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Data Structures

Started: Feb 27 at 7:31pm

Quiz Instructions

Questions to test your knowledge and understanding of basic data structures. For each question only the best solution will be graded as correct, and as usual grading is case sensitive. Note that you should be able to show your work to solve all of these problems, you should not just ask the internet for the answer. Note that this is one of the quizzes that is used for the MS admissions process. If you need to refresh your memory on any topics, see the following for links to resources: [Data Structures and Algorithms](#).

Questions

- ✓ Question 1
- ✓ Question 2
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- ✓ Question 8

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2 Hours, 57 Minutes, 24 Seconds

Question 1 1 pts

What is the worst-case running time for the following algorithm: insertion sort

O(n^2)
 O(n)
 O(2^n)
 O(n!)
 O(1)
 O(n^3)
 O($n \log(n)$)
 O($\log(n)$)

Question 2 1 pts

What is the worst-case running time for the following algorithm: quick sort

O(n!)
 O(2^n)
 O(1)
 O(n)
 O($\log(n)$)
 O($n \log(n)$)
 O(n^2)
 O(n^3)

Question 3 1 pts

What is the worst-case running time for the following algorithm: merge sort

O(n)
 O(2^n)
 O($\log(n)$)
 O(n^3)
 O($n \log(n)$)
 O(1)
 O(n!)
 O(n^2)

Question 4 1 pts

What is the best-case running time for the following algorithm: merge sort

O($n \log(n)$)
 O(n^2)
 O(2^n)
 O($n!$)
 O($\log(n)$)
 O(n^3)
 O(n)
 O(1)

Question 5 1 pts

What is the average-case running time for the following algorithm: bubble sort

O(n)
 O($\log(n)$)
 O(n^2)
 O(2^n)
 O(n^3)
 O($n \log(n)$)
 O($n!$)
 O(1)

Question 6 1 pts

What is the average-case running time for the following algorithm: linear search

O(2^n)
 O($\log(n)$)
 O(n^3)
 O($n \log(n)$)
 O(n)
 O(n^2)
 O($n!$)
 O(1)

Question 7 1 pts

What is the worst-case running time for the following algorithm: binary search

O(n)
 O($n \log(n)$)
 O(n^2)
 O(n^3)

- O(n!)
- O(1)
- O(log(n))
- O(2ⁿ)

Question 8 1 pts

What is the average-case running time for the following algorithm: merge sort

- O(2ⁿ)
- O(log(n))
- O(n log(n))
- O(n²)
- O(n!)
- O(n³)
- O(1)
- O(n)

Question 9 1 pts

What is the average-case running time for the following algorithm: heap sort

- O(n)
- O(log(n))
- O(n!)
- O(1)
- O(2ⁿ)
- O(n log(n))
- O(n³)
- O(n²)

Question 10 1 pts

What is the best-case running time for the following algorithm: heap sort

- O(n!)
- O(n log(n))
- O(n³)
- O(2ⁿ)
- O(1)
- O(log(n))
- O(n²)
- O(n)

Question 11 1 pts

What is the worst-case running time for the insert operation for the following data

What is the worst-case running time for the insert operation for the following data structure: stack (in the way that makes the most sense for this data structure)

- O(1)
- O(n)
- O(n log(n))
- O(n³)
- O(n²)
- O(2ⁿ)
- O(log(n))
- O(n!)



Question 12

1 pts

What is the worst-case running time for the lookup operation for the following data structure: stack (in the way that makes the most sense for this data structure)

- O(1)
- O(n³)
- O(n²)
- O(n log(n))
- O(n!)
- O(n)
- O(log(n))
- O(2ⁿ)



Question 13

1 pts

What is the average-case running time for the lookup operation for the following data structure: queue (in the way that makes the most sense for this data structure)

- O(n³)
- O(2ⁿ)
- O(n)
- O(n log(n))
- O(1)
- O(log(n))
- O(n²)
- O(n!)



Question 14

1 pts

What is the worst-case running time for the lookup operation for the following data structure: binary tree (balanced) (in the way that makes the most sense for this data structure)

- O(n²)
- O(2ⁿ)
- O(1)
- O(n!)

$O(n \log(n))$

$O(\log(n))$

$O(n)$

$O(n^3)$

Question 15 1 pts

What is the best-case running time for the following algorithm: insertion sort

$O(n^2)$

$O(2^n)$

$O(n^3)$

$O(\log(n))$

$O(n!)$

$O(n)$

$O(n \log(n))$

$O(1)$

Question 16 1 pts

What is the worst-case running time for the insert operation for the following data structure: hash table (in the way that makes the most sense for this data structure)

$O(n \log(n))$

$O(n^3)$

$O(\log(n))$

$O(1)$

$O(n^2)$

$O(n!)$

$O(2^n)$

$O(n)$

Question 17 1 pts

What is the average-case running time for the lookup operation for the following data structure: stack (in the way that makes the most sense for this data structure)

$O(n^3)$

$O(2^n)$

$O(n)$

$O(n!)$

$O(n^2)$

$O(\log(n))$

$O(1)$

$O(n \log(n))$

Question 18 1 pts

What is the best-case running time for the insert operation for the following data structure: queue (in the way that makes the most sense for this data structure)

- O(n)
- O(n!)
- O(n²)
- O(1)
- O(log(n))
- O(2ⁿ)
- O(n³)
- O(n log(n))



Question 19

1 pts

What is the best-case running time for the lookup operation for the following data structure: stack (in the way that makes the most sense for this data structure)

- O(1)
- O(n log(n))
- O(n³)
- O(n²)
- O(log(n))
- O(n)
- O(2ⁿ)
- O(n!)



Question 20

1 pts

What is the best-case running time for the lookup operation for the following data structure: linked list (doubly linked) (in the way that makes the most sense for this data structure)

- O(n log(n))
- O(n³)
- O(1)
- O(log(n))
- O(n!)
- O(2ⁿ)
- O(n²)
- O(n)



Question 21

2 pts

Given the following sequence of operations to a stack, what are the final contents of the stack?

[('push', 3), ('push', 24), ('push', 9), ('pop'), ('push', 39), ('push', 26), ('pop'), ('push', 16), ('push', 49), ('push', 47)]

Specify your answer by separating the values by commas and with the left being the "bottom", so that ('push', 3), ('push', 1), ('push', 10) would have correct answer: 3, 1, 10.

3, 24, 39, 16, 49, 47

Question 22 2 pts

Given the following sequence of operations to a stack, what are the final contents of the stack?
[('push', 41), ('push', 8), ('push', 22), ('pop'), ('push', 15), ('push', 7), ('push', 4), ('pop'), ('pop')]
Specify your answer by separating the values by commas and with the left being the "bottom", so that ('push', 3), ('push', 1), ('push', 10) would have correct answer: 3, 1, 10.

41, 8

Question 23 2 pts

Given the following sequence of operations to a stack, what are the final contents of the stack?
[('push', 4), ('push', 24), ('push', 28), ('push', 26), ('pop'), ('push', 4), ('pop'), ('pop'), ('push', 1), ('push', 41)]
Specify your answer by separating the values by commas and with the left being the "bottom", so that ('push', 3), ('push', 1), ('push', 10) would have correct answer: 3, 1, 10.

4, 24, 1, 41

Question 24 2 pts

Given the following sequence of operations to a queue, what are the final contents of the queue?
[('enqueue', 17), ('enqueue', 32), ('enqueue', 19), ('enqueue', 33), ('dequeue'), ('enqueue', 26), ('enqueue', 23), ('dequeue'), ('dequeue'), ('dequeue')]
Specify your answer by separating the values by commas and with the left being the "front", so that ('enqueue', 3), ('enqueue', 1), ('enqueue', 10), ('dequeue') would have correct answer: 1, 10.

26, 23

Question 25 2 pts

Given the following sequence of operations to a queue, what are the final contents of the queue?
[('enqueue', 9), ('enqueue', 4), ('enqueue', 12), ('enqueue', 29), ('dequeue'), ('enqueue', 14), ('enqueue', 25), ('dequeue'), ('dequeue'), ('dequeue')]
Specify your answer by separating the values by commas and with the left being the "front", so that ('enqueue', 3), ('enqueue', 1), ('enqueue', 10), ('dequeue') would have correct answer: 1, 10.

14, 25

Question 26 2 pts

Given the following sequence of operations to a queue, what are the final contents of the queue?
[('enqueue', 1), ('enqueue', 34), ('enqueue', 31), ('enqueue', 29), ('enqueue', 24), ('dequeue'), ('enqueue', 29), ('dequeue'), ('enqueue', 35), ('dequeue')]
Specify your answer by separating the values by commas and with the left being the "front", so that ('enqueue', 3), ('enqueue', 1), ('enqueue', 10), ('dequeue') would have correct answer: 1, 10.

29, 24, 29, 35

Question 27

2 pts

Given the following sequence of operations to a list, what are the final contents of the list?

[('insert', 0, 33), ('insert', 1, 48), ('insert', 1, 47), ('insert', 0, 40), ('insert', 3, 7), ('insert', 1, 47), ('insert', 1, 50), ('insert', 3, 35), ('delete', 0), ('insert', 7, 17)]

Specify your answer by separating the values by commas and with the left being the index 0 (and the "head"), so that ('insert', 5, 0), ('insert', 10, 1), ('insert', 20, 0) would have correct answer: 20, 5, 10.

50, 47, 35, 33, 47, 7, 48, 17

Question 28

2 pts

Given the following sequence of operations to a list, what are the final contents of the list?

[('insert', 0, 38), ('insert', 1, 42), ('insert', 1, 11), ('delete', 1), ('insert', 0, 19), ('insert', 0, 30), ('insert', 4, 25), ('insert', 2, 12), ('delete', 4), ('delete', 3)]

Specify your answer by separating the values by commas and with the left being the index 0 (and the "head"), so that ('insert', 5, 0), ('insert', 10, 1), ('insert', 20, 0) would have correct answer: 20, 5, 10.

30, 19, 12, 25

Question 29

2 pts

Given the following sequence of operations to a list, what are the final contents of the list?

[('insert', 0, 7), ('insert', 0, 33), ('insert', 0, 30), ('insert', 0, 7), ('delete', 0), ('insert', 3, 26), ('insert', 2, 28), ('insert', 2, 50), ('delete', 4), ('insert', 2, 29)]

Specify your answer by separating the values by commas and with the left being the index 0 (and the "head"), so that ('insert', 5, 0), ('insert', 10, 1), ('insert', 20, 0) would have correct answer: 20, 5, 10.

30, 33, 29, 50, 28, 26

Question 30

2 pts

Given the following sequence of operations to a binary search tree, what are the final contents of the tree?

[('add', 7), ('add', 50), ('add', 12), ('add', 39), ('add', 40), ('add', 41), ('add', 8), ('add', 5), ('delete', 5), ('delete', 50)]

Specify your answer by separating the values by giving the contents of the tree by level, so that a full BST with 3 levels containing the numbers 1 to 7 would be listed like this: 4; 2, 6; 1, 3, 5, 7. For the delete operation, you should do the following: if the node is a leaf just remove it, else if the node only has one child then redirect its parent to its child, else replace the node's value with the next larger value in the tree (its left-most descendent on its right)

7; 12; 8, 39; 40; 41

Question 31

2 pts

Given the following sequence of operations to a binary search tree, what are the final

contents of the tree?

[('add', 45), ('add', 2), ('add', 5), ('add', 30), ('add', 15), ('delete', 15), ('delete', 2), ('add', 1), ('delete', 45), ('add', 13)]

Specify your answer by separating the values by giving the contents of the tree by level, so that a full BST with 3 levels containing the numbers 1 to 7 would be listed like this: 4; 2, 6; 1, 3, 5, 7. For the delete operation, you should do the following: if the node is a leaf just remove it, else if the node only has one child then redirect its parent to its child, else replace the node's value with the next larger value in the tree (its left-most descendant on its right)

5; 1, 30; 13

Question 32

2 pts

Given the following sequence of operations to a binary search tree, what are the final contents of the tree?

[('add', 34), ('add', 27), ('add', 24), ('add', 28), ('add', 37), ('add', 45), ('add', 21), ('add', 19), ('delete', 19), ('add', 3)]

Specify your answer by separating the values by giving the contents of the tree by level, so that a full BST with 3 levels containing the numbers 1 to 7 would be listed like this: 4; 2, 6; 1, 3, 5, 7. For the delete operation, you should do the following: if the node is a leaf just remove it, else if the node only has one child then redirect its parent to its child, else replace the node's value with the next larger value in the tree (its left-most descendant on its right)

34; 27, 37; 24, 28, 45; 21; 3

Question 33

2 pts

Given the following sequence of operations to a hash table with linear probing, what are the final contents of the table?

[('add', 11), ('add', 0), ('add', 17), ('delete', 17), ('add', 8), ('add', 14), ('add', 10), ('add', 20), ('add', 19), ('add', 5)]

Give the contents of the array starting from index 0 and using “-” for empty cells. For delete, when an item is deleted put “del” in that cell (inserts/adds can put into an empty or “del” spot). So the answer might look like this: 5, 7, 3, -, 4, del

Use an initial hash table size of 10, hash function $h(\text{value}, \text{table_size}) = \text{value} * 3 \% \text{table_size}$, and only grow the table if it is completely full.

0, 10, 14, 11, 8, 20, 5, 19, -, -

Question 34

2 pts

Given the following sequence of operations to a hash table with linear probing, what are the final contents of the table?

[('add', 9), ('add', 5), ('add', 10), ('delete', 9), ('add', 9), ('add', 6), ('delete', 10), ('add', 19), ('add', 13), ('delete', 19)]

Give the contents of the array starting from index 0 and using “-” for empty cells. For delete, when an item is deleted put “del” in that cell (inserts/adds can put into an empty or “del” spot). So the answer might look like this: 5, 7, 3, -, 4, del

Use an initial hash table size of 10, hash function $h(\text{value}, \text{table_size}) = \text{value} * 3 \% \text{table_size}$, and only grow the table if it is completely full.

del, 13, -, -, 5, -, 9, 6, del

Question 35

2 pts

Given the following sequence of operations to a hash table with linear probing, what are the final contents of the table?

[('add', 15), ('add', 8), ('add', 6), ('add', 1), ('add', 2), ('add', 14), ('add', 12), ('add', 4), ('delete',

4), ('add', 7)]

Give the contents of the array starting from index 0 and using “-” for empty cells. For delete, when an item is deleted put “del” in that cell (inserts/adds can put into an empty or “del” spot). So the answer might look like this: 5, 7, 3, -, 4, del

Use an initial hash table size of 10, hash function $h(\text{value}, \text{table_size}) = \text{value} * 3 \% \text{table_size}$, and only grow the table if it is completely full.

-, 7, 14, 1, 8, 15, 2, 12, 6, del



Question 36

2 pts

Given the following sequence of operations to a max heap, what are the final contents of the heap?

[('insert', 9), ('insert', 46), ('insert', 36), ('insert', 10), ('insert', 12), ('insert', 48), ('remove max'), ('insert', 15), ('insert', 35), ('insert', 20)]

Specify your answer by giving the heap in order from top to bottom and left to right, separated by commas. A heap with 3 levels containing the numbers 1 to 7 would be listed like this: 7, 5, 6, 1, 2, 4, 3 (assuming that is what the heap ended up looking like after the operations).

48, 46, 36, 35, 12, 9, 15, 10, 20



Question 37

2 pts

Given the following sequence of operations to a max heap, what are the final contents of the heap?

[('insert', 12), ('insert', 3), ('insert', 11), ('insert', 1), ('insert', 50), ('insert', 22), ('remove max'), ('insert', 26), ('insert', 11), ('remove max')]

Specify your answer by giving the heap in order from top to bottom and left to right, separated by commas. A heap with 3 levels containing the numbers 1 to 7 would be listed like this: 7, 5, 6, 1, 2, 4, 3 (assuming that is what the heap ended up looking like after the operations).

22, 12, 11, 1, 3, 11



Question 38

2 pts

Given the following sequence of operations to a max heap, what are the final contents of the heap?

[('insert', 9), ('insert', 27), ('insert', 11), ('insert', 21), ('insert', 35), ('insert', 0), ('insert', 26), ('insert', 30), ('remove max'), ('insert', 11)]

Specify your answer by giving the heap in order from top to bottom and left to right, separated by commas. A heap with 3 levels containing the numbers 1 to 7 would be listed like this: 7, 5, 6, 1, 2, 4, 3 (assuming that is what the heap ended up looking like after the operations).

30, 27, 26, 21, 9, 0, 11, 11

Quiz saved at 6:28am

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