

## **CS203: Data Structures and Algorithms Lab**

### **Assignment - 2**

#### **Instructions:**

1. Implement the following exercise using C.
2. You are required to complete this exercise by 19/08/2024.
3. Submit all the programs in a single .zip file.

#### **Exercise:**

1. Write a program for memory mapping a 2D array into a 1D array using:
  - a. Row-major order
  - b. Column-major order

Sample Input:

1 2 3  
4 5 6  
7 8 9

Sample Output:

Row-major: 1 2 3 4 5 6 7 8 9  
Column-major: 1 4 7 2 5 8 3 6 9

2. Write a program for memory mapping lower and upper triangular 2D arrays into 1D arrays using
  - a. Row-major order
  - b. Column-major order

Sample Input (upper triangular):

1 2 3  
0 4 5  
0 0 6

Sample Output:

Row-major order: 1 2 3 4 5 6  
Column-major order: 1 2 4 3 5 6

3. Write a program for memory mapping a sparse 2D array into a 1D

array using (row index, column index, value).

4. Write a program for memory mapping a symmetric 2D array into a 1D array using:
- Row-major order
  - Column-major order

Sample Input:

1 2 3

2 5 6

3 6 9

Sample Output:

Row-major: 1 2 3 5 6 9

1 2 5 3 6 9

Column-major: 1 2 5 3 6 9

1 2 3 5 6 9

5. Write a program for memory mapping a tridiagonal 2D array into a 1D array using.
- Row-major order
  - Column-major order
  - Diagonal-wise

Sample Input (upper triangular):

1 2 0 0

3 4 5 0

0 6 7 8

0 0 9 1

Sample Output:

Row-major order: 1 2 3 4 5 6 7 8 9 1

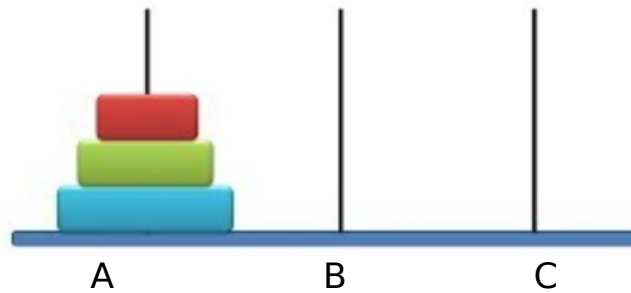
Column-major order: 1 3 2 4 6 5 7 9 8 1

Diagonal-wise: 3 6 9 1 4 7 1 2 5 8

6. Write a recursive program to solve the tower of Hanoi problem where we have three rods (A, B, C) and n disks. The disks are of different sizes and placed on the rod A in ascending order of their size, i.e. the smaller ones are placed over the larger ones. The objective is to move all the disks from A to C (using rod B in the process), obeying the following rules:

- Only one disk can be moved at a time.
- Each move consists of taking the upper disk from one of the rods and placing it on top of another rod i.e. a disk can only be moved if it is the uppermost disk on a rod.
- No disk may be placed on top of a smaller disk.

## Tower Of Hanoi



7. Write a program to solve the eight queens problem where we have to place eight chess queens on an  $8 \times 8$  chessboard so that no two queens attack each other. i.e., no two queens can share the same row, column, or diagonal.

Sample Input:

N = 4

Sample output:

0, 1, 0, 0

0, 0, 0, 1

1, 0, 0, 0

0, 0, 1, 0

8. Write a program to count all possible ways of selecting R different objects from N given objects (where  $R \leq N$ ). Note that order of the selected objects does not matter.

Sample Input:

N = 10

R = 2

Sample Output :

45