

Test Name : M21\_EndSem\_Data Structures & Algorithms for Problem Solving\_4th December 2021\_08:30 AM  
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Test Start Time  
04/12/2021, 08:30:35

Marks Scored  
14.0 / 35.5

Total Questions  
30

Attempted Questions  
27

Correct Questions  
15

Incorrect Questions  
12

Skipped Questions  
3

Pending Evaluation  
0

List of Sections

Easy ones

Q No.	Q. Type	Status	Marks	
1	Multiple Choice - Single Answer	✖	0.0	Hide Answer
Oct-Tree generalize well to very high dimensional data as opposed to Kd-Trees.				
<input type="radio"/> True !				
<input type="radio"/> False !				
<input type="radio"/> Depends on number of data points.				
2	Multiple Choice - Single Answer	✔	0.5	Hide Answer
Which of the following algorithms solves the positive weighted single source shortest path problem?				
<input type="radio"/> breadth first search				
<input type="radio"/> depth first search				
<input checked="" type="radio"/> Dijkstra's algorithm				
<input type="radio"/> Kruskal's algorithm				
<input type="radio"/> Prim's algorithm				
3	Multiple Choice - Single Answer	✔	0.5	Hide Answer
The array [21 15 18 7 9 5 11 3 5 1] forms a max-heap.				

☒ True

☐ False

4

Multiple  
Choice -  
Single  
Answer

✓

0.5

Hide Answer

Which of the following functions grows fastest?

☐  $n \log n$

☒  $2^n$

☐  $\log n$

☐  $n^2$

☐  $n^{20}$

5

Fill in the  
Blanks

✓

0.5

Hide Answer

Given two sparse matrices, what is the minimum number of arithmetic operations (including additions and multiplications) are required to obtain  $A \cdot B$ .

A			B		
Row	Col	Val	Row	Col	Val
1	2	5	1	1	3
1	3	4	1	3	7
2	1	2	2	1	4
2	3	1	2	2	2

Enter here:

6

Multiple  
Choice -  
Single  
Answer

✓

0.5

Hide Answer

A dynamic programming algorithm always uses some type of recurrence relation.

☒ True

☐ False

7

Multiple  
Choice -  
Single  
Answer

✗

0.0

Hide Answer

In a suffix tree, all internal nodes except for the root nodes have at least two children.

☐ True

☒ False

8

Multiple  
Choice -  
Single  
Answer

✓

0.5

Hide Answer

How are elements deleted in linear probing?

☐ deletion is not allowed

☐ they are changed to zero

☒ they are marked deleted

☐ unchecked deallocation

☐ none of the above

9

Fill in the  
Blanks

✓

0.5

Hide Answer

A region has 16 towns that are interconnected by road network consisting of 25 toll roads of varying toll tax values. What would be the expected time units for finding and route traversing all town while paying minimum toll tax using Prim's algorithm (implemented with binary min-heap).

164

10

Multiple  
Choice -  
Single  
Answer

✗

0.0

Hide Answer

If an element in a binary heap is stored in position  $i$  and the root is at position 1, then where is the parent stored?

☐  $\text{ceil}(i/2)$

☒  $\lfloor i/2 \rfloor$

☐  $1 + \text{ceil}(i/2)$

☐  $2i$

☐  $2i+1$

11

Multiple  
Choice -  
Single  
Answer

✓

0.5

Hide Answer

Splay trees with  $N$  elements guarantee that a sequence of  $M$  operations takes at most :

☐  $O(N * \log M)$

☒  $O(M * \log N)$

- ☐  $O(M*\sqrt{N})$
- ☐  $O(M)$

Multiple Choice Questions

Q No.	Q. Type	Status	Marks	
1	Multiple Choice - Single Answer	✓	1.0	<div>Hide Answer</div>
<div>The following items are inserted into an AVL tree: 13,6,5,12,4,17,11. Which node is the deepest?</div> <div><div><input type="radio"/> 13</div><div><input type="radio"/> 6</div><div><input type="radio"/> 5</div><div><input type="radio"/> 12</div><div><input type="radio"/> 4</div><div><input type="radio"/> 17</div><div><input checked="" type="radio"/> 11</div></div>				
2	Fill in the Blanks	✗	0.0	<div>Hide Answer</div>
<div>Consider a string <math>a^n b^n</math> (both a and b repeated n times, e.g. aaabbb for n=3).</div> <div>How many nodes will be there in the suffix trie of this string, if n = 6. Your answer should be an integer.</div> <div>Enter your answer here: <input type="text" value="25"/> Expected Solutions: <div><div>62</div><div>61</div><div>49</div><div>48</div></div></div>				
3	Multiple Choice - Single Answer	✗	0.0	<div>Hide Answer</div>
<div>Suppose we are implementing quadratic probing with a hash function <math>\text{Hash}(X) = X \bmod 100</math>. If an element with key 4591 is inserted and the first three locations attempted are already occupied, then the next cell that will be tried is</div> <div><div><input type="radio"/> 5</div><div><input type="radio"/> 17</div><div><input checked="" type="radio"/> 0</div><div><input type="radio"/> 1</div><div><input type="radio"/> None of the above</div></div>				
4	Multiple Choice -	✗	0.0	<div>Hide Answer</div>

Single  
Answer

For an unsorted large size input integer array, if we compare performance of Quick sort and Merge sort on single core machine (with no support to parallel programming) with modern compiler that supports tail call elimination, then which of the following statements is true ?

- ☐ Both methods will take same time.
- ☐ Merge sort will be faster than Quick sort.
- ☒ Quick sort will be faster than Merge sort.
- ☐ None of these.

5

Fill in the  
Blanks

1.0

Hide Answer

What will be the pre-order traversal of the expression tree corresponding to following postfix expression:

**ab+f-chxe+ /**

String format for answer: Please directly write string without using any delimiter.

Enter here:

6

Multiple  
Choice -  
Single  
Answer

1.0

Hide Answer

A 4 dimensional Kd-Trees contains 256 data elements. What would be the order of time complexity of range query :

- ☐ 8
- ☐ 64
- ☐ 16
- ☒ None of these.

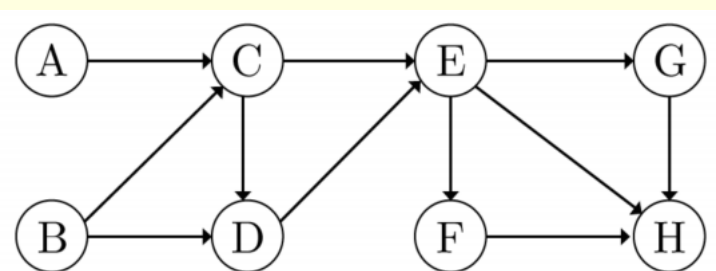
7

Multiple  
Choice -  
Single  
Answer

1.0

Hide Answer

Which of the following is not a valid topological sort of the graph below:



- ☐ ABCDEFGH
- ☒ BACEDFGH
- ☐ BACDEFGH

○ ABCDEGFH

8

Fill in the Blanks

✖

0.0

Hide Answer

A 3D Range-Trees of 32 elements have 4 elements qualifying for a range query.

What would be the time complexity of such query :  Expected Solutions:

Short Answer Type				
Q No.	Q. Type	Status	Marks	
1	Fill in the Blanks	✖	0.0	Hide Answer
<p>In order to reduce the operating costs, the government of X town has decided to optimize the road lighting. Till now every road was illuminated all night long, which costs 1 Dollar per meter. To save money, they decided to no longer illuminate every road, but to switch off the road lighting of some streets. To make sure that the inhabitants still feel safe, they want to optimize the lighting in such a way, that after darkening some streets at night, there will still be at least one illuminated path from every junction to every other junction. The road network is represented as set of 3-tuple (junction id, junction id, length):</p> <p>0 1 7 0 3 5 1 2 8 1 3 9 1 4 7 2 4 5 3 4 13 3 5 6 4 5 8 4 6 9 5 6 11</p> <p>What is the maximum daily amount of money the government of X town can save, without making their inhabitants feel unsafe?</p> <p>Enter here : <input type="text" value="39"/> Expected Solutions: <input type="text" value="49"/></p>				
2	Multiple Choice - Multiple Answers	✖	0.0	Hide Answer
<p>Consider a shortest path <math>p</math> from a vertex <math>s</math> to some other vertex <math>t</math> in a weighted undirected graph <math>G</math>, without negative weights. Under which conditions will <math>p</math> still be a shortest path from <math>s</math> to <math>t</math>?</p> <div><input checked="" type="checkbox"/> If the weights of all edges in <math>G</math> are increased by one (i.e. weight <math>w</math> is replaced by weight <math>w+1</math>).</div> <div><input type="checkbox"/> If the weights of all edges in <math>G</math> are squared (i.e. weight <math>w</math> is replaced by weight <math>w^2</math>).</div> <div><input checked="" type="checkbox"/> If the weights of all edges in <math>G</math> are increased by two (i.e. weight <math>w</math> is replaced by weight <math>w+2</math>).</div> <div><input checked="" type="checkbox"/> If the weights of all edges in <math>G</math> are multiplied by two (i.e. weight <math>w</math> is replaced by <math>2w</math>).</div>				
3	Multiple Choice - Single Answer	✔	2.0	Hide Answer

Consider a directed graph with twelve nodes ( $N_0$  to  $N_6$ ). The graph has following twelve edges:  $E = \{ (N_0; N_2; 4); (N_1; N_0; 2); (N_1; N_3; 3); (N_3; N_0; 1); (N_3; N_2; 2); (N_3; N_5; 8); (N_3; N_6; 4); (N_4; N_1; 10); (N_4; N_3; 2); (N_4; N_6; 7); (N_5; N_2; 2); (N_6; N_5; 1) \}$ .

If we initiate the standard weighted shortest path algorithm at node  $N_4$ , which is the last vertex to be declared known?

- ☐  $N_0$
- ☒  $N_1$
- ☐  $N_2$
- ☐  $N_4$
- ☐ None of the above

4

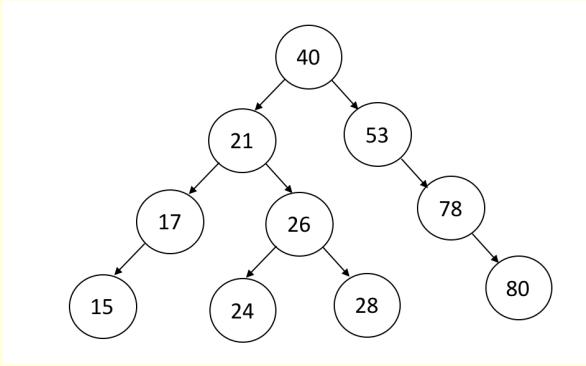
Multiple  
Choice -  
Single  
Answer

✓

2.0

Hide Answer

What will be the pre-order traversal of the following splay tree after performing these sequence of operations: find (26), add(25)



- ☐ 15, 17, 21, 24, 28, 80, 78, 40, 26, 25
- ☐ 26, 25, 24, 21, 17, 15, 40, 28, 78, 80
- ☐ 25, 24, 21, 17, 15, 26, 40, 28, 70, 80
- ☒ None of these.

5

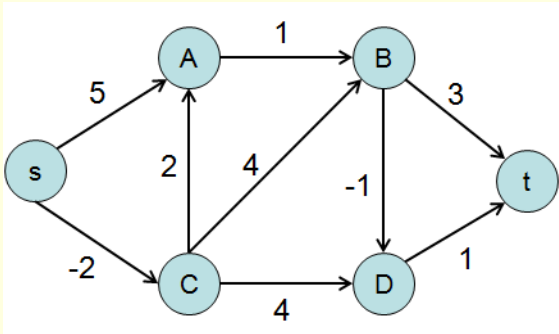
Fill in the  
Blanks

⚠

0.0

Hide Answer

Consider the following directed acyclic graph. SCABDE is one of its possible topological sorts. Use the algorithm to find shortest path for directed acyclic graph with negative weights discussed in the class (faster than Bellman Ford). Process the table in the order of topological sort given above and enter the values of the last column (column corresponding to node E). You should enter six values, the first node to be picked is S. Use inf for infinity



Example answer (six hyphen separated values): inf-inf-inf-5-2-2

Enter your answer here:

Expected Solutions: inf-inf-inf-4-1-1

6

Multiple Choice - Single Answer

✓

2.0

Hide Answer

Consider the following weighted graph:

When performing Dijkstra's algorithm starting from vertex A, how many non-infinite distinct labels will the vertex F have? In other words, how many distinct non infinite values will be there in the column corresponding to node F?

☐ 1

☐ 2

☒ 3

☐ 4

7

Fill in the Blanks

⚠

0.0

Hide Answer

What will be the post-order traversal of the splay tree constructed from following input sequence: 20, 29, 35, 18, 15, 30, 42

Please enter hyphen separated values as your answer (e.g., 18-35-20-29-30-42-15)

Enter Here:

Expected Solutions: 20-29-18-15-30-35-42

8

Multiple Choice - Single Answer

✗

0.0

Hide Answer

What will be the list of leaf nodes (listed from left to right order) and their respective depth of the following splay tree after sequence of operations: find (26), add(25)

☐ 15|5, 28|2, 80|3

☒ 15|4, 28|3, 80|4

☐ 15|4, 25|5, 28|4, 80|4

☐ None of these.



9

Fill in the Blanks

✖

0.0

Hide Answer

You have to find the shortest path from the top left corner (red circle) to the bottom right corner (blue circle). You can only move one unit right or one unit down from any cell. You have to enter the final path (hyphen separated digits as your answer). Example answer: 4-6-3-7-1-9-8-9-3

Enter your answer here:  Expected Solutions:

{4 7 8 6 4}

{6 7 3 9 2}

{3 8 1 2 4}

{7 1 7 3 7}

{2 9 8 9 3}

Note: Your uploaded rough work for the question may be reviewed.

10

Fill in the Blanks

⚠

0.0

Hide Answer

What will be the list of leaf nodes (listed from left to right order) and their respective depth of the splay tree constructed from following input sequence: 21, 28, 34, 16, 12, 28, 40.  
Please enter answer in following format : assume leaf nodes are 40 and 28 at depth 4 and 5 , respectively and thus enter 40-6|28-5.

Enter here.  Expected Solutions:

11

Fill in the Blanks

✖

0.0

Hide Answer

Given the text: abcrsabcrsqqqxystabcrsabqpp.

Your goal is to find first matching instance for the string "abcrsabq". You are using KMP string matching algorithm. How many character comparisons would be made, before finding an exact match for the given string in the above text.

Your answer should be an integer:  Expected Solutions: