

CS204: Data Structures and Algorithms Lab

Assignment - 2

25th October 2022

Instructions:

1. Implement the following exercise using C.
2. You are required to complete this exercise by 04/11/2022.
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:
 - a. Row-major order
 - b. 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

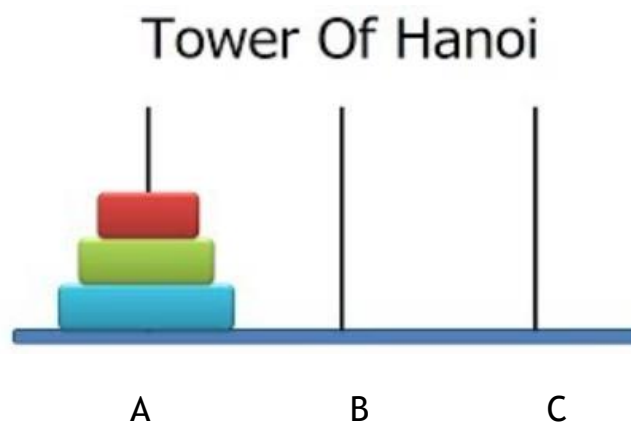
Sample Input (upper triangular):

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.



7. Write a program to solve the eight queens problem where we have to place eight chess queens on an 8×8 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 for

45