Advanced Programming External LabExam

1. Write a program to print the Pascal's Triangle

2. A permutation of an array of integers is an arrangement of its members into a sequence or linear order.

- For example, for arr = [1,2,3], the following are considered permutations of arr: [1,2,3], [1,3,2], [3,1,2], [2,3,1].

The next permutation of an array of integers is the next lexicographically greater permutation of its integer. More formally, if all the permutations of the array are sorted in one container according to their lexicographical order, then the next permutation of that array is the permutation that follows it in the sorted container. If such an arrangement is not possible, the array must be rearranged as the lowest possible order (i.e., sorted in ascending order).

- For example, the next permutation of arr = [1,2,3] is [1,3,2].
- Similarly, the next permutation of arr = [2,3,1] is [3,1,2].
- While the next permutation of arr = [3,2,1] is [1,2,3] because [3,2,1] does not have a lexicographical larger rearrangement.

Given an array of integers nums, find the next permutation of nums.

The replacement must be in place and use only constant extra memory.

3. Given an input string s and a pattern p, implement regular expression matching with support for '.' and '*' where:

- '.' Matches any single character.
- '*' Matches zero or more of the preceding element.

The matching should cover the entire input string (not partial).

4. Given a set of non-negative integers, and a value sum, determine if there is a subset of the given set with sum equal to given sum.

    Example:

Input: set[] = {3, 34, 4, 12, 5, 2}, sum = 9
Output: True
There is a subset (4, 5) with sum 9.

Input: set[] = {3, 34, 4, 12, 5, 2}, sum = 30
Output: False
There is no subset that add up to 30.

5. Given a rod of length n inches and an array of prices that includes prices of all pieces of size smaller than n. Determine the maximum value obtainable by cutting up the rod and selling the pieces. For example, if the length of the rod is 8 and the values of different pieces are given as the following, then the maximum obtainable value is 22 (by cutting in two pieces of lengths 2 and 6)

```
length  |1  2  3  4  5  6  7  8
---------------------------------------------
price   |1  5  8  9  10 17 17 20
```
And if the prices are as following, then the maximum obtainable value is 24 (by cutting in eight pieces of length 1)
```
length  |1  2  3  4  5  6  7  8
---------------------------------------------
price   |3  5  8  9  10 17 17 20
```

6. Divide and Conquer Strategy : Find the minimum and maximum element in the array using divide and conquer with recursion.

7. Given an array of strings ,group of anagrams together. You can return the answer in any order.An Anagram is a word or phrase formed by rearranging the letters of a different word or phrase ,typically using all the original letters exactly once.

8. Given an m*n matrix, return all elements of the matrix in spiral order.
9. Given a sorted array of distinct integers and a target value, return the index if the target is found. If not, return the index where it would be if it were inserted in order.

You must write an algorithm with O(log n) runtime complexity.

10. Write a python program to find the repetitive substrings in the given string.

11. Given two arrays consisting of **N** distinct integers such that the array **A[]** and **B[]** are sorted in ascending and descending order respectively, the task is to find the number of values common in both the arrays.

   Input: A[] = {1, 10, 100}, B[] = {200, 20, 2}
   Output: 0

12. Print a given matrix in counter-clock wise spiral form
   ```
   Input:
            1    2    3    4
            5    6    7    8
            9   10   11   12
           13   14   15   16
   Output:
   1 5 9 13 14 15 16 12 8 4 3 2 6 10 11 7
   ```

13. Form a Spiral Matrix from the given Array
   ```
   Input:
   arr[] = { 1, 2, 3, 4, 5,
             6, 7, 8, 9, 10,
             11, 12, 13, 14, 15, 16 };
   Output:
    1   2   3   4
   12  13  14   5
   11  16  15   6
   10   9   8   7
   ```

14. Given an **array A** containing N elements. Partition any subset of this array into two disjoint subsets such that both the subsets have an identical sum. Obtain the maximum sum that can be obtained after partitioning.

   Input: A = [1, 2, 3, 6]
   Output: 6
   Explanation: We have two disjoint subsets {1, 2, 3} and {6}, which have the same sum = 6

15. Given a list of words where each word follows CamelCase notation, the task is to print all words in the dictionary that match with a given pattern consisting of uppercase characters only.

Input: arr[] = ["WelcomeGeek", "WelcomeToGeeksForGeeks", "GeeksForGeeks"], pattern = "WTG"
Output: WelcomeToGeeksForGeeks
Explanation:
There is only one abbreviation for the given pattern i.e., WelcomeToGeeksForGeeks.

Input: arr[] = ["Hi", "Hello", "HelloWorld", "HiTech", "HiGeek", "HiTechWorld", "HiTechCity", "HiTechLab"], pattern = "HA"
Output: No match found
Explanation:
There is no such abbreviation for the given pattern.

16. Given a set of strings, find the longest common prefix.

Examples:

Input: str[] = {geeksforgeeks, geeks, geek, geezer}
Output: gee

Input: str[] = {apple, ape, april}
Output: ap

17. Given a number **N**(≥ 8), the task is to print a Hollow Triangle inside a Triangle pattern.
Example:

```
Input: N = 9
Output:
                    *
                *       *
              *           *
            *       *        *
          *       * * *          *
        *                          *
      *                              *
    *                                  *
```

* * * * * * * * * * * * * * * * *

18. Given the value of n(n < 10), i.e, number of lines, print the Fibonacci triangle.

Examples:
```
Input : n = 5

Output :

1

1 2

3 5 8

13 21 34 55

89 144 233 377 610
```

19.   Given an unsorted array A of size N, the task is to find the minimum and maximum values that can be calculated by adding exactly N-1 elements.

Examples:
Input: a[] = {13, 5, 11, 9, 7}
Output: 32 40
Explanation: Minimum sum is 5 + 7 + 9 + 11 = 32 and maximum sum is 7 + 9 + 11 + 13 = 40.
Input: a[] = {13, 11, 45, 32, 89, 21}
Output: 122 200

20. Given an array **arr** of size **N** and an integer **X**. The task is to find all the indices of the integer **X** in the array
Examples:

Input: arr = {1, 2, 3, 2, 2, 5}, X = 2
Output: 1 3 4
Element 2 is present at indices 1, 3, 4 (0 based indexing)

21. Given an array **arr[]** consisting of **N** positive integers, the task is to sort the array such that –
- All even numbers must come before all odd numbers.
- All even numbers that are divisible by 5 must come first than even numbers not divisible by 5.
- If two even numbers are divisible by 5 then the number having a greater value will come first

- If two even numbers were not divisible by 5 then the number having a greater index in the array will come first.
- All odd numbers must come in relative order as they are present in the array.

> **Examples:**
> **Input:** arr[] = {5, 10, 30, 7}
> **Output:** 30 10 5 7
> **Explanation:** Even numbers = [10, 30]. Odd numbers = [5, 7]. After sorting of even numbers, even numbers = [30, 10] as both 10 and 30 divisible by 5 but 30 has a larger value so it will come before 10. After sorting A = [30, 10, 5, 7] as all even numbers must come before all odd numbers.

22. Given an array **arr[]** consisting of **N** integers representing the number of coins in each pile, and an integer **H**, the task is to find the minimum number of coins that must be collected from a single pile per hour such that all the piles are emptied in less than **H** hours.

Note: Coins can be collected only from a single pile in an hour.

> **Examples:**
> *Input: arr[] = {3, 6, 7, 11}, H = 8*
> *Output: 4*
> *Explanation:*
> *Removing 4 coins per pile in each hour, the time taken to empty each pile are as follows:*
> *arr[0] = 3: Emptied in 1 hour.*
> *arr[1] = 6: 4 coins removed in the 1st hour and 2 removed in the 2nd hour. Therefore, emptied in 2 hours.*
> *arr[2] = 7: 4 coins removed in the 1st hour and 3 removed in the 2nd hour. Therefore, emptied in 2 hours.*
> *arr[3] = 11: 4 coins removed in both 1st and 2nd hour, and 3 removed in the 3rd hour. Therefore, emptied in 3 hours.*
> *Therefore, number of hours required = 1 + 2 + 2 + 3 = 8 (= H).*

23. Given an array **arr[]** consisting of **N** integers and an integer **K**, the task is to find the minimum number of sets, the array elements can be divided into such that the difference between the maximum and minimum element of each set is **at most K**.

> **Examples:**
> *Input: arr[] = {1, 2, 3, 4, 5}, K = 2*
> *Output: 2*
> *Explanation:*
> *The given array can be divided into two sets {1, 2, 3} having the*

difference between maximum and minimum as 3 – 1= 2 and {4, 5}
having the difference between maximum and minimum as 5 – 4 = 1.
Input: *arr[] = {5, 2, 9, 7, 3, 2, 4, 6, 14, 10}, K = 3*
Output: *4*

24. Given an array **arr[]** consisting of **N** integers, the task is to repeatedly select triplets and remove the maximum and minimum elements from the triplets in each operation, such that the remaining array is of longest possible length and consists only of distinct elements.

Examples:
Input: *N = 5, arr[] = {1, 2, 1, 3, 7}<*
Output: *3*
Explanation: *Select the triplet (1, 2, 1) and remove 1 and 2. The remaining array is [1, 3, 7] in which all elements are pairwise distinct.*
Input: *N = 6, arr[] = {8, 8, 8, 9, 9, 9}*
Output: *2*

25. Given an array of distinct integers, find length of the longest subarray which contains numbers that can be arranged in a continuous sequence.

Input: arr[] = {10, 12, 11};
Output: Length of the longest contiguous subarray is 3

Input: arr[] = {14, 12, 11, 20};
Output: Length of the longest contiguous subarray is 2