

Programming and Data Structures laboratory –

Section 15

Lab Day 5

Pre-Lab Exercises (Topic: Functions and Recursions, Single Dimensional Arrays)

(Write programs for the following problems yourself before coming to Lab on 15-12-2022)

No need to submit the solutions. These are purely for your practice.

1. Declare a floating point array of size 20. Fill it with random floating (with one significant fractional digit) in the range 1.0 to 100.0 by calling the **rand()** function. Display the numbers nicely formatted, also compute and display the average, and the standard deviation of the numbers. (**Hint:** Generate random numbers in the range 1 to 1000 and the numbers divide by 10)
2. Declare an integer array of size 20. Fill it with random integers in the range 100 to 199 by calling the **rand()** function. Display the numbers nicely formatted. Pairwise interchange the numbers (i.e, first and second, third and fourth, and so on.) and display the numbers. For example, if the array has numbers 101, 190, 130, 145, after interchange, the numbers will be 190, 101, 145, 130. (**Hint:** use mod 100 to get random numbers in the range 0 to 100. Add 100, to get numbers in the range 100 to 199.)
3. Declare an integer array of size 20. Fill it with random integers in the range [100,199] by calling the **rand()** function. Display the numbers. Display if any arbitrary pair(s) of numbers present in the array add upto a value in the range [160,170].
4. In the main function, define an integer array of size 30. Fill the array with random numbers in the range of [20,30] and display the values stored in the array nicely formatted. Based on the user choice, call the following functions in an infinite loop. Exit when the user types 'e'.
 1. **maxMin:** This function should take the array as its parameter and display the minimum and maximum of the values stored in the array.
 2. **duplicate:** This function should take the array as its parameter and display the number that occur more than once.
 3. **highestFreq:** This function should take the array as its parameter and display the number that occurs with highest frequency.
 4. **largestConsecutive:** This function should take the array as its parameter and display the largest sequence of consecutive numbers occurring in the array.
 5. **largestDecreasing:** This function should take the array as its parameter and

display the largest sequence of decreasing numbers occurring in the array.

5. Write a recursive function named **findTerm** which takes a floating point number x and an integer n as arguments and returns the n th term of the following series. In the main program, read the values of n and x ($x \leq 1$) from the user and call the function **findTerm** to display the values of the n terms of the series.

1, x ,
2!

$3x^2/2$

4!
5!
6!

,.....

6. Write a recursive function to compute and display nCr , for any values of n and r in the range 0 to 20 and $n \geq r$.

Hint: Use following recurrence.

$$\binom{n}{r} = \begin{cases} 1, & \text{if } r = 0 \\ 1, & \text{if } n = r \\ \binom{n-1}{r} + \binom{n-1}{r-1} & \text{otherwise} \end{cases}$$

Test your programs by giving different inputs and checking if you are getting correct outputs.

Appropriately document your code.

—The end —