Problem Set Two

Part A, B, C and D must be electronically submitted prior to 10 PM on Wednesday, September 04th.

Part A- Simple Java Exercises (10 points)

Read or browse through the first 2 chapters in the Tony Gaddis textbook, plus the first section or two of chapter 3 (if you have this book). Now solve the following problems.

Type up answers to the following seven problems in a simple "text file" named PartA.docx without writing complete Java programs

1. **(2 points) Precisely** explain why do each of the following is printed?

a. `System.out.println(2 + "bc");` prints: 2bc

b. `System.out.println(2 + 3 + "bc");` prints: 5bc

c. `System.out.println((2+3) + "bc");` prints: 5bc

d. `System.out.println("bc" + (2+3));` prints: bc5

e. `System.out.println("bc" + 2 + 3);` prints: bc23

2. **(3 points) Precisely** what do each of the following print?

   a. `System.out.println('b');`

   b. `System.out.println('b' + 'c');`

   c. `System.out.println((char) ('a' + 4));`

   Explain each outcome.

3. **(4 points)**Suppose that a variable `a` is declared as `double a = 3.14159`. What do each of the following print?

   a. `System.out.println(a);`

   b. `System.out.println(a + 1);`

   c. `System.out.println(8 / (int) a);`

   d. `System.out.println(8 / a);`

   e. `System.out.println((int) (8 / a));`

   Explain each outcome.

4. **(3 points)** Give the value of `a` after the execution of each of the following sequences:

```
int a = 1;              boolean a = true;       int a = 2;
a = a + a;              a = !a;                 a = a * a;
a = a + a;              a = !a;                 a = a * a;
a = a + a;              a = !a;                 a = a * a;
```

5. 8 points total

Part (a): 4 points

Precisely what does the following program output when it is executed?

```
class Strange
{
        static void first()
        {
        System.out.println("Inside first method!");
        }
        static void second()
        {
        System.out.println("Inside second method!");
        first();
        }
        static void third()
        {
        System.out.println("Inside third method!");
        first();
        second();
        }
        public static void main (String [] args)
        {
        first();
        third();
        second();
        third();
        }
}
```

Part (b): **4 points**

What would have been the output of the preceding program if the method third had instead been written like this?

6. **4 points**

To convert a temperature from Fahrenheit degrees to Kelvin (absolute), the following relationship holds:

$$K = \frac{5}{9}(^{\circ}F - 32) + 273.16$$

Write a program to solve the above equation.

7. **4 points**

Consider the following program, and the resulting error messages that occur when the program gets compiled using the "javac" command. In 1 or 2 simple English sentences, explain why the error messages occurred:

// This program does not compile. How come?

```
public class BadExample
{
        public static void main(String[] args)
        {
            int x = 3;
            int y = 7;
            computeSum();
        }
        public static void computeSum()
        {
            int sum = x + y;
            System.out.println ("sum = " + sum);
        }
}
```

Here is what was output after we attempted to compile this program:

```
BadExample.java:10: cannot find symbol
symbol : variable x
location: class BadExample
 int sum = x + y; // illegal, x/y are not in scope
 ^
BadExample.java:10: cannot find symbol
symbol : variable y
location: class BadExample
 int sum = x + y; // illegal, x/y are not in scope
 ^
BadExample.java:10: incompatible types
found : java.lang.String
required: int
 int sum = x + y; // illegal, x/y are not in scope
 ^
3 errors
```

Part B — Programming Problems (30 points total)

Solve the following problems using the javac compiler. Include the code file and the word processed answer for pseudocodes separately.

8. **10 points** **Use file** Diamond.java
Write a complete Java program to produce precisely the following output:

```
  D
 I I
A   A
M     M
 O   O
  N N
   D
```

Your answer should include the (a) Pseudocode
(b) Code listing

9. **10 points** **Use file** Prob8.java
Consider the following Java method that outputs four times a quote from a famous computer scientist named Brian Kernighan:

```
static void print4x()
{
     System.out.println("Controlling complexity is the essence of programming!");
     System.out.println("Controlling complexity is the essence of programming!");
     System.out.println("Controlling complexity is the essence of programming!");
     System.out.println("Controlling complexity is the essence of programming!");
}
```

Use this print4x method in a complete Java program that outputs the Kernighan quote 64 times. Your solution must contain a main method, the print4x method, and at least one additional method. You should not use any for loops or while loops or anything like that — just method calls!

10. **10 points** **use file** CarLoan.java
Calculate Car loan payments. *Write a program that reads in three command-line arguments* P, Y, and R and calculates the monthly payments you would have to make over Y years to pay off a P dollar loan at R per cent interest compounded monthly. The formula is :

$$\text{payment} = \frac{P\ r}{1 - (1 + r)^{-n}}, \quad \text{where } n = 12 * Y,\ r = R / 120$$

Your answer should include the (a) Pseudocode
(b) Code listing

Part C — Additional Programming Problems (10 points total)

Solve the following problems using the javac compiler. Include the code file and the word processed answer for pseudocodes separately.

11. Write a program that reads in a number of cents. The program will write out the number of dollars and cents, like this:

```
D:\users\default>java  Dollars
Input the cents:
324
That is  3 dollars and 24 cents.
```

(**Hint**: Use integer arithmetic and *avoid* floating point arithmetic. Review the integer remainder operator % if you are unsure how to proceed.)

Part D — Extra Credit Problems (5 to 10 points)

Solve the following problems using the javac compiler. Include the code file and the word processed answer for pseudocodes separately.

12. **10 points** **Use file** RealEstate.java

The New House Real Estate Corporation is planning a major new real estate development. They have purchased a large tract of land and are in the process of subdividing it into rectangular lots. Mr. Newhouse, the founder and president of the company, has heard that you are a Java programmer, and has asked you to write a program to help them figure out the acreage of their new plots.
Write a Java program that accepts 2 inputs typed on the keyboard by the user — the length of a given plot in feet, and its width in feet. The output should be the number of acres in that plot. By the way, an acre is equivalent to 4840 square yards, or 43,560 square feet! Please note that your program will be used by Mr. Newhouse, who does not understand computers at all — so the messages output by your software should be very clear and easy to understand. Your program should do something appropriate even if "inappropriate values" (e.g., negative numbers) are input for the height and/or width. Test your program out on the following sets of inputs.

(a) 100 feet by 100 feet
(b) 200 feet by 100 feet
(c) 234.5 feet by 321.8 feet
(d) 80 feet by 900 feet
(e) 1000 feet by 5000 feet