

RV University, Bengaluru
School of Computer Science and
Engineering B.Tech. (Hons.)
CP-1 Question Paper
Academic Year 2024-2025

Course: Design and Analysis of Algorithms		Course Code: CS2000	Semester: III
Date: 29/08/2024	Duration: 60 minutes (9:45 AM to 10:45 AM)	Max Marks: 20	

Sl. No.	Viva	Marks
1.	<p>Given the below sequences find which of the sorting algorithm requires the least number of swapping to arrange them in ascending order.</p> <p>a. 9, 6, 5, 0, 8 (among bubble sort, selection sort and insertion sort)</p> <p>b. 1, 2, 3, 4, 5 (among bubble sort, selection sort and insertion sort)</p>	4
	Program	
2.	<p>A team has to perform binary search on a two-dimensional sorted integer array, i.e. when one moves within a row then integers are sorted from left to right. Also, the integer at the last column in a row is less than the integer at the starting column in the next immediate row. Instead of working directly at the content level, the team decided to start with the dimensions.</p> <p>Let A be an $X \times Y$ array of integers (i.e., two dimensional array) and the value to be searched is num. The process starts by applying binary search only on the first dimension (row). Once the index, say midx, for the first dimension is identified, that implies the value num may exist somewhere in the set of elements represented by $A[\text{midx}][0..Y - 1]$. After this, the range to be searched for gets reduced to a set of elements represented by $A[\text{midx}][0..Y - 1]$. Lastly, the simple binary search is applied on the second dimension to search for num.</p> <p>In case of a successful search, one has to output the range obtained after fixing the first dimension. Also, the two indices corresponding to the searched element has to be given in the output.</p> <p>In case of an unsuccessful search, there can be two possibilities.</p> <ol style="list-style-type: none"> num is out of all the ranges available for the first dimension. Output should be zero only. num is lying in one of the ranges available for the first dimension. Output should have the range obtained after fixing first dimension and then zero for unsuccessful search. <p>###Input:</p> <ul style="list-style-type: none"> Line 1 contains three integers X, Y and N. X is the first and Y is the second dimension of an array. N is the value to be searched. Line 2 contains $X \times Y$ integers separated by space. These are the contents of a two-dimensional array in row-major order. 	6

###Output:

- Successful search:
 - Line 1 has two integers giving range obtained for the first dimension, i.e. minimum then maximum.
 - Line 2 has two integers giving indices corresponding to the searched element N .
- Unsuccessful search:
 - May have a single line as specified in possibility 1 of an unsuccessful search.
 - May have two lines as specified in possibility 2 of an unsuccessful search.

Note: Row-major order is a method for storing multidimensional arrays in linear storage, such as random access memory, where elements of each row are placed consecutively. You can refer below figure for the same.

	Col 0	Col 1	Col 2	Col 3	Col 4
Row 0	marks[0][0]	marks[0][1]	marks[0][2]	marks[0][3]	marks[0][4]
Row 1	marks[1][0]	marks[1][1]	marks[1][2]	marks[1][3]	marks[1][4]
Row 2	marks[2][0]	marks[2][1]	marks[2][2]	marks[2][3]	marks[2][4]

• Row-major order

(0,0)	(0,1)	(0,2)	(0,3)	(0,4)	(1,0)	(1,1)	(1,2)	(1,3)	(1,4)	(2,0)	(2,1)	(2,2)	(2,3)	(2,4)
Row0					Row1					Row2				

• Column-major order

(0,0)	(1,0)	(2,0)	(0,1)	(1,1)	(2,1)	(0,2)	(1,2)	(2,2)	(0,3)	(1,3)	(2,3)	(0,4)	(1,4)	(2,4)
Col0			Col1			Col2			Col3			Col4		

###Sample Input I:

3 2 12
2 11 12 19 21 25

###Sample Output I:

12 19
1 0

###EXPLANATION I:

It's a 3×2 array and we are searching for 12. Index positions and array content mapping is as follows: [0][0]:2, [0][1]:11, [1][0]:12, [1][1]:19, [2][0]:21, [2][1]:25

Based on the first dimension the loop executes only once and the range identified is 12 to 19. Finally, 12 is found at index positions [1][0].

###Sample Input II:

3 2 22
2 11 12 19 21 25

###Sample Output II:

21 25
0

###EXPLANATION II:

It's a 3×2 array and we are searching for 22. Index positions and array content mapping is as follows: [0][0]:2, [0][1]:11, [1][0]:12, [1][1]:19, [2][0]:21, [2][1]:25

Based on the first dimension the loop executes twice and the range identified is 21 to 25. Based on the second dimension the loop executes twice and 22 is not found.

###Sample Input III:

3 2 1
2 11 12 19 21 25

###Sample Output III:

0

###EXPLANATION III:

It's a 3×2 array and we are searching for 1. Index positions and array content mapping is as follows: [0][0]:2, [0][1]:11, [1][0]:12, [1][1]:19, [2][0]:21, [2][1]:25

Based on the first dimension the loop executes twice and none of the available ranges has 1.