Name:_____

CMSC 206 Data Structures
Fall 2014
Exam 1

This exam contains 8 Questions on pages numbered 1-8.

This exam is designed to be taken in 80 minutes.

This is a closed book/notes exam.

All Java statements you write should be syntactically correct.
There will be no partial credit for incorrect use of Java syntax.

Good Luck!

Question	**Points**	**Max Points**
1		**15**
2		**10**
3		**10**
4		**10**
5		**10**
6		**10**
7		**15**
8		**20**
Total		**100**

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Question 1 (2+2+2+5+4=15 points)

(a) What would be the value of `m` after the following are executed:

```
double x=5.5, y=2.0;
int m=7, n=3;
m = (int) (x * y + n / m * (m + x))
```

_____

(b) What would be the result of the expression: `13%3`

_____

(c) What would be the result of the following expression:

```
"DataStructures".equals("dataStructures")
```

_____

(d) Write the command(s) to open a file named "`BigData.txt`" as a `Scanner` object. Show command(s) to read and print all the lines in the input file:

(e) For the `try`-block, write the appropriate `catch` block that, when reached due to an error in the conversion, prints out a message indicating a bad numeric string was input.

```
try {
    numStr = in.nextLine();
    int num = Integer.parseInt(numStr);
}
```

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Question 2 (5 + 5 = 10 points)

Part A: What is the difference between a primitive-type variable and a reference variable?

Part B: Draw a memory diagram showing the allocations resulting from the following statements:

```
int a = 10;

String y = new String(“Bryn Mawr”);
String z = “Pennsylvania”;
String state = z;
```

Question 3 (10 points)

Write a complete Java program that displays all odd powers of 2 between 0 and 30. Output a table showing the power 2 is being raised to, as well as the result, on each line. You may use a TAB character to separate the two numbers on each line.

Example Output

```
1       2
3       8
5       32
7       128
…       …
```

Question 4 (10 points)

Given a string of the form:

```
String line = “Jane Doe 9/18/2014”;
```

That is, the first name, followed by last name, and the date of birth. Given the declarations below:

```
String FirstName;
String LastName;
int month;
int day;
int year;
```

Write Java commands to extract and assign values to the above variables from data in `line`.

Question 5 (10 points)

What will be output when the following code is executed:

```
int[] A;
int n = 10;

A = new int[n];

for (int i=0; i < A.length; i++) {
   A[i] = i;
}

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

Question 6 (10 points)

Give the following class definition:

```
public class Fraction {

 private int numerator;
 private int denominator = 1;

 public Fraction(int n) {
   numerator = n;
 }

 public Fraction(int n, int d) {
   numerator = n;
   denominator = d;
   normalize();
 }

 public int getNumerator() {
   return numerator;
 }

 public int getDenominator() {
   return denominator;
 }

 public String toString() {
   if (denominator != 1) {
     return numerator + "/" + denominator;
   }
   else {
     return "" + numerator;
   }
 }

 private void normalize() {
   int g = gcd(numerator, denominator);
   numerator = numerator/g;
   denominator = denominator/g;
 }

 private int gcd(int a, int b) {
   if (b == 0) return a;
   else return gcd(b, a%b);
 }

}// class Fraction
```

Answer the following questions:

(a) Name the constructor(s) defined in the class:

(b) Name the accessor(s) defined in the class:

(c) Name the modifier(s) defined in the class:

(d) Name the data fields defined in the class:

(e) Why are the methods `normalize()` and `gcd()` defined as `private` methods?

Question 7 (2+2+6+5 = 15 points)

Use the Fraction class defined in Question 6 and write Java commands to do the following:

(a) Declare two variables, `f1` and `f2`, to represent the fractions: 3/8 and 5/16:

(b) Output the values of `f1` and `f2` to the Console Window:

(c) Define a method `multiply()` (to be added to the Fraction class) to add the two fractions as shown below. (Examples: 3/8 * 5/16 = 15/128, 3/8 * 5/6 = 5/16)

```
f1.multiply(f2);
```

(d) Define a method `toNumber()` (to be added to the `Fraction` class) to return the numeric value of the fraction (as a floating point value). (Example: 3/8 = 0.375)

Question 8 (20 points)

Define a complete Java class called, `Person`, to model people. Every person has a name (first, last) and a 6-digit ID Number. Additionally, the person's year of birth is also recorded. The class should have the following methods (continue on the back if needed):

- A constructor that takes the first, last, ID Number, and year of birth as parameters.
- A print method that returns a string in the following format:

  IDNumber FirstName LastName YearOfBirth
  e.g. 561267 Jane Doe 1996

- An accessor method for the ID Number of the person
- A method called `age()` that returns the person's age in years (assuming it is 2014 now)
- An `IDequals()` method that compares if two `Person` objects have the same ID Number
- A method called `initials()` that returns the initials of the person.
  Example, for Jane Doe it would return "JD".