Problem 1: Pseudocode IF Count Operations (20 points)

Consider the following algorithm, which is used by Tom to determine whether he will accept a job offer or not.

```
READ salary
READ commuteTime
READ freeCoffee
IF salary < 50000 THEN
    DISPLAY decline offer
ELSE
    IF commuteTime < 60 THEN
          IF freeCoffee IS true THEN
               DISPLAY accept offer
          ELSE
               DISPLAY decline offer
          ENDIF
    ELSE
          DISPLAY decline offer
    ENDIF
ENDIF
```

Answer the following questions based on the Tom's algorithm:

a) (**10 points**) What is the maximum number of operations executed in the program? **7**
b) (**10 points**) What is the minimum number of operations executed in the program? **5**

Problem 2: Pseudocode WHILE Count Operations (18 points)

Consider the following algorithm written in pseudocode, then answer the questions below.

```
READ n
SET f TO 0
SET g TO 1
SET i TO 0
WHILE i <= n
    DISPLAY f
    COMPUTE f AS f + g
    COMPUTE g AS f – g
    COMPUTE i AS i+1
ENDWHILE
```

a) (**5 points**) What will be printed if n = 3? Show each output in a new line.

When i = 0, display f = 0, updated values of f and g are 1 and 0
When i = 1, display f = 1, updated values of f and g are 1 and 1

When i = 2, display f = 1, updated values of f and g are 2 and 1
When i = 3, display f = 2, updated values of f and g are 3 and 2

b) (**5 points**) Count the total operations if n = 3? Your answer should be an integer value. **4 + 5 + 4*4 = 25**

c) (**8 points**) What is the total operations for any n? Your answer should be a function of n. **4 + n + 2 + 4 * (n+1) = 5n + 10**

Problem 3: Read and Correct the Pseudocode (20 points)

The pseudocode below is intended to count the numbers between 1 and 20 inclusive that are divisible by BOTH 2 and 3 and display the result. The correct algorithm would display **3** because there are three numbers between 1 and 20 that are divisible by both 2 and 3: 6, 12, and 18. The code does not work as intended.

```
SET numDivByBoth TO 0
SET count TO 0
WHILE count < 20
     ADD 1 TO count
     IF count % 2 IS 0 THEN
          ADD 1 TO numDivByBoth
     ENDIF
     IF count % 3 IS 0 THEN
         ADD 1 TO numDivByBoth
     ENDIF
ENDWHILE
DISPLAY numDivByBoth
```

a) (**5 points**) What is displayed when this code is executed?

15

b) (**7 points**) What does the given pseudocode actually do?

Counts the numbers divisible by 2 and the numbers divisible by 3 and the numbers divisible by both 2 and 3.

Divisible by 2: 2,4,6,8,10,12,14,16,18
Divisible by 3: 3,6,9,12,15,18
Some counted twice: 6,12,18

c) (**8 points**) How can you FIX this pseudocode so that correctly solves the problem given and displays the number of numbers between 1 and 20 inclusive that are divisible by BOTH 2 and 3?

Replace the two IFS with:
IF count%2 IS 0 AND count%3 IS 0 THEN
ADD 1 to numDivByBoth
ENDIF

OR

IF count%2 IS 0 THEN

IF count%3 IS 0 THEN
ADD 1 to numDivByBoth
ENDIF
ENDIF

Problem 4: Truth Table (8 points)

Show the truth table for the Boolean expression `(x && !y) || (y && !z) || (!x && z)`

			Output
x	**y**	**z**	**(x && !y) || (y && !z) || (!x && z)**
false	false	false	**False**
false	false	true	**True**
false	true	false	**True**
false	true	true	**True**
true	false	false	**True**
true	false	true	**True**
true	true	false	**True**
true	true	true	**False**

1 point for each output

Problem 5: Data Types (18 points)

1 point each

1. Which one of the below is not a built-in data type in Java?
   a. int
   b. long
   c. double
   d. literal
   e. char

2. What is a Data Type?
   a. The opposite of a Number Type.
   b. A set of values and a set of operations on those values.
   c. A java code representation of a name.
   d. A variable whose value does not change.

3.
   a. AND
   b. JOIN
   c. OR
   d. NOT

4. True or False. Java requires you to declare the type of every variable?
   a. True
   b. False

5. Evaluate the following expression and select the type and value of the result

   (int) 3.9999
   a. int, 4
   b. double, 3
   c. int, 3
   d. long, 4
   e. Compile Error

6. Evaluate the following expression and select the type and value of the result

   (2 > 7) && (3 == '3')
   a. boolean, true
   b. boolean, false
   c. int true
   d. Compile Error
   e. Runtime Error

7. Evaluate the following expression and select the type and value of the result

   (3 < 10) || (7 != 7) && (3 <= 3)

   a. boolean, true
   b. boolean, false
   c. int, true
   d. Compile error

8. Evaluate the following expression and select the type and value of the result
   (17 % 14)

   a. double, 1.2
   b. double 3.0
   c. int, 3
   d. int, 1
   e. Compile error

9. Evaluate the following expression and select the type and value of the result

   ((12 % 4) || (33 == 33))

a. boolean, true
b. boolean, false
c. int, true
d. int, false
e. Compile error

10. What is the output of `System.out.println(“2” + 3 + "forfighting");`
    a. 5forfighting
    b. 2forfighting3
    c. 23forfighting
    d. 13

11. This is the output of the following snippet of code?

```
boolean a = true;
System.out.println( a + a );
```

    a. true
    b. 2
    c. Compile error
    d. Aa

12. Which of the following data types does not represent an integer?
    a. int
    b. short
    c. long
    d. float
    e. byte

13. Which of the following is not a special value for a floating point number?
    a. NaN
    b. Infinity
    c. Undefined
    d. -Infinity

14. The code snippet produces an error. Explain why and then explain how to perform the intended operation correctly.

```
int b = (int)(args[0]);
System.out.println( b );
```

String cannot be converted to int…need to replace assignment with int b = Integer.parseInt(args[0]);

15. Which of the following is not a form of type conversion in JAVA
    a. Explicitly defined
    b. Automatic
    c. Casting
    d. Expansion

16. Give the type and value for the expression (11 / 5) * 3.0 **6.0 a double**

17. Give the type and value for the expression (11 / 5.0) * 2 **4.4 a double**

18. Give the type and value for the expression 2.11 + "hello" **2.11hello a String**

Problem 6: Java (16 points)

Write a Java program called `Equals` that takes 3 integer command-line arguments as input and displays `true` if the 3 inputs are equal, `false` otherwise. Write your program using only Boolean expressions, do not use `if{}` or `if{}else{}` statements.

```
public class Equals {
    public static void main (String[] args) {
      int a = Integer.parseInt(args[0]);  // 3 points
      int b = Integer.parseInt(args[1]);  // 3 points
      int c = Integer.parseInt(args[2]);  // 3 points
      boolean d = (a == b) && (a == c);   // 5 points
      System.out.println(d);              // 2 points
  }
}
```