IT22111- PROGRAMMING FOR PROBLEM SOLVING LABORATORY

List of programs for lab sessions

Exercise 1 **Usage of Basic Linux commands**

Commands: mkdir, cd, mv, rm, ls, cat, vi, cp, rm etc.,

Exercise 2 **C Programming using Simple statements and expressions**

0. Print your name, I am an Engineer. Sample: My name is Sivaji, I am an Engineer. Get familiar with vi, cc, and ./a.out.
1. Print your details Name, age, Gender (M/F), Address, CutOff (in HSC) with one detail per line and tab between label and value.
2. Read your details through keyboard and display them. (Use gets() for string)
3. Kumar has Rs.x and Sheela has Rs.y. Both exchange their amounts. Simulate this as an interactive C program.
4. Calculate the daily wage of a labour taking into account the pay per day, number of hours worked, TA, and DA.
5. Box 1 has M apples and Box 2 has N apples. Assuming you do not have any other space/storage to hold the apples, exchange the apples in Box 1 and Box 2. (Swap without temp)
6. Display the sum of ASCII values of vowels in English letters.
7. Read a complex number. Display the number in the format a+ib. and calculate its modulus value as the square root of the sum of squares of a and b. (Use sqrt, pow functions)

Exercise 3 Scientific problems solving using decision making

1. Ram, Balaji, and Kumar are siblings aged x,y, and z respectively. Find the youngest and oldest among them.
2. Calculate the ESE marks of a subject as 40%(Internal_mark) + 60%(External_mark) for theory subject and 60%(Internal_mark) + 40%(External_mark) for practical subject. Internal_mark is calculated as 70%(CAT1+CAT2+AT3) + 30%(Assignment1 + Assignment2 + Assignment3). The External_mark is awarded for 100. (Hint: Read 'P' and 'T' to differentiate practical and theory subjects)
3. "This Month" is an application that reads a number between 1 and 12 and prints the numbers of days in that month. For example, if it reads 3, it displays 31. Develop the application 'This Month'. Take care of Leap years. (Use if-else)
4. 'Solar System' is an application that reads a number between 1 and 9 and prints the respective planet. For example, if it reads 3, it displays 'Venus'. Develop the application Solar System. (simple switch)
5. Develop a 'Kids Laptop' with minimum of 10 English letters to display A says Apple, B says Ball… Enable the kids to learn both upper and lower case letters with same word. (Use switch case clustering)

Exercise 4 Scientific problem solving using looping

1. Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
2. An astrologer calculates the day’s fortune as the sum of the numbers in the date of birth. If the sum is between 1 and 5(both inclusive), he predicts the day as ‘Excellent’. If the sum is between 6 and 8 (both inclusive) he predicts the day as ‘Good’ and if the sum is 9 he predicts the day as ‘Fair’. Develop an application for this model. (Hint: Repeat the process until the sum is a single digit)

   Grading System for Q3 and Q4

Grade	O	S	A	B	C	D	U
Mark range	100	90-99	80-89	70-79	60-69	50-59	<50
Grade point	10	9	8	7	6	5	0

3. Read the credits of each subject and the marks scored by a student in Sem 1 subjects and calculate the grade and credits earned for each subject.
4. Generate the grade sheet with all subjects along with their credits; calculate the GPA (with 2 digits precision) as the fraction of total credits earned over the total credits in Semester 1.
5. Assume SVCE mark entry portal has facility to enter the ESE marks and its equivalent in words by the teacher. However, the teachers wish that it would be great if the marks in number are converted to their words by the software. Can you please develop a C program for the same? Marks range from 0 -100. Sample: 81 – Eight One
6. Print the following patterns using the concept of nested loops

(a)
```
1
2 2
3 3 3
4 4 4 4
5 5 5 5
```

(b)
```
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
```

(c)
```
        *
      * *
    * * *
  * * * *
* * * * *
```

Exercise 5 Simple programming for one dimensional and two dimensional arrays

1. Prof. Siva awards marks for N questions in the range 0-16. Support him in finding the total. Ensure the following:
    a. Only numbers are entered
    b. If he awards marks out of the range, ask him to re-enter the mark
    c. limit the total to 100
2. Dr. Sudha marks daily attendance of N students as a sequence of 'P' and 'A' for present and absent respectively. Help her to find the number of present and absentees for a day.
3. Prof. Vimal is interested in forming project teams as a triplet of every alternate student in his class. Say, if 10,11,12,13,14,15 are the roll numbers of the students, then team_1 will be (10,12,14) and team_2 will be (11,13,15). Automate this team formation to Vimal when he gives the class size and the roll numbers. Ensure that this is possible only when the class size if a multiple of three.
4. Calculate the Mean, Variance, and SD of a N values using the following formulae:
    a) Mean as the average of the values
    b) Variance: $s^2 = \frac{\sum (X - \bar{X})^2}{N-1}$
    c) SD = s (Square root of Var)
5. Read a square matrix and an element e in it, write a program to print the elements adjacent to e. Ensure the following:
        a) e should be present in the matrix
        b) IF e is a boundary elements, do not overshoot/undershoot the indices
6. Read the marks scored by M students in N subjects and perform the following:
    a) Calculate the subject-wise maximum marks
    b) Calculate the total of each student
    c) Find the row index of the topper student
    d) Find the grand total of all marks of all students
7. Read the sales done by 2 salesmen in 5 months for 4 products. Calculate the total sales done for each product for every month. (Matrix addition)
8. A shopkeeper delivers rice bags to three shops SHOP1, SHOP2, SHOP3 in quantities of 10kg, 20kg and 30kg for a month. The price of 10kg, 20kg and 30kg bags are Rs 100, Rs 200 and Rs 300 respectively. If the shopkeeper delivers one bag to each shop, calculate the income from the three shops separately. (Vector-Matrix multiplication)

Approach:

Read the quantities sold as a 1*3 vector; treat as quantity per shop row-wise [1,1,1]

Read the amounts of 10kg, 20kg, and 30kg bags for each shop as a 3*3 matrix; treat shops column-wise

100	100	100
200	200	200
300	300	300

Then the income from each shop as vector-matrix multiplication is [600,600,600]

(Suggestion: Extend the vector as matrix as sales in 3 months for complete matrix multiplication)

Exercise 6 Solving problems using Strings

0. Print your name by initializing and reading from keyboard using `char *s`.
1. Read a name and count the number of vowels in it.
2. A numerologist suggests renaming a person by repeating the vowel in the name subsequent to its existing position. Ex: Sivakumar : Siivaakuumaar. Write a C program to automate his suggestion.
3. Read the first name, middle name, and last name of a person and form a full name as the concatenation of them. (Using and without using library functions)
4. Write a C program to design a encryption technology that replaces every non-vowel character of a string with its subsequent character in a rotation. Ex: BASKARZ : CATLASA
5. The strength of a name is the sum of the ASCII values of its characters. Find the strength of a name.
6. Read a string and check if it's a palindrome. (Using and without using library functions)
7. Print a funny pattern like this :

COMPUTER
OMPUTER
MPUTER
PUTER
UTER
TER
ER
R

Exercise 7 **Programs to illustrate structures and union**

1. Create a structure Complex and perform addition, subtraction, and multiplication of 2 complex numbers.
2. Create a structure STUDENT with <Roll_no,Name,Gender,marks[5], grades[5],GPA>. Calculate the grade of each subject (assuming one-to-one mapping of marks and grades) and GPA as the average of marks scored by a student.
3. Calculate the grades and GPA of N students of a class using the STUDENT structure.
4. Create a structure DOB <Day,month,year>. Include this as a sub structure in STUDENT and read and print the DOB a student along with other details.
5. Create a structure subject <sub_code,title,credits>. Include this subject as a nested structure in student as an array of size 5. Generate a grand grade sheet of a student with student details, subject details, grade and GPA (as per grading system in ex 4).

   Suggested design:

```
struct student{
int roll;
char name[20];
char gender;
struct DOB
birthday;
struct subject
sub[5];
int marks[5];
char grades[5];
float GPA;
}
```

```
struct DOB{
    int day, month,
year;
}

struct subject{
char sub_code[8];
char title[20];
int credit;
}
```

6. Create a union employee <emp_id, salary>. Read and write the employee details and demonstrate the significance of union's space management.

Exercise 8 Programs to illustrate Pointers

Use pointers for to implement the following

1. Implement a Pocket calculator with arithmetic operators (include increment/decrement also).
2. Demonstrate the effect that changing the value through the pointer to a structure variable reflects the actual value of the variable. (Hint: Initialize a structure variable; create a pointer to the variable; modify the value using pointer and show the changes)
3. Use Dynamic memory allocation to read the marks of N students in a subject and find the total, average, maximum, and minimum among them.
4. Read and display the details of N books where each book has <ISBN,title,price,author>.
5. Generate a multiplication table for user input M and N.

Exercise 9 Programs to illustrate user defined functions

1. Create functions of prototypes `print_int(int)`, `print_float(float)`, `print_char(char)`,`print_string(char *)`. Define the functions with only printf(). Read your roll_no, GPA, gender, and name and use the prototypes to print them.
2. Simulate pocket calculator operations using functions of various styles (with/without parameter/return). Pass a variable `result` in `main()` by reference to demonstrate pass by reference.
3. Being a question of syllabus in CAT, Prof. Selvi wishes to award an addition of x marks to all students of her class. Write a C program that achieves this using a function of prototype `void grace_marks(marks[], n, int x)`. Write functions `get_marks(marks[], n)` and `print_marks(marks[], n)` to read and print marks. //uses passing an array (reference)
4. Demonstrate sorting N student details using a function `rank_students(student[], n)` based on their GPA. Use STUDENT <roll_no,name,GPA>.
5. Write programs using recursive functions for the following:
    a) Find the sum of digits of a number (refer Astrologer scenario)
    b) Search an element in an array (Linear search)
    c) Print the marks in letters (refer SVCE exam portal scenario)

Exercise 10 File Handling in C

1. Read a sentence from console and write into a file out.txt. Read out.txt, change the case of each character, and write in console.
2. Read any of the C files from your previous exercises and print the same on the console.
3. Read <roll, Name,GPA> of a student from console and write into a file student.txt
4. Add a new record read from console say <100, Srinivasan,9.8> to student.txt (append)
5. Retrieve the details of a student named “Krishna” and print in console.
6. Copy the contents of student.txt to new_student.txt

Exercise 11 Enumerated data types, macros, and storage classes

1. Create an enumerator for months of a year, days of a week, and display them.
2. Create an enumerator GEMS with user-defined values as price for a gram of each GEM (diamond,pearl etc). Use typedef for GEMS and print the price of a GEM.
3. Calculate the square and cube of a number using macro functions.
4. SBI generates tickets at its automated counter machine starting from 100. Each user gets a subsequent ticket number. Demonstrate this using appropriate storage class.

Exercise 12 Mini-project