Disclaimer:

As per usual, I independently create most of the resources I present to you, this in no way guarantees the difficulty of the exam, but should rather serve as a guide for your study purposes. It is in your best interest to complete the exam as part of your studies in a timed and silent environment that will mirror the actual exam. Extra note: the question division is different from the actual exam, this exam is actually longer :)

Multiple Choice Section
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1. A Special Method used to initialize the instance variables of an object is known as what?
    a. Method Overloader
    b. Constructor
    c. Accessor Method
    d. Mutator Method
    e. None of the Above

2. The parameter list when referring to a method signature is known as?
    a. Implicit Parameters
    b. Explicit Parameters
    c. Formal Parameters
    d. Actual Parameters
    e. Command Line Arguments

3. This table shows how we turn the internal storage of chars to the character they represent. What do we call it?
    a. ASCII
    b. UTF
    c. USB
    d. UDP
    e. None of the Above

4. This algorithm has a big-O cost of N^2 and does not have a consistent efficiency function associated with it. Which algorithm does the above describe?
    a. Linear Search
    b. Merge Sort
    c. Selection Sort
    d. Insertion Sort
    e. Binary Search

5. A variable with class level scope and for which each instantiated object has its own copy.
    a. Static variable
    b. Instance variable
    c. Class Variable
    d. Local Variable
    e. None of the Above

6. An instance of a class is known as a(n)?
    a. Class
    b. Object
    c. Instance Variable
    d. Constructor
    e. Encapsulation

7. When you provide a new implementation for a method you inherited from the superclass this is called?
    a. Method Overloading
    b. Method Overriding
    c. Method Aliasing
    d. Static Polymorphism
    e. Two or more of the above

8. What kind of statement is needed in order to use certain functionalities like ArrayLists and Scanners?
    a. Package
    b. Static import
    c. Import
    d. Method Signature
    e. Static Code Block

9. What keyword is used in the class definition to demonstrate the “is a” relationships?
   a. final
   b. implements
   c. static
   d. protected
   e. extends

10. What is the name for the interface that ArrayList implements that gives it the properties of Lists?
   a. Collection
   b. Comparable
   c. List
   d. Iterable
   e. Two of the Above

11. Consider the list of numbers A=(8,1,2,6,4,5). Recall the insertion-sort algorithm from class What will the list look like after 3 iterations of the outer loop?
   a. (1,2,4,5,8,6)
   b. (1,2,6,8,4,5)
   c. (1,2,4,6,8,5)
   d. (1,2,4,5,6,8)
   e. None of the Above

12. How many comparisons does the insertion-sort algorithm seen in class take to sort the list A=(8,1,2,6,4,5)?
   a. 11
   b. 7
   c. 9
   d. 13
   e. 0

13. If a list has 11 elements in it, what is the minimum number of searches necessary to make first sorting the list and then using binary search better than just using linear search in terms of the total number of comparisons over all searches? Assume we sort using selection sort!

a. 9
b. 8
c. 11
d. 0
e. None of the Above

14. What is the range of values x can have after the following statement:

```
int x = (int)(Math.random()*52+5)
```

a. [5,56]
b. [0,57)
c. [5,57)
d. A and C
e. None of the Above

15. The method mystery has the following method signature, what is the return type of the method?

```
public double mystery()
```

a. boolean
b. double
c. int
d. String[]
e. Locale

16. Which of the following conditions is a way to test whether x is between 2 and 7 (inclusive) in Java?

```
 i.   2 <= x <= 7
ii.   2 <= x || x <= 7
iii.  !(x <= 2 || x >= 7)
iv.   !(x < 2 || x > 7)
```

a. (iv) only
b. (i) and (iv)
c. (i) and (iii)
d. All of the Above

e. None of the Above

17. Which properties are true of String objects in Java?

i. The index of the first character is 1
ii. The shortest string has length 0
iii. A String object may be mutated by changing its characters using the mutator method replace.
iv. String are immutable

a. (iv) only
b. (i) and (iii)
c. (ii) and (iv)
d. All of the Above
e. None of the Above

18. Consider the following Code Snippet:

```
String x = "Columbia";
String y = x.substring(1,4);
String y = x.substring(3,4);
```

What is the value contained within y afterwards?

a. "Col"
b. "l"
c. "u"
d. A Runtime Exception Occurs
e. A Compiler Error Occurs

19. Which statement(s) about lists implemented with the ArrayList class in Java are not true?

a. You can delete any specific item of a list.
b. You can iterate through an ArrayList using the enhanced for loop.
c. You can insert an item to the list anywhere in the list
d. You can access their size using .size()
e. All of the above are true

20. Consider an array nums such that nums.length > 1. How do you access the last element of nums?
    a. nums[0]
    b. nums[-1]
    c. nums[nums.length]
    d. nums[nums.length-1];
    e. Both (b) and (c)

For Questions 21-22 consider a class Foo that has two instance variables of type int. The values of these two instance variables may be assigned with the methods set1(x) and set2(x) where x is an int. The values of the two instance variables may be accessed through methods get1() and get2(). Assume that y and z are object references for two separate instances of the class Foo. The following instructions are executed:

```
y.set1(3);
y.set2(2);
z.set1(2);
z.set2(y.get2());
```

21. The statement y.get2(); will
    a. Return 0
    b. Return 2
    c. Return 3
    d. A Runtime Exception Occurs
    e. None of the Above

22. Suppose the statement z=y; is executed after the four lines above. Which of the following is true?

```
 i.   (y.get1( )==z.get1( )) and (y.get2( )==z.get2( ))
 ii.  (y == z)
 iii. (y.get2( )==z.get2( )) and (z.get2( )==z.get1( ))
 iv.  (y.get1( )==z.get1( )) but (y.get2( )!=z.get2( ))
```

    a. (i) only
    b. (i) and (ii) only
    c. (ii) and (iii) only
    d. All of the Above
    e. None of the Above

23. In the loop below assume that stuff is a nonempty array of distinct positive int values.

```
int foo = 0;
for(int j=1; j<stuff.length; j++){
    if (stuff[j] > stuff[foo])
        foo = j;

}
```

What does this loop do?

a. It stores the largest value in the array stuff (the maximum) in the variable foo
b. It stores the location of the smallest value in the array stuff in the variable foo
c. It stores the location of the largest value in the array stuff in the variable foo
d. It stores the smallest value in the array stuff (the minimum) in the variable foo
e. None of the Above

Questions 24-26 Concern the following class definitions:

```
public class BankAccount{}
public class CheckingAccount extends BankAccount{}
public class SavingAccount extends CheckingAccount{}
```

24. Consider the following lines of code, which of the following do not compile if any?

```
 i.  BankAccount accountOne = new CheckingAccount();
ii.  BankAccount accountTwo = new SavingAccount();
iii. SavingAccount accountThree = new BankAccount();
```

a. (i) and (iii)
b. (ii) and (iii)
c. (ii) only
d. (iii) only
e. All of the Above Compile

25. If we were to write deposit methods for each of the classes, such that each deposit was unique per class and we ran this line of code: accountTwo.deposit(500); Which class's deposit method will be invoked?
    a. BankAccount's deposit()
    b. CheckingAccount's deposit()
    c. SavingAccount's deposit()
    d. It will be chosen at random
    e. None of the Above

26. If we deleted the deposit method from BankAccount and reran the lines from Question 24. Which if any would not compile?
    a. (i) and (iii)
    b. (ii) and (iii)
    c. (ii) only
    d. (iii) only
    e. None of the Above Compile

27. Linear (sequential) search has an efficiency on the order of _____ where N is the number of items being searched
    a. O(logN)
    b. O(NlogN)
    c. O(N)
    d. O(1)
    e. Linear Search has no big-O cost

For Questions 28-30 Consider the following code snippet in Java:

```
String s="College";
String s2="";
int c=0;
for (int i=0;i<s.length();i++){
     c=0;
     for (int j=0;j<s.length();j++){
     if (s.substring(i,i+1).equals(s.substring(j,j+1)))
          c++;
     }
     s2=s2+c;
}
System.out.println(s2);
```

28. What does the above code block do when executed?
    a. Counts the number of characters and stores that value in c
    b. Counts the total occurrence of the characters and stores it in c
    c. Concatenates the number of occurrences of each character to s2
    d. Both B and C
    e. None of the Above

29. What is printed from the code snippet above?
    a. 1122212
    b. 2122211
    c. 0000000
    d. 11
    e. 7

30. How many times does the conditional evaluate to false?
    a. 11
    b. 49
    c. 32
    d. 38
    e. It is always true

For Questions 31 and 32 consider the following Base 10 number:

myNumber = 3134

31. What is myNumber in Base 2?
    a. 110000111110
    b. 110000111111
    c. 110110100110
    d. 110100111111
    e. 100000111110

32. What is myNumber in Base 16?
    a. 3EC
    b. C3E
    c. EC3
    d. DF9
    e. None of the above

33. How many classes can you extend within a single class?
    a. 2
    b. 1
    c. 4
    d. 42
    e. Is there even a limit?

34. How many classes can you implement within a single class?
    a. 0
    b. 65535
    c. 1
    d. 2
    e. Is there even a limit?

For Questions 35 and 36 consider the following method:

```
public void mystery(int[] list){
     for(int i = 1; i < list.length-1; i += 2){
          if(list[i] % 2 == 0)
               list[i+1] = list[i];
          else
               list[i-1] = list[i+1];
     }
}
```

35. Say we execute the above method on the following list {2,1,5,3,-2} What will the list look like after the method finishes.
    a. 5,1,2,2,2
    b. -2,3,-2,1,5
    c. 5,1,-2,3,-2
    d. A Compiler Error will Occur
    e. A Runtime Exception Occurs

Assume we change the following lines in the method as described below:

1. Change the for-loop definition such that we iterate backwards,

still ignoring the first and last element

2. Swap the lines in the conditional

36. If we were to execute this new method on the same list as above what would the list look like after execution?
    a. -2,1,-2,3,-2
    b. 1,3,2,2,-2
    c. 2,1,1,3,3
    d. A Runtime Exception Occurs
    e. A Compiler Error Occurs

For Questions 37 and 38 Consider the following code snippet:

```
private int[] arrOfInts = {1,2,3,4,5};
public void doubleDoubleArray(){
     int[] temp = new int[arrOfInts.length*2];
     for(int i = 0; i < arrOfInts.length; i++){
          temp[i] = arrOfInts[i];
     }
     arrOfInts = temp;
}
```

37. What is the length of arrOfInts after we compile and run the method above?
    a. 5
    b. 0
    c. 10
    d. A Runtime Exception will Occur
    e. A Compiler Error will Occur

38. After the above code has finished executing, there is an object in memory with no in scope references to it, what are the contents of that object?
    a. {1,2,3,4,5,6,7,8,9,10}
    b. {1,2,3,4,5,0,0,0,0,0}
    c. {1,2,3,4,5}
    d. All of the Above have no valid reference
    e. None of the Above

For Questions 39 and 40 consider the following recursive method:

```
public int mystery(int foo){
     if(foo == 1)
          return 1;
     if(foo % 2 == 0)
          return foo + mystery(foo/2);
     return foo + mystery(3*foo+1);
}
```

Suppose we call this method as follows:

```
int x = mystery(10);
```

39. What is the value of x after the code above executes?
    a. 45
    b. 259
    c. 339
    d. 46
    e. 15

40. How many calls do we make to mystery(int foo) during the lifetime of the program? Do not include the initial call or the call that executes the base case!
    a. 7
    b. 5
    c. 4
    d. 8
    e. A StackOverFlow Error Occurs

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Short Answer Section
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1. What is Object Oriented Programming? What are the 4 key principles of this paradigm?

2. Over the course of the semester we talked a lot about parameters, specifically with regards to parameter passing. How does Java pass parameters to methods? How does this differ between primitives and nonprimitive types?

3. When we discussed ArrayLists back in March, they were described as parameterized, knowing what you know now reflect back on that statement, what does this mean? What are the benefits of parameterized methods/data structures?

4. What is an access modifier? In the context of 1004 what are the two access modifiers we learned about and how do they differ?

5. What does it mean for an attribute of a Class to be marked as static? Give an example of when it is useful to have static attributes.

6. Why are Arrays more efficient than ArrayLists when handling large data sets? Why do we typically still use ArrayLists despite this difference in efficiency?

7. What is the difference between checked and unchecked exceptions? Why is it important for some exceptions to be checked?

8. We have used the Scanner class for two different operations throughout 1004, what are those operations?

9. The enhanced for-loop is a loop structure that is useful when you need to iterate through a collection. What is a drawback of the enhanced for-loop other than the fact that we do not have direct access to the current index in the collection.

10. Explain the process from transforming a while loop to a traditional for-loop, why is this useful?

11. This course is labeled as “Introduction to Computer Science and Programming in Java” What is Computer Science? and how is it different from programming?

12. What are the three laws of recursion? Why is it important for all three of them to be present simultaneously in a recursive algorithm?

13. What is the difference between top-down design and bottom-up design, when would it be a good idea to use either design practice?

14. What is the difference between the “throws” and “throw” keywords in Java? When would you use each?

15. What is a good reason to write interfaces in Java?

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Coding Section
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1. Consider the following method from a previous lecture:

```
public int compareTo(AudioBook other){
      if (this.minutes>other.minutes)
            result=-1;
      if (this.minutes<other.minutes)
            result=1;
      return -1*result;
}
```

   This method does not compile, nor does it produce the right answers when it does compile. Rewrite the compareTo method that demonstrates proper functionality. You may not alter the method signature in any way.

2. Recall the following Class from a previous lecture:

```
public class Checking extends BankAccount {

    private int transactions;
    private double fee;

    public Checking(String name, double fee)
    {
        super(name);
        transactions = 0;
        this.fee = fee;
    }

    public void withdraw(double amt){
        transactions++;
        super.withdraw(amt);
    }

    public void monthly(){
        super.withdraw(fee*transactions);
        transactions=0;
    }
}
```

Add onto this Class by writing an accessor and a mutator method for the fee attribute and just an accessor for the transactions attribute

3. Everyone listens to AudioBooks! At least that is what Professor Cannon thinks should be true, it would probably be a lot more fun if we had a way to rank people's audiobook collections. Consider the following method signature below:

```
public void sortCollections(AudioBookCollection[] abc){
     //TODO IN QUESTION 3
}
```

To help you out the following methods has been added to the AudioBookCollection class:

```
public ArrayList<AudioBook> getCollection(){
     return this.collection;
}

public double getTotalCost(){
     return this.totalCost;
}
```

Your job is to implement the method above such that the array (abc) at the end is sorted from least to greatest in terms of total cost of the collection.