

**Department of Electrical and Computer Engineering  
University of Puerto Rico Mayagüez**

**ICOM 4015 Advanced Programming – Fall 2006**

**Exam I Practice Exercises and Problem Set 1**

**DUE: September 14, 2006 In class**

- 1) Create a new Eclipse project titled *icom4015f06*
- 2) Create an *pal* package to hold all the classes created for this problem set.
- 3) Design a *MyComplex* Java class to represent complex numbers. Provide accessors to extract the imaginary part, the complex part, the magnitude and the phase angle. In addition provide methods to add, subtract, multiply and divide complex instances of the class.
- 4) Design a Junit *TestCase* to test the *MyComplex* class as comprehensively as possible.
- 5) Design a *HexInt* Java class to represent hexadecimal numbers (base 16). Hexadecimal numbers consist of digits 0-9 plus letters A-F to represent values from 10-15 correspondingly. For instance, the number FF represents  $15 * 16^1 + 15 * 16^0$  which equals 31. Provide a constructor accepting a String representing the number and another constructor accepting a long integer representing its decimal value. Provide a *toString* method that returns the String representation of the hexadecimal number. Provide methods to add, subtract, multiply and divide (quotient) hexadecimal numbers. Provide a method to return the binary representation of the number.
- 6) Design Junit suite to test the *HexInt* class as comprehensively as possible.
- 7) Design a *Die* Java class to represent a die. The class should have a null constructor and a *roll()* method that returns the outcome of a single roll of the die.
- 8) Design Junit suite to test the *Die* class. How would you go about testing methods that return random outcomes?
- 9) Design a *DiceGames* class with several static methods to conduct experiments rolling dice using the *Die* class developed in exercise 5. Provide a method *countSixes(rolls)* to compute the fraction of attempts that a single die rolls a six in *rolls* attempts. Provide a method *countFullHouses(rolls)* to compute the fraction (%) of attempts that a roll of five dice yields a full house. Conduct other experiments of interest to you. What can this teach you about probabilities?
- 10) Design a *Phasor* class to represent the value of an alternating current or voltage. The class should use the *MyComplex* class developed above. Design a *PhasorTest* class to test your class.
- 11) Design *Resistor*, *Capacitor* and *Inductor* classes to represent ideal electrical circuit components. Each class should have *current(Phasor voltage)* and *voltage(Phasor current)* methods to return the *Phasor* object that represents the current that flows thru the component when a voltage is applied, or the voltage change across the element when a current is flowing through it. For each component design a Junit testing class.

You should hand a jar file with all your classes by email to [icom4015-profs@ece.uprm.edu](mailto:icom4015-profs@ece.uprm.edu) by the due date.