2020 COMP201W2 Data Structures

◄ Theory Test I Clash with COMP314 Test

Practical Test ►

Started on	Thursday, 5 November 2020, 10:32 AM
State	Finished
Completed on	Thursday, 5 November 2020, 11:45 AM
Time taken	1 hour 13 mins
Marks	35.00/50.00
Grade	**70.00** out of 100.00

Question 1

Incorrect

Mark 0.00 out of 0.50

The priority of a PriorityQueue cannot be reversed once a PriorityQueue is created.

Select one:

- True
- False

The correct answer is 'False'.

Question 2

Correct

Mark 0.50 out of 0.50

java.util.HashSet implements the java.util.Queue interface.

Select one:

- True
- False

The correct answer is 'False'.

Question 3

Correct

Mark 0.50 out of 0.50

A PriorityQueue orders its elements according to their natural ordering using the Comparable interface even if a Comparator is specified.

Select one:

- True
- False

The correct answer is 'False'.

Question 4

Correct

Mark 0.50 out of 0.50

Methods in the Collections class are static.

Select one:

- True
- False

The correct answer is 'True'.

Question 5

Correct

Mark 0.50 out of 0.50

The HashSet is more efficient than the TreeSet if you do not want the elements in a set to be sorted.

Select one:

- True
- False

The correct answer is 'True'.

Question 6

Correct

Mark 0.50 out of 0.50

The dynamic programming approach is the process of solving subproblems and then combining the solutions of the subproblems to obtain an overall solution.

Select one:

- True
- False

The correct answer is 'True'.

Question 7

Correct

Mark 0.50 out of 0.50

A PriorityQueue orders its elements according to the Comparator if a Comparator is specified in the constructor.

Select one:

- True
- False

The correct answer is 'True'.

Question 8

Correct

Mark 0.50 out of 0.50

The TreeSet is unsorted, but the HashSet is sorted.

Select one:

- True
- False

The correct answer is 'False'.

Question 9

Incorrect

Mark 0.00 out of 0.50

java.util.LinkedHashSet implements the java.util.Queue interface.

Select one:

- True
- False

The correct answer is 'False'.

Question 10

Correct

Mark 0.50 out of 0.50

java.util.PriorityQueue implements the java.util.Queue interface.

Select one:

- True
- False

The correct answer is 'True'.

Question 11

Correct

Mark 1.00 out of 1.00

Which of the following statements is NOT true?

Select one:

- a. A Comparator object contains the compare method that compares two objects.
- b. The Comparable interface contains the compareTo method with the signature "public int compareTo(Object)".
- c. The Comparator interface contains the compareTo method with the signature "public int compareTo(Object, Object)".
- d. A Comparable object can compare this object with the other object.

The correct answer is: The Comparator interface contains the compareTo method with the signature "public int compareTo(Object, Object)".

Question 12

Correct

Mark 1.00 out of 1.00

O(1) is _____.

Select one:

- a. linear time
- b. logarithmic time
- c. constant time
- d. log-linear time

The correct answer is: constant time

Question 13

Correct

Mark 1.00 out of 1.00

Suppose list list1 is [1, 2, 5] and list list2 is [2, 3, 6]. After list1.addAll(list2), list2 is _____.

Select one:

- a. [1, 5]
- b. [2]
- c. [1, 2, 2, 3, 5, 6]
- d. [1, 2, 3, 5, 6]
- e. [2, 3, 6]

The correct answer is: [2, 3, 6]

Question 14

Correct

Mark 1.00 out of 1.00

The worst-time complexity for heap sort is _____

Select one:

- a. O(nlogn)
- b. O(n^2)
- c. O(n)
- d. O(logn)
- e. O(1)

The correct answer is: O(nlogn)

Question 15

Incorrect

Mark 0.00 out of 1.00

Which of the following is correct to perform the set intersection of two sets s1 and s2?

Select one:

- a. s1.join(s2)
- b. s1.retainAll(s2)
- c. s1.intersect(s2)
- d. s1.intersection(s2)

The correct answer is: s1.retainAll(s2)

Question 16

Correct

Mark 1.00 out of 1.00

Analyze the following code.

```
import java.util.*;
public class Test {
   public static void main(String[] args) throws Exception {
      TreeSet<String> set = new TreeSet<>();
      set.add("Red");
      set.add("Yellow");
      set.add("Green");
      set.add("Blue");
      SortedSet temp = set.headSet("Purple");
      System.out.println(temp.first());
   }
}
```

Select one:

- a. The program displays Blue
- b. The program displays Green
- c. The program displays Red
- d. The program displays Purple
- e. The program displays Yellow

The correct answer is: The program displays Blue

Question 17

Correct

Mark 1.00 out of 1.00

Which of the data types below could be used to store elements in their natural order based on the compareTo method?

Select one:

- a. TreeSet
- b. HashSet
- c. LinkedHashSet
- d. Collection
- e. Set

The correct answer is: TreeSet

Question 18

Correct

Mark 1.00 out of 1.00

Suppose set s1 is [1, 2, 5] and set s2 is [2, 3, 6]. After s1.addAll(s2), s2 is _____.

Select one:

- a. [2, 3, 6]
- b. [1, 5]
- c. [2]
- d. [1, 2, 3, 5, 6]
- e. [1, 2, 2, 3, 5, 6]

The correct answer is: [2, 3, 6]

Question 19

Correct

Mark 1.00 out of 1.00

O(n) is _____.

Select one:

- a. constant time
- b. log-linear time
- c. logarithmic time
- d. linear time

The correct answer is: linear time

Question 20

Correct

Mark 1.00 out of 1.00

Analyze the following code:

```
import java.util.*;
public class Test {
   public static void main(String[] args) {
      PriorityQueue<Integer> queue = new PriorityQueue<Integer>( Arrays.asList(60, 10, 50, 30, 40, 20));
      for (int i: queue)
       System.out.print(i + " ");
   }
}
```

Select one:

- a. The program displays 10 20 30 40 50 60
- b. There is no guarantee that the program displays 10 20 30 40 50 60
- c. The program displays 60 50 40 30 20 10
- d. The program displays 60 10 50 30 40 20

The correct answer is: There is no guarantee that the program displays 10 20 30 40 50 60

Question 21

Correct

Mark 1.00 out of 1.00

Suppose your program frequently tests whether a student is in a soccer team and also need to know the student's information such as phone number, address, and age, what is the best data structure to store the students in a soccer team?

Select one:

- a. HashMap
- b. LinkedList
- c. ArrayList
- d. TreeMap
- e. HashSet

The correct answer is: HashMap

Question 22

Correct

Mark 1.00 out of 1.00

What is the output of the following code?

```
import java.util.*;
import java.util.*;
public class Test {
   public static void main(String[] args) {
      Set<String> set1 = new HashSet<>();
      set1.add("Atlanta");
      set1.add("Macon");
      set1.add("Savanna");
      Set<String> set2 = new HashSet<>();
      set2.add("Atlanta");
      set2.add("Macon");
      set2.add("Savanna");
      Set<String> set3 = new HashSet<>();
      set3.add("Macon");
      set3.add("Savanna");
      set3.add("Atlanta");
      System.out.println(set1.equals(set2) + " " + set1.equals(set3));
   }
}
```

Select one:

- a. false false
- b. true true
- c. false true
- d. true false

The correct answer is: true true

Question 23

Incorrect

Mark 0.00 out of 1.00

Analyze the following code:

```
public class Test {
  public static void main(String[] args) {
    Map<String, String> map = new HashMap<>();
    map.put("123", "John Smith");
    map.put("111", "George Smith");
    map.put("123", "Steve Yao");
    map.put("222", "Steve Yao");
  }
}
```

Select one:

- a. After all the four entries are added to the map, "123" is a key that corresponds to the value "John Smith".
- b. A runtime error occurs because two entries with the same key "123" are added to the map.
- c. After all the four entries are added to the map, "123" is a key that corresponds to the value "Steve Yao".
- d. After all the four entries are added to the map, "Steve Yao" is a key that corresponds to the value "222".
- e. After all the four entries are added to the map, "John Smith" is a key that corresponds to the value "123".

The correct answer is: After all the four entries are added to the map, "123" is a key that corresponds to the value "Steve Yao".

Question 24

Correct

Mark 1.00 out of 1.00

What is the output for the following code?

```
import java.util.*;
public class Test {
	public static void main(String[] args) {
		Set<A> set = new HashSet<>();
		set.add(new A());
		set.add(new A());
		set.add(new A());
		set.add(new A());
		System.out.println(set);
	}
}
class A  {
	int r = 1;
	public String toString() {
		return r + "";
	}
	public int hashCode() {
		return r;
	}
}
```

Select one:

- a. [1, 1]
- b. [1, 1, 1]
- c. [1, 1, 1, 1]
- d. [1]

The correct answer is: [1, 1, 1, 1]

Question 25

Correct

Mark 1.00 out of 1.00

Which of the following statements is NOT true?

Select one:

- a. The Collection interface provides the basic operations for adding and removing elements in a collection.
- b. The AbstractCollection class is a convenience class that provides full implementation for the Collection interface.
- c. The Collection interface is the root interface for manipulating a collection of objects.
- d. All interfaces and classes in the Collections framework are declared using generic type since JDK 1.5.
- e. Some of the methods in the Collection interface cannot be implemented in the concrete subclass. In this case, the method would throw java.lang.UnsupportedOperationException, a subclass of RuntimeException.

The correct answer is: The AbstractCollection class is a convenience class that provides full implementation for the Collection interface.

Question 26

Correct

Mark 1.00 out of 1.00

The worst-time complexity for bubble sort is _____.

Select one:

- a. O(n)
- b. O(1)
- c. O(nlogn)
- d. O(n^2)
- e. O(logn)

The correct answer is: O(n^2)

Question 27

Correct

Mark 1.00 out of 1.00

Suppose your program frequently tests whether a student is in a soccer team, what is the best data structure to store the students in a soccer team?

Select one:

- a. LinkedList
- b. ArrayList
- c. Vector
- d. Vector
- e. HashSet

The correct answer is: HashSet

Question 28

Correct

Mark 1.00 out of 1.00

The iterator() method returns an instance of the _____ interface.

Select one:

- a. Collection
- b. Iterable
- c. Iterator
- d. ArrayList

The correct answer is: Iterator

Question 29

Correct

Mark 1.00 out of 1.00

Suppose a list is {2, 9, 5, 4, 8, 1}. After the first pass of bubble sort, the list becomes

Select one:

- a. 2, 5, 4, 8, 1, 9
- b. 2, 1, 5, 4, 8, 9
- c. 2, 9, 5, 4, 1, 8
- d. 2, 5, 9, 4, 8, 1
- e. 2, 9, 5, 4, 8, 1

The correct answer is: 2, 5, 4, 8, 1, 9

Question 30

Correct

Mark 1.00 out of 1.00

Suppose list1 is ["Atlanta", "Macon"] and list2 is ["Atlanta", "Macon", "Savannah"], which of the following returns true?

Select one:

- a. list1.contains(list2.get(2))
- b. list1.contains(list2)
- c. list2.contains(list1)
- d. list2.contains(list1.get(0))

The correct answer is: list2.contains(list1.get(0))

Question 31

Incorrect

Mark 0.00 out of 1.00

Suppose you write a program that reads numbers and displays the distinct numbers. The order of the number does not matter. The best data structure for storing the numbers in the program is _____.

Select one:

- a. ArrayList
- b. TreeSet
- c. LinkedList
- d. LinkedHashSet
- e. HashSet

The correct answer is: HashSet

Question 32

Correct

Mark 1.00 out of 1.00

Which of the following data types does NOT implement the Collection interface?

Select one:

- a. Map
- b. LinkedList
- c. HashSet
- d. TreeSet
- e. ArrayList

The correct answer is: Map

Question 33

Incorrect

Mark 0.00 out of 1.00

Which method do you use to find the number of elements in a set or list named x?

Select one:

- a. x.length()
- b. x.size()
- c. x.counts()
- d. x.sizes()
- e. x.count()

The correct answer is: x.size()

Question 34

Incorrect

Mark 0.00 out of 1.00

What is the output of the following code?

```
ArrayList<Integer> list = new ArrayList<>();
list.add(1);
list.add(2);
list.add(3);
list.remove(2);
System.out.println(list);
```

Select one:

- a. [2, 3]
- b. [1, 2, 3]
- c. [1, 2]
- d. [1, 3]
- e. [1]

The correct answer is: [1, 2]

Question 35

Correct

Mark 1.00 out of 1.00

Analyze the following code:

```
import java.util.*;
public class Test {
  public static void main(String[] args) throws Exception {
    Set<String> set = new TreeSet<>();
    set.add("Red");
    set.add("Green");
    set.add("Blue");
    System.out.println(set.first());
  }
}
```

Select one:

- a. The program displays Green
- b. The program displays Red
- c. The program displays Blue
- d. The program cannot compile, because the first() method is not defined in Set.
- e. The program may display Red, Blue, or Green.

The correct answer is: The program cannot compile, because the first() method is not defined in Set.

Question 36

Correct

Mark 1.00 out of 1.00

Suppose you write a program that reads numbers and displays the distinct numbers in their input order. The best data structure for storing the numbers in the program is _____.

Select one:

- a. ArrayList
- b. LinkedList
- c. LinkedHashSet
- d. TreeSet
- e. HashSet

The correct answer is: LinkedHashSet

Question 37

Incorrect

Mark 0.00 out of 1.00

Which of the following is correct to perform the set union of two sets s1 and s2?

Select one:

- a. s1.add(s2)
- b. s1.union(s2)
- c. s1 + s2
- d. s1.addAll(s2)

The correct answer is: s1.addAll(s2)

Question 38

Correct

Mark 1.00 out of 1.00

For an instance of Collection, you can obtain its iterator using _____.

Select one:

- a. c.iterable()
- b. c.iterator()
- c. c.getIterator()
- d. c.iterators()

The correct answer is: c.iterator()

Question 39

Correct

Mark 1.00 out of 1.00

Suppose you choose the first element as a pivot in the list {5 2 9 3 8 4 0 1 6 7}. Using the partition algorithm in the book, what is the new list after the partition?

Select one:

- a. 4 2 1 3 0 5 8 9 6 7
- b. 4 2 3 0 1 5 6 7 9 8
- c. 2 3 4 0 1 5 6 7 8 9
- d. 5 2 9 3 8 4 0 1 6 7
- e. 2 3 4 0 1 5 9 8 6 7

The correct answer is: 4 2 1 3 0 5 8 9 6 7

Question 40

Partially correct

Mark 2.00 out of 6.00

Deduce the time complexity of the code snippet in the figure below

```
int count = 0;
    for(int i = n; i > 0; i/= 2 )
        for(int j = 0; j < i; j++ )
            count++;
```

a. Supposing that the outer loop runs k +1 times, what is value of k relative to n?

◉ $n/2$ wrong ○ $log_{10}(n)$ ○ $log_2(n)$ ○ $n-1$

Mark 0.00 out of 1.00

The correct answer is: $log_2(n)$

[1]

b. Which of the following is the time complexity function of the above algorithm in terms of k and n?

◉ $T(n) = nc + \frac{n}{2}c + \frac{n}{2^2}c + \frac{n}{2^3}c + \ldots + \frac{n}{2^k}c$ OK

○ $T(n) = c + 2c + 3c + \ldots + (n-k)c$

○ $T(n) = c + \frac{1}{2}c + \frac{1}{2^2}c + \frac{1}{2^3}c + \ldots + \frac{1}{2^k}c$

○ $T(n) = c + 2c + 2^2c + 2^3c + \ldots 2^kc$

Mark 2.00 out of 2.00

The correct answer is: $T(n) = nc + \frac{n}{2}c + \frac{n}{2^2}c + \frac{n}{2^3}c + \ldots + \frac{n}{2^k}c$

[2]

c. What is your final expression for the time complexity of the algorithm above after substituting k with the value you got from Question (a)?

○ $2c - \frac{1}{n}c$ ◉ $\frac{n(n+1)c}{2}$ wrong ○ $2cn - c$ ○ $2nc + c$

Mark 0.00 out of 2.00

The correct answer is: $2cn - c$

[2]

d. The algorithm above runs in_____ time.

○ $O(nlog(n))$ ○ $O(n^2)$ ◉ $O(log(n))$ wrong ○ $O(n)$

Mark 0.00 out of 1.00

The correct answer is: $O(n)$

[1]

Question 41

Partially correct

Mark 6.00 out of 10.00

a. Study the Merge Sort algorithm given below, and answer the following questions

```
public void mergeSort(E[] list, int first, int last) {
    int mid;
    if(first < last)        {
        mid = (first + last) / 2;
        mergeSort(list, first, mid);
        mergeSort(list, mid+1, last);
        merge(list, first, mid, last); // the merge method runs in O(n), where
 n is the size of a sub-list
    }
}
```

a. i. What is the time complexity function for the Merge Sort algorithm?

- $T(n) = T(n-1) + O(n)$
- $T(n) = T(\frac{n}{2}) + O(n)$
- $T(n) = 2T(\frac{n}{2}) + O(n)$ OK
- $T(n) = 2T(n-1) + O(n)$
- $T(n) = 2T(\frac{n}{2}) + c$

Mark 1.00 out of 1.00

The correct answer is: $T(n) = 2T(\frac{n}{2}) + O(n)$

[1]

a. ii. The algorithm terminates when there are [ ] elements in a sublist

[1]

a. iii. The number of recursive calls at termination in terms of n (the size of the original list) is:

- $log_{10}(n)$
- $n/2$
- $log_2(n)$ OK
- $n-1$

Mark 1.00 out of 1.00

The correct answer is: $log_2(n)$

[1]

b. The divide and conquer algorithm for finding two closest pair of points in a Cartesian plane is given by the formula $T(n) = 2T(\frac{n}{2}) + nc$, where n is the number of points on the plane. The algorithm terminates when $n = 1$ and $T(1) = c$. Determine the time complexity of the algorithm.

b. i. What is the time complexity function of the algorithm after 3 recursive calls?

- $T(n) = 2^3T(\frac{n}{2^3}) + 3nc$
- $T(n) = 2^3T(\frac{n}{2^3}) + 2^2nc + 2nc + nc$ wrong
- $T(n) = 2T(\frac{n}{2^3}) + 2nc + nc$

○ $T(n) = 2T(\frac{n}{2^3}) + 2^2nc + 2nc + nc$

Mark 0.00 out of 2.00

The correct answer is: $T(n) = 2^3T(\frac{n}{2^3}) + 3nc$

[2]

b. ii. Which one of the following equations represents the time complexity function after k recursive calls?

◉ $T(n) = 2^kT(\frac{n}{2^k}) + 2^{k-1}nc + 2^{k-2}nc + ... + 2nc + nc$ wrong

○ $T(n) = 2^kT(\frac{n}{2^k}) + knc$

○ T(n)= 2T(\frac{n}{2^k}) + (k-1)nc + (k-2)nc + ... +nc

○ T(n)= 2T(\frac{n}{2^k})+ 2^{k-1}nc+2^{k-2}nc+ ... +2nc+nc

Mark 0.00 out of 1.00

The correct answer is: $T(n) = 2^kT(\frac{n}{2^k}) + knc$

[1]

b. iii. What is value of k relative to n when the algorithm terminates?

○ $log_{10}(n)$ ◉ $log_2(n)$ OK ○ $n - 1$ ○ $n/2$

Mark 1.00 out of 1.00

The correct answer is: $log_2(n)$

[1]

b. iv. What is your final experssion for the time complexity of the algorithm above after substituting k with the value you got from Question (b. iii)?

○ cn^2 ○ $cn - c$ ○ $cn^2 + cn$ ◉ $cn + cnlog_2(n)$ OK

Mark 2.00 out of 2.00

The correct answer is: $cn + cnlog_2(n)$

[2]

b. v. The divide and conquer algorithm for finding two closest pair of points in a Cartesian plane runs in _____ time.

○ $O(n)$ ○ $O(log(n))$ ○ $O(n^2)$ ◉ $O(nlog(n))$ OK

Mark 1.00 out of 1.00

The correct answer is: $O(nlog(n))$

[1]

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