CIT 590 - 2016 Special final examination

Name (please write your official name) ____________________________
PennID Number _________________________
Note that your PennID number is the 8 digit bold number on your penn card.

DO NOT START WRITING (aside from name and email) ON THIS SHEET UNTIL INSTRUCTED TO DO SO

• Please feel free to use the back side of any sheet (including this one).
• There will be partial credit on most questions. No partial credit for the first three questions.
• Please write neatly. We have a lot of exams to grade. If we cannot read your answer you are highly likely to get a 0.

Good luck!
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<th>Question</th>
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1. (10 points) True or False

1. If the line of code x = '5' compiles, then x must be a String
2. 5/2 == 2
3. int a = (int)"4"; is a line of code that will compile
4. It is impossible to run a Java program until it has been compiled
5. A class with a single abstract method must be declared as abstract.
6. An interface can have abstract methods.
7. The == operator can be used to compare two Strings. The result is always true if the two string are identical.
8. If an array is declared as an array of doubles we could store integers in that array.
9. If an array is declared as an array of integers we could store doubles in that array.
10. A private instance variable must have both a getter and a setter.
2. (2 points) We would like to store the integers 1, 2 and 3 in an ArrayList. Write java code that accomplishes this. Assume that you are already in a main method. Note that this question carries only 2 pts. Please do not write 20 lines of code!

3. (2 points) Write the method signature for the main method.
4. (5 points) Consider the leftmost and rightmost appearances of some value in an array. We’ll say that the ”span” is the number of elements between the two inclusive. A single value has a span of 1. Returns the largest span found in the given array.

Here are some examples of what the inputs are and what the expected output would be:

maxSpan([1, 2, 1, 1, 3]) → 4
maxSpan([1, 4, 2, 1, 4, 1, 4]) → 6
maxSpan([1, 4, 2, 1, 4, 4, 4]) → 6

public int maxSpan(int[] nums) { }
5. (5 points) Here is the code for a class representing complex numbers (from the textbook). We would like to add another method called pow() that takes an integer i and computes the value of the complex number raised to the ith power.

Write the pow() method. There is space provided in the code for the class that is listed below.

Remember that a to the ith power is a a a i times. You can assume that i is positive.

```java
public class Complex {
    private final double re;
    private final double im;
    public Complex(double real, double imag) {
        re = real;
        im = imag;
    }
    public String toString() { return re + " + " + im + "i"; }
    public double abs() { return Math.sqrt(re * re + im * im); }
    public Complex plus(Complex b) {
        double real = re + b.re;
        double imag = im + b.im;
        return new Complex(real, imag);
    }
    public Complex times(Complex b) {
        double real = re * b.re - im * b.im;
        double imag = re * b.im + im * b.re;
        return new Complex(real, imag);
    }

    // TODO write the pow() method here
}
```
6. (2 points) What does the following program print?

double x = 1;
double y = 1;
int i = 0;
while (y >= 1.5)
{
    x = x / 2;
    y = x + y;
    i++;
}
System.out.println(i);

7. (2 points) Why is it useful to override the toString() method? What is the method signature of the toString method?
8. (9 points) Object oriented programming question. Please note that there are few different parts for this question and it continues onto the next page.

```java
public interface Animal {
    public String getName();
    public String speak();
}

public interface Talker {
    public String speak(String s);
}

public class Dog implements Animal {
    private String name = null;
    public Dog(String name) { ... }
    ...
}

public class CartoonCharacter implements Animal, Talker {
    public CartoonCharacter(String name) { ... }
    ...
}

Based on the code above, are the following code fragments valid. Please just write Yes or No. (4 pts)

- CartoonCharacter c = new CartoonCharacter("Mickey Mouse");
  Animal a = c; a.speak();
- Dog d = new Dog("Pluto"); CartoonCharacter c = (Animal) d; c.speak("Hello");

For 3 pts, List the signatures of all methods that can be called on an instance of the CartoonCharacter class (excluding constructors).
(2 pts) Provide the body for the Dog constructor, based on the class definition above.

```java
public Dog(String name) {
    // your code here
}
```
9. (5 points) Your friend who does not understand the meaning of the term static asks you to explain it to them. Provide an example of a class with a static instance variable and also a static method. Please note that the static method example cannot be the main method.

This is an open ended question. Feel free to use your imagination. We do want you to write a complete class but the points in this question are mostly for the static instance variable and the static method. You do not need to write constructors, getters, setters, main method etc.

A short class is totally totally fine.
10. (5 points) Write unit tests for the following method inside a class called SetOfNames whose javadocs and method signature have been provided to you. Please do not try and write the actual add method. We care about the unit test only. Assume that a unit test class has already been made for you.

```java
public class SetOfNames{
    private ArrayList<String> names;

    /**
     * add an array of strings to the ArrayList
     * @param stringArrayOfNames
     */
    public void add(String[] stringArrayOfNames) {
        
    }
}
```

11. (1 point) What is the name of the interface that needs to be implemented if you want a JButton to be clickable?