Quiz #6

1) Suppose you wanted to test your sort on an array filled with different elements each time the code is run. What is an efficient technique for creating an array of 1,000 elements for each run?

a) Run the program many times, entering different values for the array elements.
b) Make a file with many sets of values and loop through them, sorting each one.
c) Use the `Random` class to generate array elements, sorting each set in a loop.
d) Create many different arrays with different elements in the program code and sort each array.

2) Consider an array with n elements. If we visit each element n times, how many total visits will there be?

a) n
b) $2n$
c) n^n
d) n^2

3) In big-Oh notation, suppose an algorithm requires an order of n^3 element visits. How does doubling the number of elements affect the number of visits?

a) It doubles the number of visits.
b) It quadruples the number of visits.
c) It triples the number of visits.
d) It number of visits goes up by a factor of eight.

4) In Big-Oh notation, selection sort is a(n) _____ algorithm.

a) $O(n^2)$
b) $O(1)$
c) log n
d) $O(\log n^2)$

5) Which sort algorithm starts with an initial sequence of size 1, which is assumed to be sorted, and increases the size of the sorted sequence in the array in each iteration?

a) insertion sort
b) selection sort
c) merge sort
d) quicksort

6) If the array is already sorted, what is the performance of insertion sort?

a) $O(n)$
b) $O(n^2)$
c) $O(\log n)$
d) $O(n \log n)$

7) Merge sort is a(n) _____ algorithm.

a) $O(n)$
b) $O(n \log(n))$
c) $O(n^2)$
d) O(log n)

8) Assume we are using quicksort to sort an array in ascending order. What can we conclude about the elements to the left of the currently placed pivot element?

a) They are all sorted.
b) They are all less than or equal to the pivot element.
c) They are all greater than or equal to the pivot element.
d) None can equal the pivot element.

9) In the worst case, quicksort is a(n) _____ algorithm.

a) $O(n)$
b) $O(\log(n))$
c) $O(n^2)$
d) O(n log n)

10) The following code is an example of a ___ search.

```
public static int search(int[] a, int v)
{
   for (int i = 0; i < a.length; i++)
   {
      if (a[i] == v) { return i; }
   }
   return -1;
}
```

a) sorted
b) binary
c) linear
d) random

11) Binary search is an _____ algorithm.

a) $O(n)$
b) $O(n^2)$
c) $O(\log n)$
d) O(n log n)

12) Given an ordered array with 31 elements, how many elements must be visited in the worst case of binary search?

a) 16
b) 8
c) 5
d) 4

13) A portion of your program includes the loop shown in the code snippet below to examine the elements of an array arr:

```
int count = 0;
int targetVal = 70;
for (int i = 0; i < arr.length; i++)
{
   if (arr[i] >= targetVal)
   {
      count++;
   }
}
```

What can you conclude about the running time of this section of code?

a) Its running time will be $O(n)$.
b) Its running time will be $O(n^2)$.
c) Its running time will be $O(\log (n))$.
d) Its running time will be $O(n \log (n))$.

14) An algorithm that cuts the work in half in each step is an _____ algorithm.

a) $O(n)$
b) $O(n^2)$
c) $O(\log (n))$
d) $O(n \log (n))$

15) Which of the following arrays can be used in a call to the `Arrays.sort` method?

I   Any array with primitive numeric data, such as `int, double, …`
II   Arrays of `String` or numeric wrapper classes like, `Integer, Double, …`
III Any class that implements the `Comparable` interface

a) I
b) II
c) I and II
d) I, II and III

16) The `ArrayList` class implements the _____.

a) Queue interface.
b) Set interface.
c) List interface.
d) Stack interface.

17) A queue is a collection that _____.

a) remembers the order of elements, and allows elements to be added and removed only at one end.
b) does not remember the order of elements but allows elements to be added in any position.
c) remembers the order of elements and allows elements to be inserted in any position.
d) remembers the order of elements and allows elements to be inserted only at one end and removed only at the other end.

18) A collection that allows speedy insertion and removal of already-located elements in the middle of it is called a _____.

a) linked list
b) stack
c) set
d) queue

19) What is included in a linked list node?

I   a reference to its neighboring nodes
II   an array reference
III a data element

a) I
b) II
c) II and III
d) I and III

20) Rather than storing values in an array, a linked list uses a sequence of _____.

a) indexes
b) nodes
c) elements
d) accessors

21) Consider the following code snippet:

```
LinkedList<String> words = new LinkedList<String>();
words.addFirst("abc");
words.addLast("def");
words.addFirst("ghi");
System.out.print(words.removeLast());
System.out.print(words.removeFirst());
System.out.print(words.removeLast());
```

What will this code print when it is executed?

a) abcdefghi
b) ghiabcdef
c) abcghidef
d) defghiabc

22) Which of the following statements about hash tables is NOT correct?

a) Elements are grouped into smaller collections that share the same characteristic.
b) You can form hash tables holding objects of type `String`.
c) You can add an element to a specific position within a hash table.
d) The value used to locate an element in a hash table is called a hash code.

23) Which of the following statements about manipulating objects in a set is correct?

a) If you try to add an element that already exists, an exception will occur.
b) A set iterator visits elements in the order in which they were added to the set.
c) You can add an element at the position indicated by an iterator.

d) You can remove an element at the position indicated by an iterator.

24) Assume that you have declared a set named `mySet` to hold `String` elements. Which of the following statements will correctly remove an element from `mySet`?

a) `mySet.get("apple");`
b) `mySet.remove("apple");`
c) `mySet.pop("apple");`
d) `mySet.delete("apple");`

25) Which of the following statements about manipulating objects in a map is NOT correct?

a) Use the `add` method to add a new element to the map.
b) Use the `get` method to retrieve a value from the map.
c) Use the `keyset` method to get the set of keys for the map.
d) Use the `remove` method to remove a value from the map.

26) Assume that you have declared a map named `myMap` to hold `String` elements with `Integer` keys. Which of the following statements will correctly remove an element from `myMap`?

a) `myMap.get(3);`
b) `myMap.remove(3);`
c) `myMap.pop(3);`
d) `myMap.delete(3);`

27) Consider the following code snippet:

```
Map<String, Integer> scores;
```

You expect to retrieve elements randomly by key, and want fastest retrieval times. Which of the following statements will create a structure to support this?

a) `scores = new HashMap<String, Integer>;`
b) `scores = new TreeMap<String, Integer>;`
c) `scores = new Map<String, Integer>;`
d) `scores = new TreeSet<String, Integer>;`

28) You need to access values in the order in which they were added (first in, first out), and not randomly. Which collection type should you use?

a) Map
b) Hashtable
c) Stack
d) Queue

29) You need to access values using a key, and the keys must be sorted. Which collection type should you use?

a) TreeMap
b) ArrayList
c) HashMap
d) Queue

30) You have decided to store objects of a class in a `TreeSet` structure. Which of the following statements is correct?

a) If the object class implements the `Comparable` interface, and the sort order in the `compare` method is acceptable, you do not have to do anything else.
b) If the object class implements the `Comparable` interface, and the sort order in the `compareTo` method is acceptable, you do not have to do anything else.
c) If the object class implements the `Comparable` interface, and the sort order in the `compare` method is acceptable, you must create a comparator object.
d) If the object class implements the `Comparable` interface, and the sort order in the `compareTo` method is acceptable, you must create a comparator object.

31) You need to write a program to simulate the effect of adding an additional cashier in a supermarket to reduce the length of time customers must wait to check out. Which data structure would be most appropriate to simulate the waiting customers?

a) map
b) stack
c) queue
d) linked list

32) Which of the following statements about stacks is correct?

a) A stack implements first-in, first-out retrieval.
b) A stack implements random retrieval.
c) A stack implements last-in, first-out retrieval.
d) A stack stores elements in sorted order.

33) Assume that you have declared a stack named `myStack` to hold `String` elements. Which of the following statements will correctly remove an element from `myStack`?

a) `myStack.remove();`
b) `myStack.get();`
c) `myStack.delete();`
d) `myStack.pop();`

34) Print jobs submitted to a printer would probably be stored in which type of data structure?

a) queue
b) linked list
c) stack
d) hash table

35) Suppose we have two `String` objects and treat the characters in each string from beginning to end in the following way: With one string, we push each character on a stack. With the other string, we add each character to a queue. After processing both strings, we then pop one character from the stack and remove one character from the queue, and compare the pair of characters to each other. We do this until the stack and the queue are both empty. What does it mean if all the character pairs match?

a) The strings are the identical.

b) The strings are different.
c) One string is the reverse of the other.
d) We can only conclude the strings are of the same length
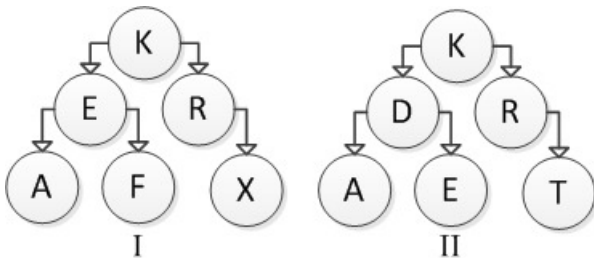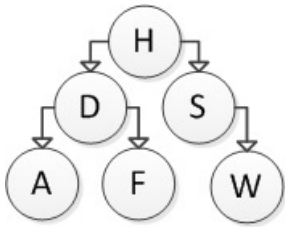
36) Consider the following tree diagrams:

I   II   III
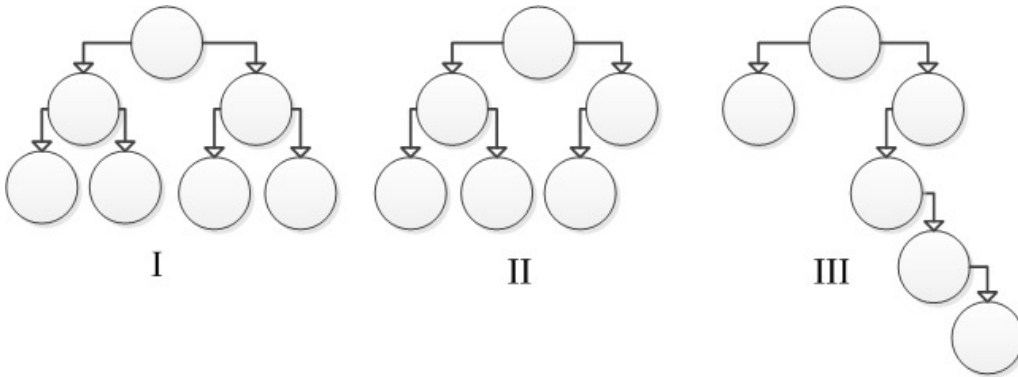
Which of these trees is considered to be balanced?

a) I
b) I and II
c) II and III
d) I and III

37) In a binary search tree, where the root node data value = 45, what do we know about the data values of all the descendants in the left subtree of the root?

a) the root's left child value < 45, but the right child of the root's left child value is > 45
b) some values will be < 45, but there may be a few values > 45
c) approximately half the values are < 45, the other half are > 45
d) all will be < 45
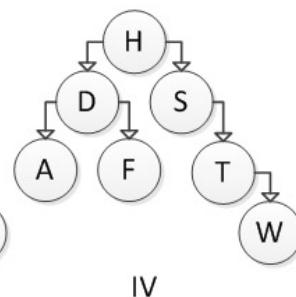
38) Consider the following tree diagrams:

I   II
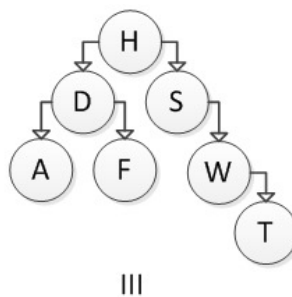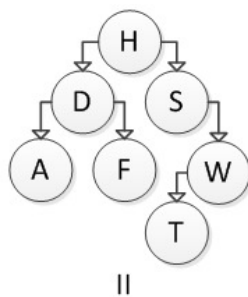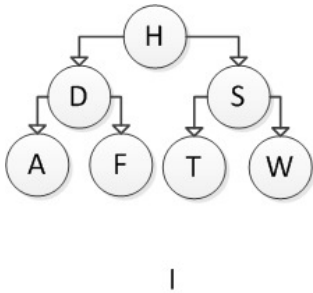
Which of the above are binary search trees?

a) I
b) II
c) I and II
d) Neither I nor II
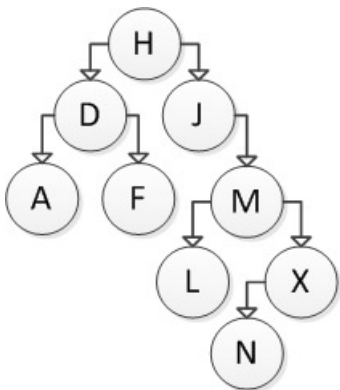
39) Consider the following binary search tree diagram:

Which of the following trees represents the correct result after inserting element T?

a) I
b) II
c) III
d) IV

40) Consider the following binary search tree diagram:

If node J is to be removed, which node should be copied into its location?

a) M
b) L
c) X
d) N

41) Removing an element from a balanced binary search tree takes _____ time.

a) $O(n)$
b) $O(\log (n))$
c) $O(1)$
d) $O(n^2)$

42) Adding an element to an unbalanced binary search tree takes _____ time.

a) $O(n)$
b) $O(\log (n))$
c) $O(1)$
d) $O(n^2)$

43) You wish to traverse a binary search tree in sorted order using inorder traversal. Arrange the following actions in the correct order to accomplish this.

I Print the right subtree recursively
II Print the root
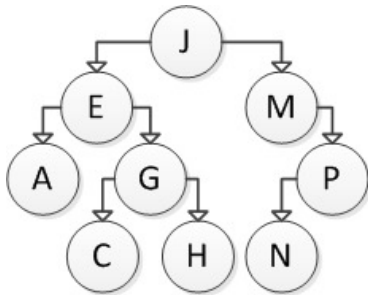III Print the left subtree recursively

a) I, II, III
b) III, II, I
c) II, III, I
d) III, I, II

44) Consider the following binary search tree:

Which of the following sequences correctly represents preorder traversal of this tree?

a) J, E, M, A, G, P, C, H, N
b) A, C, H, G, E, N, P, M, J
c) J, E, A, G, C, H, M, P, N
d) A, C, E, G, H, J, M, N, P