Preface

For many of you this was your first Computer Science course and it very well may be your last as well. This exam represents the culmination of all the stuff you have learned over the last semester - which is a lot - but this also represents the culmination of all the work I have done for Professor Cannon's courses over the last 5 semesters. From this the same general statements apply, this set of questions is prepared **WITHOUT KNOWLEDGE** of the contents of the final exam any questions that appear on here that also appear on the final exam are **PURELY COINCIDENTAL** and you are just lucky haha.

Below you will find a brief guide on how to study for this exam and what assistance you can expect from myself and the other members of the teaching staff:

HOW TO STUDY:

1. Review Midterm 1 and Midterm 2 material via released exams and the practice materials

2. Review Lecture Examples

3. Review Homeworks

4. Finally complete this practice exam and any other samples that are released to you

RESOURCES AVAILABLE TO YOU:

1. The solutions will be available the normal route via my website as well as more likely than not a full walkthrough

2. There will more likely than not be a TA held review session at some point prior to the exam

3. TA Office Hours will continue until Exam period begins at which point office hours will cease due to our own exams as well as to ensure fairness to students taking the exam at different times

Best of luck to you all on your *final* endeavor of the course!

COMS 1004: Introduction to Computer Science and Programming in Java

Name: _____

UNI: _____

Please Use **CAPITAL LETTERS** to fill in the boxes: A B C D E

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.
16.	17.	18.	19.	20.
21.	22.	23.	24.	25.
26.	27.	28.	29.	30.

Short Answer Form: Please Write Your Answer on the line provided

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

Multiple Choice Section:

1. This algorithm has a Big-O cost of N^2 and has a consistent efficiency function associated with it, which algorithm is being described?
   a. Merge Sort
   b. Selection Sort
   c. Binary Search
   d. Bubble Sort
   e. Insertion Sort

2. The Java interface that requires you to implement the compareTo method is known as?
   a. Collections
   b. Sortable
   c. Iterable
   d. Comparable
   e. CompareTo

3. The methodology that details what attributes and methods get passed to a child from its parent is known as
   a. Polymorphism
   b. Compilation
   c. Inheritance
   d. Generics
   e. Segmentation

4. Typically the first statement you write in a java file, relative to this course, that allows you to include additional functionality is?
   a. The import statement
   b. The package statement
   c. The class header
   d. The static import statement
   e. None of the above

5. Words like “public”, “int”, “return” and others are known as what in java?
   a. Access Modifiers
   b. Reserved Words
   c. Class Words
   d. Checked Phrases
   e. Classified Types

6. A homogenous collection of items which is not fixed in size
    a. Set
    b. HashMap
    c. Vector
    d. ArrayList
    e. Array

7. A variable which has class level scope but is not shared among instances of a class is said to be what?
    a. Class Variable
    b. Static Variable
    c. Instance Variable
    d. Final Variable
    e. Transient Variable

8. A special method that initializes the instance variables is known as?
    a. Instantiater
    b. Constructor
    c. Creator
    d. Accessor Method
    e. Destructor Method

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

10. This keyword is used when you wish to access some implementation of the parent class
    a. this
    b. self
    c. par
    d. super
    e. obj

11. Consider the binary number 10110110 what is it in base 10?
    a. 186
    b. 172
    c. 178
    d. 184
    e. 182

12. How many comparisons does the selection sort algorithm seen in class take to sort the list A = {8,1,2,6,4,5}
    a. 7
    b. 11
    c. 9
    d. 13
    e. 15

13. The method mystery has the following method header, which of the following is not a valid overload of the method?

```
public double mystery(int x)
```

    a. public int mystery(double x)
    b. public int mystery(int x)
    c. public double mystery(double x)
    d. public double mystery()
    e. All of the above are valid

14. Consider an array grades such that grades.length > 1. How do you access the last element of nums?
    a. grades[0];
    b. grades[-1];
    c. grades[grades.length - 1];
    d. grades[grades.length];
    e. More than one correct answer

15. How many bytes are allocated for an int in Java?
    a. 8
    b. 4
    c. 2
    d. 6
    e. 32

Questions 16-18 Concern the following class definitions:

```
public class Animal{}
public class Dog extends Animal{}
public class Shepherd extends Dog{}
```

16. Which of the following lines, compile if any?

```
 I.   Animal doe = new Shepard();
II.   Shepherd doh = new Animal();
III.  Dog dog = new Dog();
```

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

17. If we were to write an eat method for each class, which class's eat method would execute if the following were to be executed: doe.eat();
a. Animal's
b. Dog's
c. Shepherd's
d. It will be chosen at random
e. None of the above

18. The process described in Questions 16 and 17 is referred to as?
a. Polygenesis
b. Polytheism
c. Monomorphism
d. Polymorphism
e. Monosaccharide

19. Binary search has an efficiency on the order of ____ where N is the number of elements in the collection
a. O(NlogN)
b. O(logN)
c. O(1)
d. O(N)
e. $O(N^2)$

20. Convert the following number to binary: 3134
    a. 0110000111110
    b. 0110000111111
    c. 0110000100110
    d. 1000000111100
    e. None of the above

21. How many classes are you able to be the child of?
    a. 2
    b. 4
    c. 1
    d. 65535
    e. 42

For Questions 22 and 23 consider the following recursive method:

```
public static int fizz(int buzz) {
   if (buzz <= 1) {return 1;}
   if (buzz % 2 == 0) {return buzz + fizz(buzz/2);}
   return buzz + fizz(3 * buzz + 1);
}
```

22. What is the result of the following method execution fizz(7) ?
    a. 288
    b. 278
    c. 287
    d. 290
    e. 285

23. How many calls do we make to fizz(int buzz) during the lifetime of the program? Do not include the initial call or the call that executes the base case!
    a. 18
    b. 14
    c. 17
    d. 16
    e. 15

For Questions 24 and 25 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] = 2 * arrOfInts[i];
  }
  arrOfInts = temp;
}
```

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

25. 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. {1,2,3,4,5,6,0,0,0}
    b. {2,4,6,8,10,0,0,0,0,0}
    c. {2,4,6,8,10}
    d. {1,2,3,4,5}
    e. All of the above have valid references

26. Which of the following is true regarding Strings in Java ?

    I. They are a primitive data type
    II. They are immutable
    III. They are denoted like this: 'a'

    a. (I) and (II)
    b. (I) and (III)
    c. (III) only
    d. (I) only
    e. (II) only

27. Which statements 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 an enhanced for loop
    c. You can insert an item anywhere in the list
    d. You can access their size using .size()
    e. All of the above are true

28. Which of the following raises an exception to the terminal?
    a. throws new Exception();
    b. raise new Exception();
    c. throw new Exception();
    d. new Exception().throw();
    e. None of the above

29. The .equals() method in the String class returns which of the following?
    a. String
    b. boolean
    c. int
    d. void
    e. Object

30. Which of the following does not need to be imported in order to be used?
    a. Scanner
    b. ArrayList
    c. arrays
    d. String
    e. More than one answer

[BLANK FOR FORMATTING PLEASE SCROLL]

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

   A programming paradigm which makes use of objects; 1. Inheritance 2. Polymorphism 3. Abstraction 4. Encapsulation

2. Consider a class named FinalExample. What command would you use to compile this file?

   javac FinalExample.java

3. What is the difference between "throws" and "throw" keywords in Java? When would you use each?

   throw is used to trigger an exception and you use it as such; throws is used in the method header to acknowledge a checked exception you do not wish to handle it

4. I wish to declare an ArrayList of Animal objects named zoo, write this declaration.

   ArrayList<Animal> zoo;

5. When we discussed ArrayLists, they were described as parameterized, what does this mean? What are the benefits of parameterized methods/data structures?

   Parameterized means it can be made of any type and these parameters are specified via generics, the benefit is we can write generic code to handle multiple different types of scenarios.

6. What is an example of a Checked Exception? Unchecked Exception? What is the difference between the two types?

   FileNotFoundException; NullPointerException; Checked exceptions differ from unchecked as they are required to be handled or acknowledged by the java compiler.

7. Write the line of code that would give me an int named x in the range of [22, 31] or [22, 32) Use Math.random()

   int x = (int) ((Math.random() * 10) + 22);

8. What are the three laws of recursion? Why is it important for all three to be true in a recursive algorithm? Give an example of a recursive algorithm you learned in 1004.

   1. Have a base case 2. Make progress towards the base case; 3. Call yourself; Merge Sort

9. Polymorphism means "many forms" provide an example of this that you have seen either in lecture or your homeworks

   BankAccount Archetype: BankAccount; CheckingAccount; SavingsAccount

10. What is the difference between Method Overloading and Method Overriding?

    Overriding occurs when you reimplement an inherited method; Overloading is when you write a method with the same name as another but overall different method signature.

11. The enhanced for loop is a looping structure that is useful when you need to iterate through a collection. What is an advantage of using it and what is a disadvantage of using it?

    Advantage: No possibility of IndexOutOfBound
    Disadvantage: Cannot alter the structural integrity of the list using remove() causing a ConcurrentModificationException

12. What is an algorithm? How is it different from a program?

    Algorithms are instruction sets with inputs, outputs and run in a finite amount of time, programs implement algorithms.

Programming Section:
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1. Consider the following method header, you may assume there is enough boilerplate such that the code compiles beyond this method, implement the method such that when given an array of ints, the third largest value is returned, it is okay if there are duplicates i.e. the highest 3 were 4 5 5 you'd still return 4.

```
public int findThirdLargestValueFromArray(int[] array) {
   int n = array.length;
   for (int i = 0; i < n; i++) {
      int minIndex = i;
      for (int j = i + 1; j < n; j++) {
        if (array[minIndex] > array[j]) {
          minIndex = j;
        }
      }
      int temp = array[i];
      array[i] = array[minIndex];
      array[minIndex] = temp;
   }
   return array[n-3];
}
```

2. Imagine you are working at a university and they ask you to write a class called "Course" which keeps track of: the instructor, the enrollment, and the location. Write the Course class with all necessary instance variables, constructors, accessors and mutators

```
public class Course {
  private String instructor;
  private int enrollment;
  private String location;

  public Course(String i, String l) {
    instructor = i;
    location = l;
    enrollment = 0;
  }


  public void setInstructor(String i) {
```

```
        instructor = i;
    }

    public void setLocation(String l) {
        location = l;
    }

    public void setEnrollment(int e) {
        enrollment = e;
    }

    public String getInstructor() {
        return instructor;
    }

    public String getLocation() {
        return location;
    }

    public int getEnrollment() {
        return enrollment;
    }
}
```

3. Professor Cannon has decided to be devious when tracking your grades, he wants to write a method such that when given an ArrayList of doubles each element - barring the first and the last elements - is converted to the average of it's two neighbors the method should change these values in place and not return anything, the only requirement is that the method be named gradeChanger.

```
public void gradeChanger(ArrayList<double> grades) {
    for (int i = 1; i < grades.size()-1; i++) {
        grade.set(i, (grades.get(i-1) + grades.get(i+1))/2);
    }
}
```