |  |
| 3 | 3 | 3 |  |  |  |
| 4 | 4 | 4 | 4 |  |  |
| 5 | 5 | 5 | 5 | 5 | 5 |
| 5 | 5 | 5 | 5 | 5 |  |
| 4 | 4 | 4 | 4 |  |  |
| 3 | 3 | 3 |  |  |  |
| 2  1 | 2 |  |  |  |  |
|  |  |  |  |  |  |  |
|  | 1 |  |  |  |  |  |
|  | 2 | 4 |  |  |  |  |
|  | 3 | 5 | 7 |  |  |  |
|  | 6 | 8 | 10 | 12 |  |  |
|  | 9 | 11 | 13 | 15 | 17 |  |

1. Write a program to generate the multiplication table for n numbers up to k terms (nested loops).
2. Write a program to print the Fibonacci numbers that fall in the given range.
3. Write a program to print the Nth the prime number.
4. Write a program to print the Nth the Armstrong number.

**Lab 8. 1-D Array**

1. F Write a program to find the largest and smallest element in an array.
2. Write a program to find the sum of odd index numbers in an array.
3. Write a program to print the subarray that lies between the two indexes.
4. Write a program to find the number of positive numbers, negative numbers, odd numbers, even numbers, and the number of 0 of an array.
5. Write a program to reverse an array with an auxiliary array.
6. Write a program to check whether an array is sorted or not.
7. Write a program to arrange the elements of an array in ascending order by a simple sorting method. (Selection sort/bubble sort)
8. Write a program to take an array of 10 elements. Split it into the middle and store the elements in two different arrays. E.g.- Initial array:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **58** | **24** | **13** | **15** | **63** | **9** | **8** | **81** | **1** | **78** |

After splitting:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **58** | **24** | **13** | **15** | **63** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **9** | **8** | **81** | **1** | **78** |

**Lab 9. 2-D Arrays**

1. Write a program to take 3 student marks in 5 subjects. Print the total marks of each student and the average marks of each subject.
2. Write a program for searching for an element in the matrix and counting the number of occurrences of that element.
3. Write a program to multiply two matrices.
4. Write a program to check if the given matrix is a magic square or not.
5. Write a program to find whether a given matrix is symmetric or not.

*Hint: A = AT*

1. Write a program to find the trace and norm of a given square matrix.

*Hint: Trace = sum of principal diagonal elements*

*Norm = sort (sum of squares of the individual elements of an array)*

**Lab 10. Strings**

1. Write a program to change all lower-case letters into upper case in a sentence.
2. Write a program to find the last occurrence of a particular character.
3. Write a program to concatenate/length/copy two strings using the library function.
4. Write a program to count the number of words in a sentence.
5. Write a program to reverse a string.
6. Write a program to find the string length of a string without using the predefined function.
7. Write a program to find the substring of a given string.
8. Write a program to check if the given string is a palindrome or not.

**Lab 11. Functions**

1. Write a program to find the factorial of a number using a function. (Ex: 5! =5\*4\*3\*2\*1. Use a function Fact to evaluate factorial & print the result).
2. Write a program to find the maximum of a given set of numbers using functions. (Use a function Max and return the result to the main function)
3. Write a program to find the GCD of two numbers recursively. (Ex: GCD of 9, 24 is 3)
4. Write a program to check whether the given number is prime or not. Using this function generates first n prime numbers using the above function.
5. Write a function to generate the nth Fibonacci term using recursion. Print first N Fibonacci terms using this function. Hint: (Fibonacci series is 0, 1, 1, 2, 3, 5, 8,)
6. Write a program to check if the given string is a palindrome or not, using the string handling function.
7. Write a function **Sort** for sorting a list of names which will use a function **compare** to compare two names. (Selection /bubble Sort may be used).

**Lab 12. Pointers**

1. Write a program to access two integers using pointers and add them.
2. Write a program to find out the greatest and the smallest among the three numbers using pointers.
3. Write a program to determine the length of a character string using a pointer.
4. Write a program to compute the sum of all elements stored in an array using a pointer.
5. Write a program to determine whether a substring (string 1) is in the main string or not. If present, return the pointer of the first occurrence.

**Lab 13. Structures**

**w**

1. Write a program to define a structure personal that would contain the person’s name, date of joining, and salary. Using this structure write a program to read this information for one person from the keyboard and print the same on the screen.
2. Write a program to create an array of student structures to store the roll no., name, and marks in 3 subjects. Input the details of N students into the array and display roll no., name, and total marks of each student in decreasing order of total marks.
3. Write a program to create an array of employee structures to store emp-no, name, basic salary, and HRA. Input the details of N employees and display emp-no, name, basic, HRA, and net salary. Display the details of all employees whose net salary is more than the average net salary of all employees.
4. Write a program to create a structure named Date having day, month, and year as its elements. Store the current date in the structure. Now add 45 days to the current date and display the final date.

**Lab 14. End-term Exam**