

CIS 1068  
Program Design and Abstraction  
Spring2016  
Midterm Exam 1

Name \_\_\_\_\_ **SOLUTION** \_\_\_\_\_

Page	Points	Score
2	15	
3	8	
4	18	
5	10	
6	7	
7	7	
8	14	
9	11	
10	10	
Total	100	

## 1. Program Traces (41 points, 50 minutes)

Answer the questions below about each snippet of code. For the sake of brevity, I have left off the lines "public class <ClassName> {" and "public static void main(String [] args) {" from most of these questions. Pretend they are there.

- a. (4 points) Number Calculation: what are the values of w, x, y, and z after these lines execute?

```
int w;  
int x = 5, y = 8;  
int z = y % x;  
y += 1 + z;
```

w	x	y	z
<input type="text" value="?"/>	<input type="text" value="5"/>	<input type="text" value="12"/>	<input type="text" value="3"/>

- b. (3 points) Value of boolean variable and precedence order: what are the values of a, b, and c after these lines execute?

```
boolean a;  
boolean b = 3 < 5 / 2 && true;  
boolean c = b || (!b && 1 > 6 % 2);
```

a	b	c
<input type="text" value="?"/>	<input type="text" value="false"/>	<input type="text" value="true"/>

- c. (3 points) Type Compatibility: what are the values of a, b, and c after these lines execute?

```
int a = 2 + 1 / 2;  
double b = 2.5 + 1 / 2;  
double c = 2.5 + 1.0 / 2;
```

a	b	c
<input type="text" value="2"/>	<input type="text" value="2.5"/>	<input type="text" value="3.0"/>

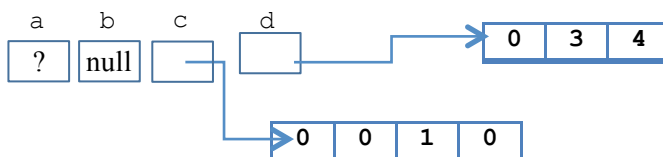
- d. (1 point) String: what does this code display on the screen?

```
int a = 25;  
boolean b = false;  
String s = "";  
System.out.println(a + s + b);
```

"25false"

- e. (4 points) Array: what are the values of a, b, c, and d after these lines execute?

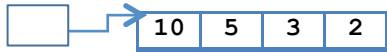
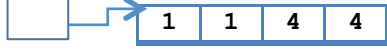

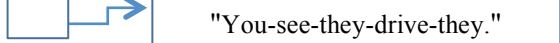
```
int [] a;  
int [] b = null;  
int [] c = new int[4];  
int [] d = {2, 3, 4};  
c[2] = 1;  
d[0] = d[1] - d.length;
```



f. (8 points) For each column, show what the code displays on the screen.

Code	Output:
<pre>int x = 2; int y = 3; int z = 4; if(x + y &gt; z) z = z + 2; System.out.println("z=" + z);</pre>	<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: auto;">z=6</div>
<pre>int x = 2; int y = 3; boolean b = true; if(b    x &gt; y) { System.out.println(x); } else { System.out.println(b); }</pre>	<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: auto;">2</div>
<pre>int x = 1; int y = 2; boolean b = true; boolean c = false; if(b &amp;&amp; x &gt;= y) { System.out.println(x); } else if (c    x &lt; y) { System.out.println(b); } else System.out.println(c);</pre>	<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: auto;">true</div>
<pre>int [] x = {1, 3, 5}; int [] y = {1, 2, 3, 4}; if(x.length&gt;y.length) { x[y.length-1] = y[y.length-1]; } else if (x[2] &gt; y[2]) { y[3] = x[2]; } else { y[1] = x[1] + x[2]; } System.out.println(y[1]+y[2]+y[3]);</pre>	<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: auto;">10</div>
<pre>boolean b = true; inti = 0; while (b) { b = i ++ &lt;2; System.out.println(i); System.out.println(b); }</pre>	<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: auto;"> 1 true 2 true 3 false </div>

g. (18 points) What are the values of a, b, and c at the end of the code in each column?

Code	Value of a, b, and c
<pre>int [] a = {3, -2, 4, 5}; int b = 0, c = 0; for( b=0; b&lt;a.length; b++) { c = c + a[b]; } for( b=0; b&lt;a.length; b++) { a[b] = c / (b+1); }</pre>	<p>a <input type="text" value="10"/> </p> <p>b <input type="text" value="4"/></p> <p>c <input type="text" value="10"/></p>
<pre>int [] a = {1, -2, 4, 3}; int b = a[0]; int c = 0; for( c=0; c &lt;a.length; c++) { if (a[c] &gt; b) { b = a[c]; } } a[c] = b; }</pre>	<p>a <input type="text" value="4"/> </p> <p>b <input type="text" value="4"/></p> <p>c <input type="text" value="4"/></p>
<pre>String a = "You-see-you- drive-you."; String u = "you"; String v = "they";  int b = a.indexOf(u); String c = "";  while(b&gt;=0) { String word = a.substring(0,b); c = c + word + v; a = a.substring(b+u.length()); b = a.indexOf(u); } c = c + a;</pre>	<p>a <input type="text" value="."/> </p> <p>b <input type="text" value="-1"/></p> <p>c <input type="text" value="\"/>You-see-they-drive-they.\""/&gt; </p>

## 2. Fill the blanks (10 points, 10 minutes)

For the requirement specified in the below, complete the corresponding loop program so that the computer can print out the expected result.

- a. Write a program to print out the result of  $1+2+3+4+\dots+99$ .

```
int total = _____ 0 _____;
inti=0;
while (i<100){
    total=total+i;
    i++;
}
System.out.print(total);
```

---

- b. Write a program to print out the result of  $1+2+4+8+\dots+4096$ .

```
int total = _____ 1 _____;
inti=1;
while (i<3000){
    i *= 2;
    total=total+_____ i _____;
}
System.out.print(total);
```

---

- c. Write a program that reads in an integer  $n$  from the keyboard, and displays whether  $n$  is a "perfect number" or not. A number is "perfect" if it is equal to the sum of all of its factors (not including itself as a factor, but including 1 as a factor). 6 is the first perfect number, because its factors are 1, 2, and 3, and  $1+2+3 = 6$ .

```
int n = keyboard.nextInt();
int total = 1;

for(____ int factor = 2 _____; _____ factor < n _____; factor++)
if (n%factor ==0)
    total += factor;
System.out.println(n == total);
```

### 3. Writing short programs (39 points, 40 minutes)

For each problem below, write some Java code to solve it.

*You do not need to define a class or the main method, or import any classes. For this question, you should assume that all necessary classes (e.g., Scanner, Arrays) have been imported. Furthermore, assume that the following line precedes every question below, for you to use if you want:*

```
Scanner keyboard = new Scanner(System.in);
```

- a. (7 points) Write code that reads in a word *W* and a number *N* from the user (i.e., via keyboard). Your code should display *W* on *N* lines. For example, if the user enters "hello" for *W* and 3 for *N*, your code should display:

```
hello  
hello  
hello
```

```
String W = keyboard.nextLine();  
int     N = keyboard.nextInt();  
  
for(int i = 0; i < N; i++)  
    System.out.println(W);
```

- b. (7 points) Write code that reads in an integer N via the keyboard, and displays all the products of 7, from 1 x 7 up to N x 7. For instance, if the user enters 4, the program should display:

1x7=7  
2x7=14  
3x7=21  
4x7=28

```
int N = keyboard.nextInt();  
  
for( int i = 1; i<=N; i++)  
    System.out.println(i+"x7="+i*7);
```

- c. (14 points) Write code that reads in a number  $C$  and a number  $R$  from the user (i.e., keyboard), and displays a figure with  $R$  rows and  $2 \times C$  columns of "\$" and " " characters. For instance, if the user enters a 5 for  $C$  and 4 for  $R$ , your program should display the following shape of "\$":

```
$$    $$
$$$  $$$
$$$$ $$$$
$$$$$$$$
```

```
int C = keyboard.nextInt();

int R = keyboard.nextInt();

for( int i = 0; i < R; i++){
    int j;
    for(j = 0; j < C-(R-i-1); j++)
        System.out.print("$");
    for(j = 0; j < 2*(R-i-1); j++)
        System.out.print(" ");
    for(j = 0; j < C-(R-i-1); j++)
        System.out.print("$");
    System.out.println();
}
```



- d. (11 points) Write code that reads in a number C and a number R from the user (i.e., keyboard), and displays a figure with R rows and C columns. The numbers count up from 1 to (rows x cols). The output are displayed in column-major order, meaning that the numbers shown increase sequentially down each column and wrap to the top of the next column to the right once the bottom of the current column is reached. You may assume that both C and R are greater than 0.

Here are some example calls to your method and their expected results:

<b>Input</b>	3 6	5 3	4 1	1 3
<b>Output</b>	1, 4, 7, 10, 13, 16 2, 5, 8, 11, 14, 17 3, 6, 9, 12, 15, 18	1, 6, 11 2, 7, 12 3, 8, 13 4, 9, 14 5, 10, 15	1 2 3 4	1, 2, 3

```

for(int i = 1; i<= r; i++){
    int num = i;
    for(int j = 1; j< c; j++){
        system.out.print(num+ ", ");
        num+=r;
    }
    system.out.println(num);
}

```

#### 4. Challenge: Writing a full Java program (10 points, 20 minutes)

Write a complete Java program called CoPrime.java that reads in two integers and prints “Co-Prime” if the numbers are co-prime, and “Not Co-Prime” if they are not. Don’t forget import statements, and declarations for the class and main method.

Two integers are said to be *co-prime* if they share only one factor, the number 1. For instance, 8 and 9 are *co-prime*, because the factors for 8 are {1, 2, 4, 8}, and the factors for 9 are {1, 3, 9}. Only the number 1 is a factor for both 8 and 9. The numbers 6 and 9 are *not co-prime*, because 3 is a factor of both.

*Hint: Use the % operator to determine if one number is a factor of another. For instance, (x % y == 0) is true if y is a factor of x, and false otherwise.*

```
import java.util.Scanner;
public class MidtermC {
public static void main(String args[]){
Scanner keyboard= new Scanner(System.in);
int n1 = keyboard.nextInt();
int n2 = keyboard.nextInt();
int f;
for(f=2; (n1%f!=0 || n2%f!=0 ) && f<=((n1<n2)?n1:n2); f++);
System.out.print(f>n1);
}
}
```