Practice Set-4

Topic : File I/O and Recursion and function

No of Questions: 20

Q1.

Given a string s, find the minimum number of cuts you can make on s so that all the substrings that we get from cutting s are palindromes.

Sample test cases:

1) s = "abababakkkk"

We can cut the string just once such that we have 2 palindromes "abababa" and "kkkk" so answer = 1.

2) s = "gggg"

We don't have to make any cuts so answer = 0.

3) s = "abcde"

Since all the individual letters make palindromes and there is no other way to get palindromes in less than 4 cuts, our answer in this case = 4.

Constraints:

|s| <= 16

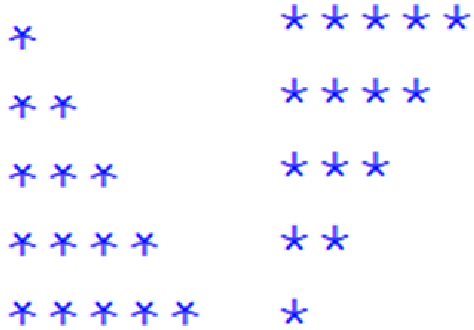
HINT: Use recursion

NOTE:

1) This question should help you appreciate how recursion greatly simplifies our lives through function reusability.
2) This question should also help you understand how to use loops inside a recursive function and the immense expressive power this technique holds.

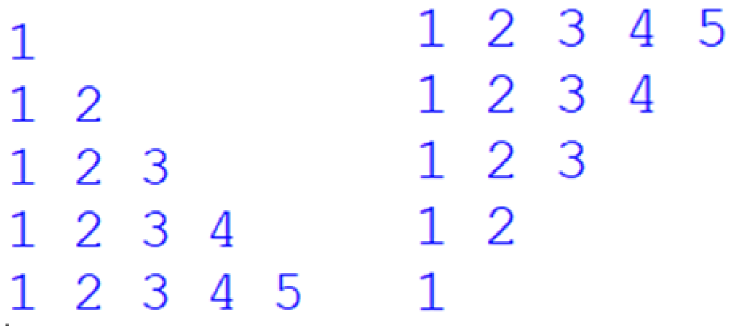
Q2 .

a) Print the following 2 patterns without using any form of loops



```
*               *****
**              ****
***             ***
****            **
*****           *
```

b) Print the following 2 patterns without using any nested loops i.e. a single loop is allowed



```
1               1 2 3 4 5
1 2             1 2 3 4
1 2 3           1 2 3
1 2 3 4         1 2
1 2 3 4 5       1
```

c) [Bonus]

Do (b) without using any form of loops.

HINT: Use recursion

Q3.

a) Implement a function g, that takes in A (an n x n matrix i.e. a list of lists) as input and subtracts transpose of A from it.

Example: If the initial matrix is

1 2 3

4 5 6

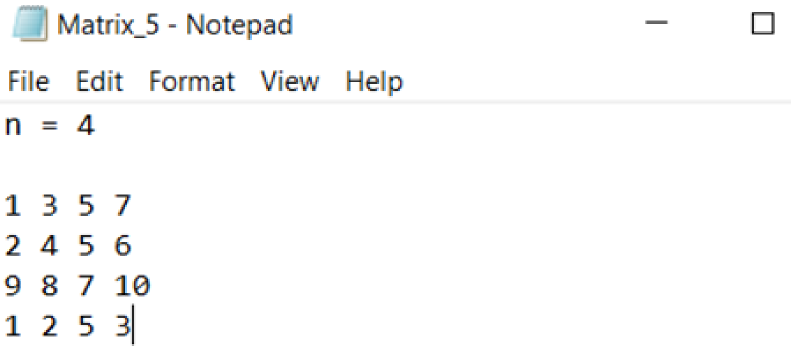
7 8 9,

then after the operation our matrix will be
0 -2 -4
2 0 -2
4 2 0

b) Now, you're given 5 txt files named as Matrix_[i].txt where [i] = 1,2,3,4,5. The first line of each file contains n in forms such as "n = 7", which is the number of rows and columns of a matrix. The next n lines contain n integers each representing the matrix.

Use the function g previously defined to transform each of these matrices in the .txt files. Now overwrite the existing files with the newly transformed matrix.

Sample file:



```
n = 4

1 3 5 7
2 4 5 6
9 8 7 10
1 2 5 3
```

c)
[Bonus] In many embedded systems, the programs require to use the least amount of memory possible. So can you implement g, without defining any new matrix inside g? Can you do it in-place i.e. without actually taking the transpose?

Q4.

Given the total number of persons n and a number k which indicates that k-1 persons are skipped and kth person is killed in circle in a fixed direction.

The task is to choose the safe place in the circle so that when you perform these operations starting from 1st place in the circle, you are the last one remaining and survive.

Input:

n = 3 k = 2

Output: 3

Explanation:

There are 3 persons so skipping 1 person i.e 1st person 2nd person will be killed. Thus the safe
position is 3.

Q5)

The tower of Hanoi is a famous puzzle where we have three rods and N disks. The objective of the puzzle is to move the entire stack to another rod. You are given the number of discs N. Initially, these discs are in the rod 1. You need to print all the steps of discs movement so that all the discs reach the 3rd rod. Also, you need to find the total moves.
Note: The discs are arranged such that the top disc is numbered 1 and the bottom-most disc is numbered N. Also, all the discs have different sizes and a bigger disc cannot be put on the top of a smaller disc.

Input:
N = 2

Output:

```
move disk 1 from rod 1 to rod 2
move disk 2 from rod 1 to rod 3
move disk 1 from rod 2 to rod 3
3
```

Explanation: For N=2 , steps will be as follows in the example and total 3 steps will be taken.

Q6) Write a to verify if a number is prime or not, using a recursive method.

Input : n = 11
Output : Yes

Q7. A function f is defined as follows F(N)= (1) +(2*3) + (4*5*6) ... N. Given an integer N the task is to print the F(N)th term.

Example 1:

Input: N = 5
Output: 365527

Explaination: F(5) = 1 + 2*3 + 4*5*6 + 7*8*9*10 + 11*12*13*14*15 = 365227.

Your Task:

You do not need to readd input or print anything. Your task is to complete the function sequence() which takes N as input parameter and returns the value of F(N).

Constraints:

$1 \leq N \leq 10$

REF

Q8.

Given two numbers A and B, the task is to find f(A^B). f(n) which takes a positive integer n as input and does the following:

f(A^B)=A^B

```
f(n):
if n < 10
    return n
else return f( sum_of_digits(n) )
```

Input1: A = 6, B = 6

Output1: 9

Explanation:

f(6^6) = f(46656) = f(27) = f(9) = 9

Input2: A = 7, B = 3

Output2: 1

Explanation:

f(7^3) = f(343) = f(10) = f(1) = 1

You don't need to read or print anything. Your task is to complete the function SumofDigits() which takes A and B as input parameters and returns f(A^B).

Constraints:

1 <= A, B <= 10^9

Q9.

Your Task:

You will code a python script to find duplicate files in the file system or inside a particular folder.

Using Filecmp

The python module filecmp offers functions to compare directories and files. The cmp function compares the files and returns True if they appear identical otherwise False.

Syntax: filecmp.cmp(f1, f2, shallow)

Parameters:

- **f1:** Name of one file
- **f2:** Name of another file to be compared
- **shallow:** With this, we set if we want to compare content or not.

Note: The default value is True which ensures that only the signature of files is compared, not content.

Return Type: Boolean value (True if the files are same otherwise False)

Example:

We’re assuming here for example purposes that “text_1.txt”, “text_3.txt”, “text_4.txt” are files having the same content, and “text_2.txt”, “text_5.txt” are files having the same content. **REF**

Q10.

a) Implement a function f, that takes in input a list of functions and returns the sum of all the return values from the functions in the list.

NOTE: Choosing the number of parameters for the functions in the list and passing the arguments is upto the student.

b) Can you implement a dictionary of functions for part (a)? How about a tuple or a set? Is it possible?

Q11.

(a) Given an array of integers, A, generate the powerset of A.

NOTE:

1) Each set in the powerset should be unique.

2) You can store the powerset as a list of lists or a set. It's upto you. Preferably try both.

(b) Is there a subset of A such that elements of A sum upto k?

Here k can be any user input.

Q12 .

(a) You're given a list of functions, L = [f1, f2, ...]. Your task is to implement a recursive function g that takes in input L and recursively calls itself with the argument as L but without the function at first index. As the base case, when you have just one function, you need to print the value returned by the last remaining function.

Example:

If L = [f1, f2, f3]

then we first call g(L) with L = [f1, f2, f3],

then we call g(L) with L = [f2, f3]

then we call g(L) with L = [f3]. Since this is our base case, we stop recursion.

(b)

[Bonus] Repeat part (a) but instead of removing the first function, remove the function that has the minimum return value

Q13 .

Implement pow(x, n), which calculates x raised to the power n (i.e., x^n).

Example 1:

Input: x = 2.00000, n = 10

Output: 1024.00000

Example 2:

Input: x = 2.10000, n = 3

Output: 9.26100

Example 3:

Input: x = 2.00000, n = -2

Output: 0.25000

Explanation: 2-2 = 1/22 = 1/4 = 0.25

Q14.

Polycrap recently learned fibonacci number , and tried coming up with his own sequence , called Polycrap sequence , which is given as follows :

- **f(0) = a;**
- **f(1) = b;**
- **f(n) = f(n-1) ^ f(n-2);** when n>1, where ^ denotes the bitwise xor operation.

You are given three integers **a**,**b** and **n** , calculate **f(n)**.

The first line of input contains a single integer **T** (**1≤T≤10^3**), the number of test cases.

Each of the **T** following lines contains three space-separated integers **a**, **b**, and **n** (**0≤a,b,n≤10^9**) respectively.

Sample Input

4

86 77 15

93 35 86

92 49 21

62 27 90

Sample Output

86

126

92

Q15.

Artho hates loops . Now he wants to compute the sum of all the digits of a given number n but he cannot use a loop , it . Write a code that will help him to find the sum of all digits of a given number n. Use of loops is not allowed.

Hint:(Use Recursion)

Input 1: 12345

Output1 : 15

Explanation : 1+2+3+4+5 =15

Input 2: 45632

Output 2:20

Ref

Q16.

Given a number n, check whether it's prime number or not using recursion.

Input 1: n = 11

Output1 : Yes

Input 2: n = 15

Output 2: No

Ref

Q17.

Given a number n (number of variables) and val (sum of the variables), find out how many such non-negative integral solutions are possible.

Input : n = 5, val = 1

Output : 5

Explanation:

x1 + x2 + x3 + x4 + x5 = 1

Number of possible solution are :

(0 0 0 0 1), (0 0 0 1 0), (0 0 1 0 0),

(0 1 0 0 0), (1 0 0 0 0)

Total number of possible solutions are 5

Ref

Q18 .Solve this question using recursion:

Given an integer n, print True if it is a power of four. Otherwise, print False. An integer n is a power of four, if there exists an integer x such that $n == 4^x$.

Example 1:

Input: n = 16

Output: True

Example 2:

Input: n = 5

Output: False

Example 3:

Input: n = 1

Output: True

Reference

Q19.

Solve this question using recursion:

Given a string **s** and a non-empty substring **sub**, write a function strDist() which takes these 2 strings as parameters to recursively compute the largest substring of **s** which starts and ends with **sub** and return its length.

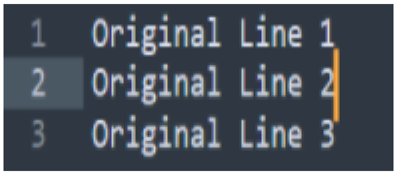
Examples:
strDist("catcowcat", "cat") → 9
strDist("catcowcat", "cow") → 3
strDist("cccatcowcatxx", "cat") → 9

Reference

Q20 .

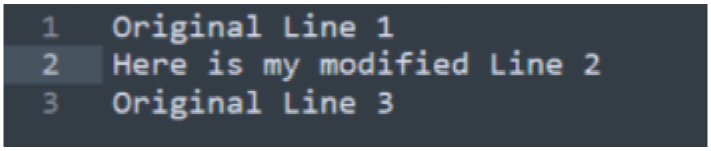
Take an integer **n (n>0)** as input from the user. The next **n** lines will contain n strings as input from the user. Create a file **userInput.txt** and store these strings in separate lines. Again take an integer **m (0<m<=n)** as input from the user. The next line will contain 1 string as input from the user. Replace the mth line of userInput.txt with this new string.

userInput.txt for original strings



```
1  Original Line 1
2  Original Line 2
3  Original Line 3
```

userInput.txt after modifying the 2nd line:



```
1  Original Line 1
2  Here is my modified Line 2
3  Original Line 3
```

Reference