Your Name:______________________

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CS 1316 Exam 1
Summer 2009

Section/Problem	Points Earned	Points Possible
1. Vocabulary Matching		32
2. Fill in the Blank		12
3. Multiple Choice		4
4. Code Understanding		9
5. Turtle Graphics		6
6. Write Code: SumTo		12
7. Better Dorm		15
8. Convert Picture		10
Total Points:		100

1. Vocabulary Matching (32 points)

Write the number before the definition on the right on the line before the matching vocabulary word.

__29__Array

_12___Block

_11___Boolean

_13_Boolean Expression

_26___Cast / Casting

_14___Class

_21___Constructor

_16_Data Encapsulation

_8__Double

_27__Field

_19__Final

_3__Graph

_23__Inheritance

_9__Int

_31__Iterate

_4___Linked List

_28___Method

_30___Method Signature

_1___Model

__15__Object

_18___Private

_17___Public

_5___Simula

_2___Simulation

_6___Smalltalk

__20__Static

__10__String

__22__Subclass

_24___Superclass

__32__Traverse

__7__Type Declaration

__25__Void

1. A detailed description of structure and behavior.
2. Execution of a model.
3. A data structure that uses nodes/points and their edges/connections to model aspects of the real world.
4. A data structure made up of a collection of nodes, where each node points to the next node in line.
5. The earliest object oriented programming language.
6. An early object oriented programming language created by Alan Kay.
7. The process of telling the compiler what type of data a variable will hold.
8. A data type that holds numbers with fractional components.
9. A data type that holds numbers without a fractional component.
10. A data type that holds sequences of characters.
11. A data type that has only two possible values.
12. A section of code, typically enclosed with curly brackets {} that makes up the body of a loop, function, or conditional.
13. A logical statement that evaluates to either True or False.
14. The fundamental building block of Java programs, they act as the blueprints from which objects are constructed, including definitions of fields and methods.
15. The instantiation of a class, they have fields that store state and methods (functions) that encode behavior.
16. The process of hiding internal state from direct access by outsiders, and instead requiring that all accesses to the internal state be done through methods that can act as gatekeepers.
17. A keyword that means that anybody can see and manipulate a particular field or method.
18. A keyword that means that only methods within the object can access a particular field or method.
19. A keyword that means that a field will not change.
20. A keyword that means a field or method belongs to the class, and not specific objects that are instantiated from it.
21. A method that is called when a new instance is created.
22. A class that inherits behaviors and state (methods and fields) from a superclass.
23. The process of extending a superclass, gaining it's behaviors and state.
24. A class that is extended by subclasses.
25. A keyword that indicates "nothing", as in returns nothing.
26. The process of forcing Java to convert data from one data type to another.
27. These contain state within an object, sometimes called object variables.
28. A function that is associated with an object and implements behavior.
29. A homogeneous linear collection of objects which are stored together in memory.
30. The unique collection of method name and parameter number and type that define a method. Multiple methods may share the same name as long as the type or number of their parameters differ.
31. To (potentially) repeat the execution a block of code multiple times, as with a for or while loop.
32. To move through a linear data structure (or a sequence) doing something to or with each individual element.

2. Fill in the Blank (12 points)

In Java, a __= or single-equal sign__ is used to indicate assignment, while a _ = = or double equal sign__ is used for equality checking.

Most statements in Java must be ended with a ___; or semi-colon________________. The only exception is if you have only a single statement alone in a __block_____________.

In Java, logical **and** is written using the ___&&______ symbol, and logical **or** is written using the ____ | | _____ symbol.

Assume that the Student class is a subclass of the Person class, and the Person class is a subclass of the Human class. A variable that is defined to be of type Person can refer to (hold) an object of type _Person__________ or type _Student__________ but a variable defined to be of type Student can only refer to an object of type __Student__________.

A picture that is 200 pixels wide and 100 pixels high has a total of __200x100 or 20,000_______ pixels. Each pixel needs ____3_______ BYTES, to represent the color of the pixel. How many total BITS are used to represent the 200 by 100 picture? Answer: __200x100x3x8 or 480,000_________

3. Multiple Choice (4 points)

Circle the correct answer.

Which of the following is an incorrect conditional statement?

`A.`
`if ( thisColor == myColor )`
`setColor( thisPixel , newColor );`
	`B.`
	`if ( thisColor == myColor )`
	`{ setColor( thisPixel , newColor );`
	`}`

`C.`
` if ( thisColor == myColor )`
`{x = 12;`
`setColor ( thisPixel , newColor ) ; } ;`
	`CORRECT: D. All are correct.`

The new operator:

A. invokes the constructor of an object.
B. instantiates a specific instance of a class.
C. allocates memory space for the object.
D. A and C only.
CORRECT: E. A, B, and C.

4. Code Understanding (9 points)

What does the following code output?

```
int [] a = new
int[10];
for ( int i = 0; i <
10; i++) {
     a[i] = 9 – i;
}

for( int i = 0; i <
10; i++) {
     int index = a[i];
     a[i] =
a[  index ];
}

for(int i = 0; i < 10;
i++) {
   System.out.println(
a[i] );
}
```

Answer:

```
0
1
2
3
4
4
3
2
1
0
```

Grading:
Exactly right = 9 points
Numbers right, but printed horizontally = 8 points

1-2 numbers wrong = 6 points

3 or more wrong, but in ascending or descending order = 4 points

Worse or blank = 3-0 points.

5. Turtle Graphics (6 points)

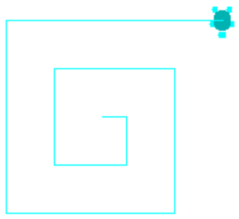
The following code creates a turtle and moves it around. Draw the turtle's path in the box on the right:

```
Turtle t = new Turtle(new World());

for( int i = 0; i < 20; i++) {

  if (i %2 == 0) {
     t.forward( 10 * i );
  } else {
     t.turn(90);
  } // end if/else

} // end for
```



Grading: Turns in correct direction + 2
Forwards increasing by 20 each: + 1
First forward goes zero distance +1
Correct number of lines/turns: +2

6. Write Code (12 points)

Write (twice) a method sumTo which returns the sum of the first *n* reciprocals. In other words, sumTo(*n*) returns:

1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6 + ... + 1/n

You may assume that *n* is never a negative number. sumTo(0) returns 0.0, and sumTo(1) returns 1.0. *The first time you write the method, use a for or while loop. The second time you write the method, you must use recursion instead of a loop.* The return value and header for the method(s) are the same:

```
// sumTo with a for or while loop
public static double sumTo(int n) {
   double answer = 0.0;

   for (int i = 1; i <= n; i++) {
      answer = answer +  1.0 / i;  // or + (double) 1 / i;
    }

   return answer;
}
```

Grading:

6 pts total this part:

+1 points for returning answer as a double

+1 points for iterating through all the values from 1--n

+1 point for using casts or 1.0 to ensure correct division.

+1 point for summing all values together.

+2 got correct answer

-1 for minor syntax errors.

```
// sumTo using recursion
public static double sumTo(int n) {
  if ( n == 0) {
     return 0.0;
  } else {
     double answer = 1.0 / n + sumTo(n-1);
     return answer;
   }
}
```

Grading: +2 points for returning correct answer. +1 point for correct 1.0 or cast to ensure double division. +2 points for correct recursive call. +1 correct terminating condition. -1 for minor syntax errors.

7. Create an Object: Better Dorm (15 points)

Examine the source code for the “Dorm” object provided at the end of this exam. Write code for a subclass of the Dorm object called **BetterDorm**. Your subclass must have:

- A constructor that accepts a string and two int's representing the name of the dorm and the number of men and women in the dorm.
- A method called **percentMale** that takes no parameters and returns the percentage of the dorm's population that is male (as a double). Your function must work for all possible numbers of men & women in the dorm.

```
public class BetterDorm extends Dorm {
  public BetterDorm(String N, int M, int W) {
     super(N,M,W);
   }
  public double percentMale() {
     int M = getNumMen();
     int W = getNumWomen();
     if (M+W == 0) {
        return 0.0;
      }
      double answer = (double) M / (M+W);
      return answer; // or return answer * 100;
    }
} // end public class BetterDorm
```

Grading:

+2 for extending the superclass

+2 for the BetterDorm header correct

+2 – call to super in constructor correct.

+2 for the percentMale header correct

+2 for using accessor methods to get number of men/women.

+1 check for division by zero

+2 correctly calculating men / total (as double!)

+2 – returning correct answer

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8. Convert a picture (10 points)

Write a new method for the Picture class that will return a black and white copy of itself. The method should make a new copy of itself, convert the pixels to B&W (using the following formula), and return it. Your method must be named **bwCopy**, take no parameters, and return a Picture object.

Use the following formula to convert from R,G,B values to a single Luminance (Y) value to put into all 3 (r,g,b) color slots :

$$Y = 0.299 * R + 0.587 * G + 0.114 * B$$

```
public Picture bwCopy() {
   int w = getWidth();
   int h = getHeight();
   Picture c = new Picture(w,h);

   Pixel [ ] orig = getPixels();
   Pixel []  copy = c.getPixels();

   for(int i = 0; i < orig.length; i++ ) {
      int R = orig[i].getRed();
      int G = orig[i].getGreen();
      int B  = orig[i].getBlue();

      int Y = (int) ( 0.299 * R + 0.587 * G + 0.114 * B);

      copy[i].setRed(Y);
      copy[i].setGreen(Y);
      copy[i].setBlue(Y);
   } // end for each pixel.

return c;
} // end bwCopy()
```

Grading:

+1 points for creating a new picture to save the Luminace data to.

+2 points for itterating through all pixels in the original picture (ourselves)

+2 points for retriving the R,G,B values from the pixels.

+2 points for the Luminance calculation

+2 points for putting the Y data into the pixels in the copy.

+1 point for returning the B&W copy.

Definition of the “DORM” class:

```
public class Dorm {

     private String myName;
     private int myNumMen;
     private int myNumWomen;

     // Constructor
     public Dorm( String name, int men, int women) {
          myName = name;
          myNumMen = men;
          myNumWomen = women;
     }

     public void setNumMen( int men)
     { myNumMen = men; }

     public void setNumWomen( int women)
     { myNumWomen = women; }

     public void setName( String name)
     { myName = name;}

     public int getNumMen()
     {    return myNumMen; }

     public int getNumWomen()
     {    return myNumWomen; }

     public String getName()
     {    return myName; }


} // end dorm
```