

Indian Institute of Technology (IIT-Kharagpur)

AUTUMN Semester, 2015

COMPUTER SCIENCE AND ENGINEERING

PDS Laboratory

PDS Lab

Full Marks: 40

Time allowed: 3 hours

INSTRUCTIONS: Please see the questions and write C programs step by step. Ensure proper indentations to improve the readability of your code. All these features are necessary and absence will lead to deduction of marks.

Please do not forget to upload files before you leave.

Laboratory Exam

1. Consider the problem of entering a list of strings into the computer and rearranging them into alphabetic order. Approach the problem using a **one-dimensional array of pointers**, where each pointer indicates the beginning of a string. The string interchanges can now be carried out by simply reassigning the pointers, as required.

Write the function in two parts: the **main** function, and the user defined function, **void reorder(int n, char *x[])**. You can assume that the size of a string can be maximum 20 characters, and you are free to use any in-built string manipulation function.

(10 marks)

2. Declare a structure to store the following information of an employee:

- (a) Employee code
- (b) Employee name
- (c) Salary
- (d) Date of Join (which is itself a structure consisting of day, month, and a year)

Write a C program to store the data of n employees where n is given by the user (Use dynamic memory allocation). Include a menu that will allow user to select any of the following features:

- (a) Use a function to display the employee information getting the maximum and minimum salary.
- (b) Use a function to display the employee records in ascending order according to their date of join.

(20 marks)

3. Catalan numbers are a sequence of natural numbers that occurs in many interesting counting problems like the following: Counting the number of expressions containing n pairs of parentheses which are correctly matched. For $n = 3$, possible expressions are $((()))$, $()(())$, $()()()$, $((())())$, $((())())$.

The recursive definition of Catalan's number is $C_0 = 1$, $C_{n+1} = \sum_{i=0}^n C_i C_{n-i}$, for $n \geq 0$. Write a C program using a recursive function `unsigned long int catalanrec(unsigned int n)` to compute the n^{th} Catalan number.

Rewrite the above recursive function to an iterative version, called `catalaniter`, where the Catalan numbers are stored in an array (whose space is dynamically allocated depending on the number n). This approach helps to prevent recomputation of the same Catalan number more than once for a given n .

(10 marks)
