

## A few practice problems for the final exam.

Adapted from Paul Kube's practice final.

### True or False:

1. \_\_\_\_\_ The cells of an array are usually contiguous in memory; the nodes in a linked list are usually not.
2. \_\_\_\_\_ A precise interface specification can only be implemented in one way.
3. \_\_\_\_\_ Stacks, lists, and trees are examples of linear data structures.
4. \_\_\_\_\_ If A is an interface, not a class, then you cannot declare a variable to be of type A.
5. \_\_\_\_\_ A major advantage of arrays over linked lists is that it takes fewer steps to insert a new element at the beginning of a long array than at the beginning of a long list.
6. \_\_\_\_\_ With unit testing, it is usually possible to test the mutator methods of a class independently of the accessor methods.
7. \_\_\_\_\_ If searching for items in a data structure happens much more often than inserting and deleting items, a sorted array is a better choice than a binary search tree.
8. \_\_\_\_\_ An AVL rotation in a binary search tree always produces a binary search tree.
9. \_\_\_\_\_ If a function  $g$  is  $\Theta(N)$ , then it is also  $O(N)$ .  
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10. \_\_\_\_\_ For a key to be correctly stored in a binary search tree, it must be possible to determine if that key is less than, equal to, or greater than other keys in the tree.
11. \_\_\_\_\_ In Java, `<? extends Comparable<String>>` is a bounded wildcard.
12. \_\_\_\_\_ Worst case time cost of an "insert" operation in a heap is the same as the worst case time cost of an "insert" operation in an array.
13. \_\_\_\_\_ In Java a class can be declared to extend only one other class, but can implement any number of interfaces.
14. \_\_\_\_\_ If a function  $f(n)$  is  $O(N)$ , then it is also  $O(N^2)$ .
15. \_\_\_\_\_ For large problem sizes, an algorithm with time cost  $O(2^N)$  is faster than an algorithm that has time cost  $O(N^2)$ .
16. \_\_\_\_\_ ADT stands for Abstract Data Tree.
17. \_\_\_\_\_ In a tree, a leaf is a node without a parent.
18. \_\_\_\_\_ A stack, also known as a FIFO buffer, is a first-in-first-out linear data structure.
19. \_\_\_\_\_ The minimum height of a binary tree with 7 nodes is 4.

## Multiple choice

1. \_\_\_\_\_ Suppose that some node X of a tree contains the value 1, and that the right child of node X contains the value 0, and the node X has no left child. Which of the following statements is true?

- A. This tree could be a binary search tree. B. This tree could be a (MAX) heap.  
C. Both A and B above. D. Neither A nor B above.

2. \_\_\_\_\_ Suppose a heap is implemented as an array in the usual fashion, with the root stored in array element indexed 0. What is the index of the left child of the right child of the root?

- A. 4 B. 5 C. 6 D. 7 E. None of these

3. What is the order of the following function:  $9H^3 + 7H \log H + 100$

- A.  $O(100)$  B.  $O(H \log H)$  C.  $O(H^3)$   
D. both B and C above E. none of the above

4. \_\_\_\_\_ Given the declaration `Node np;` the expression `np.next` will cause a runtime error whenever

- A. `np` points to the same node as some other pointer B. `np` is null  
C. `np` points to a dummy node D. `np.next` is null

5. \_\_\_\_\_ Suppose a generic Java class is parameterized by a type parameter E. Which of the following expressions would be permitted in the definition of a method of that class?

- A. `x instanceof E` B. `new E[5]` C. `new E()` D. `(E[]) new Object[5]`