CSci 1103
Midterm

Name: ____________________________________________

Student ID: _____________________________

Instructions: Please pick and answer any 7 of the 9 problems for a total of 70 points. If you answer more than 7 problems, only the first 7 will be graded. The time limit is 50 minutes. Please write your answers in the space provided. The exam is open book and notes. You may use electronic devices to ONLY look at either an e-book version or electronic notes. You may not use the internet, compiler or any other outside resources. (If you are typing on your keyboard/input device for anything other than ctrl-F to find words in the e-book or notes, this is probably not acceptable.)

Problem (1) [10 points] Write a single if-statement that is true for all the values of i shown and false on on values not shown. The ”...” represents that the pattern of numbers continues in the direction indicated.

(Example) int i: ... -2, -1, 0
Answer: if(i <= 0)

(a) int i: 0, 1, 2, 3, 4, 5
(b) int i: ... -2, -1, 0, 5, 6 7, 8, ...
(c) int i: ... -2, 0, 2, 4, 6, 8, ...
(d) int i: 0, 2, 4, 6, 8
(e) int i: ... -4, -2, 2, 4, 6, 8, ...

Solution:
(a) if(0 <= i && i <= 5)
(b) if(i <= 0 || 5 <= i)
(c) if(i%2==0)
(d) if(i%2==0 && 0 <= i && i < 10)
(e) if(i%2==0 && i!=0)
Problem (2) [10 points] Suppose you need to calculate $d$ as follows:

$$d = max(\frac{6}{5}, min(x, y))$$

Write some Java code that when finished finds $d$ as desired, without using any methods, i.e. Math.max() or Math.min(). Assume all the variables involved have already been declared to be of type double.

```java
double dmin = x;
if(y < x) {
    dmin = y;
}
d = 6.0/5;
if (dmin > d) {
    d = dmin;
}
```

Problem (3) [10 points] Assume $x$, $y$, and $z$ are ints that have already been declared.
(a) The following Java code fragment, which is complete except for the if-condition, should print out "a and b are both between y and z" if both $a$ and $b$, are between the values of $y$ and $z$.

```java
if ( // condition missing )
    System.out.println("a and b are both between y and z");
```

In Java, write the missing condition here:

Solution:

```java
if((a > z && b > z && a < y && b < y) || (a > y && b > y && a < z && b < z))
```
(b) Suppose you are given four declared variables d, e, f and g of type int. Write Java code that finds the two median values and put them in a and b from part (a)). For example, if d=2, e=7, f=10 and g=5, then a=5 and b=7 (or a=7 and b=5)

Solution (easiest way might be to write part (a) 6 times. Another solution is:

```java
a=d;
if((d < e && d < f && d < g) || (d > e && d > f && d > g)) { //d is max or min
    a=e;
    if((e < d && e < f && e < g) || (e > d && e > f && e > g)) {
        a=f;
        b=g;
    } else {
        b=f;
        if((f < d && f < e && f < g) || (f > d && f > e && d > g)) {
            b=g;
        }
    }
} else {
    b=e;
    if((e < d && e < f && e < g) || (e > d && e > f && e > g)) {
        b=f;
        if((f < d && f < e && f < g) || (f > d && f > e && f > g)) {
            b=g;
        }
    }
}
```
Problem (4) [10 points] Suppose the user enters an int \( n \). Write a Java code segment that displays a triangle of height \( n \) and base \( n \) using the character ‘x’. You may assume \( n \) already has a value entered before your code segment (you do not need to read it with a Scanner). Declare any variables other than \( n \) that you use. For example, if \( n=5 \), then the code should display the following:

```
x
xx
xxx
xxxx
xxxxx
```

Solution:

```java
for(int i=1; i <= n; i++)
{
    for(int j=1; j <= i; j++)
    {
        System.out.print("X");
    }
    System.out.println();
}
```

Problem (5) [10 points] Write a piece of Java code that reads from the keyboard and counts the number of characters before a period (‘.’).

Example (user input is underlined):

```
Hi.
```

2 characters

Solution:

```java
Scanner reader = new Scanner(System.in);
String something = reader.nextLine();
System.out.println(something.indexOf("."));
Problem (6) [10 points] Suppose d and e are ints, and consider the following code:

```java
if ( (d+e)%2==0 && (!(e/10 == d/10 || e > d)) )
    System.out.println("Meets condition");
else
    System.out.println("Does not meet condition");
```

For each of the three cases below, circle whether the code would output "Meets condition" or "Does not meet condition".

Solution:

(d+e)%2==0 && (!(e/10 == d/10 || e > d))
(13+19)%2==0 && (!(13/10 == 19/10 || 13 > 19))
(32)%2==0 && (!(1 == 1 || F) )
T && (!(T || F) ) // can stop here due to short circuit evaluation
T && F
T && F
F

Does not meet condition

(b) d = 4, e = 1

Meets condition Does not meet condition

Solution:

(d+e)%2==0 && (!(e/10 == d/10 || e > d))
(4+1)%2==0 && (!(1/10 == 4/10 || 1 > 4))
(5)%2==0 && (!(0 == 0 || F) )
F && (!(T || F) ) // can stop here due to short circuit evaluation
F && (!T)
F && F
F

Does not meet condition

(c) d = 12, e = 2

Meets condition Does not meet condition
Solution:
(d+e)%2==0 && (!(e/10 == d/10 || e > d))
(12+2)%2==0 && (!(2/10 == 12/10 || 2 > 12))
(14)%2==0 && (!(0 == 1 || F) )
T && (!(F || F) )
T && (F)
T && T
T

Meets condition
(d) d = 2, e = 12

Meets condition Does not meet condition

Solution:
(2+12)%2==0 && (!(2/10 == 12/10 || 2 > 12))
(14)%2==0 && (!(0 == 1 || F) )
T && (!(T || F) )
T && (!T)
T && F
F

Does not meet condition
(e) d = 13, e = 1

Meets condition Does not meet condition

Solution:
(13+1)%2==0 && (!(1/10 == 13/10 || 1 > 13))
(14)%2==0 && (!(0 == 1 || F) )
T && (!(F || F) )
T && (!F)
T && T
T

Meets condition
**Problem (7)** [10 points] Find 3 possible places for errors inside the following `main()` method. Assume there are no errors outside of the `main()` method (such as improperly importing Scanner) and that the user properly enters an integer. Explain specifically what causes the error and whether it is a syntax, runtime or logic error:

```java
public static void main(String[] args) {
    int start;
    Scanner reader = new Scanner(System.in);
    System.out.println("Enter a number: ");
    start = reader.nextInt();
    System.out.println("Between 0 and " + start);

    for (start > 0)
    {
        if (start % 7 == 0)
        {
            divisible++;
        }
    }

    System.out.println(" there are "+ divisible + " number divisible by 7 exactly.
\n");
}
```

**Solution:**
1. `divisible` not declared, syntax.
2. `divisible` not initialized to zero, logic.
3. `start` not changing inside loop (need `start--;`), logic.
4. `for` loop looks like a `while` loop, syntax.
**Problem (8)** [10 points] For each of the following, write what is displayed after running the following pieces of code:

(a)

```java
for(int i=1; i < 30; i*=2)
{
    i--;
    System.out.println(i" ",
}
```

**Solution:**
0, -1, -3, -7, 15, ... (infinite loop)

(b)

```java
int i = 20;
while(i > 0)
{
    i++;
    System.out.println(i + ", ");
i = i/3;
}
```

**Solution:**
21, 8, 3, 2

(c)

```java
int x = 97,i = 10;
while(x > 0)
{
    System.out.println(x%i + ", ");
x-=x%i;
}
```

**Solution:**
7, 0, 0, 0, 0, ... (infinite loop)
Problem (9) [10 points] For each of the following loops, assume `a` is declared and has value 0 before the loop runs. What is the value of `a` after the loop? (i.e. how many times did the loop run?)

(a)  
for(int i=30; i > 0; i=i/3)
{
    a++;
}

Solution:
4 (30, 10, 3, 1, 0)

(b)  
int i = 20;
while(i > 0)
{
    i-=((i/2)+1);
    a++;
}

Solution:
4 (20, 9, 4, 1, 0)

(c)  
for(int i=0; i < 30; i++)
{
    for(int j=0; j < 10; j++)
    {
        a++;
    }
}

Solution:
300 (30 times 10)