Started on	Sunday, 4 April 2021, 7:51 PM
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Time taken	1 hour
Grade	**13.00** out of 20.00 (**65**%)

Question **1**

Correct

Mark 1.00 out of 1.00

Which one of the following statements is INCORRECT?

Select one:

- a. Divide and conquer reduces a big problem to simpler sub-problems and solve sub-problems recursively
- b. The efficiency of divide and conquer depends on the size of sub-problems
- c. The efficiency of divide and conquer depends on the number of sub-problems
- d. Divide and conquer approach can always produce more efficient algorithms than non-divide and conquer approaches ✔

Your answer is correct.

The correct answer is:
Divide and conquer approach can always produce more efficient algorithms than non-divide and conquer approaches

Fill in the blanks in the following statement:

1) A binary search tree is _____.

2) A red-black tree is _____ .

3) A red-black tree is a _____ with additional properties.

Select one:

Select one:

- a. unbalanced, unbalanced, B-tree
- b. balanced, unbalanced, binary search tree
- c. unbalanced, close to balanced tree, binary search tree ✔
- d. unbalanced, balanced, binary search tree

Your answer is correct.

The correct answer is: unbalanced, close to balanced tree, binary search tree

Question **3**

Incorrect

Mark 0.00 out of 1.00

Which one of the following $T(n)$ is the second fastest in asymptotic analysis?

Select one:

- a. $T(n) = 2 \cdot T(n/2) + O(n)$ ✖ Apply Master Theorem, noting that $\log_3(3.1) = 1.0298$
- b. $T(n) = 3.3 \cdot T(n/3) + O(n^{1.1})$
- c. $T(n) = 3.1 \cdot T(n/3) + O(n)$
- d. $T(n) = T(n/4) + O(n^{1.2})$

Your answer is incorrect.

The correct answer is: $T(n) = 3.1 \cdot T(n/3) + O(n)$

Is this statement true or false?

$O(n!) \subseteq O(2^n)$

Select one:

- True ✖
- False

Factorial grows much after than 2^n

The correct answer is 'False'.

Question **5**

Correct

Mark 1.00 out of 1.00

Is this statement true or false?

$O(n^2) \subseteq \Theta(n^2)$

Select one:

- True
- False ✔

It should be

$\Theta(n^2) \subseteq O(n^2)$

The correct answer is 'False'.

Which one of the following statements is INCORRECT?

Select one:

- a. $2n^2 + n + 100$ is in $\Theta(n^3)$ ✔
- b. $n^2 + 9999$ is in $\Omega(100n^2)$
- c. $100n^3 + 10000$ is in $O(2n^3)$
- d. $0.01n^2 - 10000$ is in $\Omega(n \cdot \log(n))$

Your answer is correct.

The correct answer is: $2n^2 + n + 100$ is in $\Theta(n^3)$

Question **7**

Correct

Mark 1.00 out of 1.00

If you insert the following keys to an empty AVL tree: 34, 5, 8, 22, 9, 12

What will be the balance of the root of the final tree?

Select one:

- a. 1
- b. -1
- c. 0 ✔
- d. -2

Your answer is correct.

The correct answer is:
0

Mark 1.00 out of 1.00

[Discarded] Compute the time complexity of the following method:

(Assume that function c() requires a constant number of operations)

```
public void method(int n) {
    c();
    if (n > 0) { method(n/3); method(n/2);}
}
```

Select one:

- a. $O(\log(n))$ ✔ Write runtime as $T(n) = T(n/3) + T(n/2) + O(1) < 2T(n/2) + O(1)$. Apply Master Theorem
- b. $O(1)$
- c. $\Theta(n)$
- d. $\Omega(n)$

Your answer is correct.

The correct answers are: $\Theta(n)$, $O(\log(n))$

Question **9**

Correct

Mark 1.00 out of 1.00

What is the black-height of the root of a red-black tree with tree height as 5?

Select one:

Select one:

- a. The black-height is at least 1
- b. The black-height is at most 3
- c. The black-height is at least 2
- d. The black-height is at most 5 ✔

Your answer is correct.

The correct answers are: The black-height is at least 2, The black-height is at most 5, The black-height is at least 1

If a red-black tree has n internal nodes and a height h. Which one of the values of n and h are possible?

Select one:

- a. n = 2, h = 3 ✖ There are two internal nodes. h cannot be 3
- b. n = 3, h = 5
- c. n = 10, h = 7
- d. n = 5, h = 3

Your answer is incorrect.

The correct answer is:
n = 5, h = 3

Question **11**

Correct

Mark 1.00 out of 1.00

What is the height of a balanced binary search tree with 55 leaf nodes? (Note: The height of the root-only tree is 0)

Select one:

Select one:

- a. 5
- b. 3
- c. 4
- d. 6 ✔

Your answer is correct.

The correct answer is: 6

Which one the following multiplication algorithms is the fastest, when the input size is large?

Select one:

- a. Long multiplication algorithm
- b. Schönhage–Strassen multiplication algorithm ✔
- c. Karatsuba multiplication algorithm
- d. Divide-and-conquer multiplication algorithm

Your answer is correct.

The correct answer is:
Schönhage–Strassen multiplication algorithm

Question **13**

Incorrect

Mark 0.00 out of 1.00

Which one of the following statements is INCORRECT?

Select one:

- a. Karatsuba Multiplication uses divide-and-conquer.
- b. Long multiplication algorithm is faster than Karatsuba Multiplication, when the input size is small
- c. Karatsuba Multiplication's running time is $O(3^{\log(n)})$ ✖ Karatsuba Multiplication is divided into 3 subproblems, each of size $n/2$
- d. Karatsuba Multiplication is divided into 3 subproblems, each of size $n/3$

Your answer is incorrect.

The correct answer is:
Karatsuba Multiplication is divided into 3 subproblems, each of size $n/3$

Which one of the following statements is INCORRECT?

Select one:

- a. Merge sort for sorting intervals will take $O(n \log(n))$
- b. Merge sort takes $O(n \log(n))$ running time for any input size
- c. Insertion sort is slower than merge sort when the input size is large
- d. Merge sort is the fastest algorithm if the input sequence is already sorted ✔

Your answer is correct.

The correct answer is:
Merge sort is the fastest algorithm if the input sequence is already sorted

Question **15**

Correct

Mark 1.00 out of 1.00

Is this statement true or false?

$O(n!) \subseteq O(n^n)$

Select one:

- True ✔
- False

The correct answer is 'True'.

Question **16**

Correct

Mark 1.00 out of 1.00

Which one of the following properties is INCORRECT in a red-black tree?

Select one:

Select one:

- a. The root and leaves should be black.
- b. Every node must be either red or black.
- c. All simple paths from any node x to a descendant leaf have the same number of black nodes.
- d. If a parent is red, then its children can be either red or black ✔ Correct, this is not a property of red-black trees. If a node is red, both children are black

Your answer is correct.

The correct answer is: If a parent is red, then its children can be either red or black

Which one of the following statements is CORRECT?

Select one:

- a. AVL Tree can maintain absolute balance ✖ B-tree is a generalized binary search tree
- b. B-tree is a generalized binary search tree
- c. B-tree has at most 5 children per node
- d. Red-black tree is always more balanced than AVL tree

Your answer is incorrect.

The correct answer is:
B-tree is a generalized binary search tree

Question **18**

Incorrect

Mark 0.00 out of 1.00

Which one of the following statements is CORRECT?

Select one:

- a. Breath-first search explores one possible option recursively at each step
- b. Depth-first search explores only one option at each step until hitting a dead-end, then return to the start and explore another option ✖ Binary search **d**ivides the search range by half at each step
- c. Binary search applies divide-and-conquer by dividing into 2 subproblems, each of which has only a half of the problem size.
- d. Binary search takes at most $\log(n)$ steps to find an item in unstructured space

Your answer is incorrect.

The correct answer is:
Binary search applies divide-and-conquer by dividing into 2 subproblems, each of which has only a half of the problem size.

Which one of the following statements is CORRECT?

Select one:

a. $5^{\log(n)} = O(n^{2.322}), 5^{\log(n)} = \Omega(n^{2.322}), 5^{\log(n)} = \Theta(n^{2.322})$

b. $\log(n) = O(n), \log(n) = \Omega(n), \log(n) = \Theta(n)$

c. $\log(\log(n)) = O(\log(n)), \log(\log(n)) = \Omega(\log(n)), \log(\log(n)) = \Theta(\log(n))$ ✖

$5^{\log(n)} = n^{\log(5)} = n^{2.322}$

d. $n^2 \log(n) = O(n^2), n^2 \log(n) = \Omega(n^2), n^2 \log(n) = \Theta(n^2)$

Your answer is incorrect.

The correct answer is: $5^{\log(n)} = O(n^{2.322}), 5^{\log(n)} = \Omega(n^{2.322}), 5^{\log(n)} = \Theta(n^{2.322})$

Question **20**

Correct

Mark 1.00 out of 1.00

Compute the time complexity of the following method:

(Assume that function c() requires a constant number of operations)

```
public void someMethod(int n) {
        c();
        for (int i = 0; i<n; i++ ) {
            c();
            for (int j=0;j<i;j++) {
              c();
            }
        }
    }
```

Select one:

Select one:

a. $O(n \log n)$

b. $O(1)$

c. $O(\log \log n)$

d. $O(n^2)$ ✔

Your answer is correct.

The correct answer is: $O(n^2)$

Quiz 3 ►