Please answer FIVE OF THE SIX questions, in the spaces provided. On this score sheet, clearly indicate which questions you are answering by circling the numbers of the questions you are choosing to answer and crossing out the one left out. Only five questions will be graded. If you make a mistake or for some other reason need more space, please use the back of pages and clearly indicate where the answer can be found.
1. [ /20] 
   a) What gets printed by the following program?

   // Guess what this does
   public class Midterm
   {
     public static void main(String args[])
     {
       int x = 10;
       int a = 20;
       int b = 30;
       x = a;
       a = b;
       b = 40;
       String mood = "happy";
       System.out.println(" Welcome to the \n1051 Test \"experience\"");
       System.out.println(" x = " + x + " a = " + a + " b = " + b);
       System.out.print(" and this: " + (2 + 3));
       System.out.print(" Try this: " + 2 + 3);
       System.out.println(" and this also: " + "2 + 3");
       System.out.println(" This is a " + mood + " " + mood + " day!");
     }
   }

   Output

   Welcome to the 1051 Test "experience"
   x = 20 a = 30 b = 40
   and this: 5 Try this: 23 and this also: 2+3
   This is a happy happy day!

   b) Write a single println statement that would output:

   System.out.println ("Hi\n\t\"there\"");
2. [20] Short answer questions.

- For each of the following expressions, indicate the order in which the operations are performed by writing a number beneath each operator.

  \[ a / b - d * e + f \]
  \[ 1 \quad 3 \quad 2 \quad 4 \]

  \[ a / (b + c) / e - f \]
  \[ 2 \quad 1 \quad 3 \quad 4 \]

- Consider the following code fragment:

  ```java
  if (a>0)
  if (b<0)
      x = x + 5;
  else
      if (a>5)
          x = x + 4;
      else
          x = x + 3;
  else
      x = x + 2;
  ```

  If \( x \) is currently 0, \( a = 5 \) and \( b = 5 \), what will \( x \) become after the above statement is executed?
  \[ x = \_3\_ \]

- The code below is supposed to print the numbers from 1 to 10, but it has an error.

  ```java
  int count = 1;
  while (count <= 10);
  {
      System.out.println (count);
      count++; 
  }
  ```

  a) Describe the error and how to correct it?

  Incorrect semicolon after while

  b) If the error is not corrected, what, if anything gets printed?

  Nothing -- infinite loop

  c) Is this a syntax, runtime, or logical error? Logic
3. [ /20]
What gets printed? Please show output as it will appear or indicate “NO OUTPUT”. If it’s an infinite loop, be sure to show some of the output followed by “INFINITE LOOP.”

```java
int a = 4;
while (a < 8) {
    a++; // Corrected the increment operation
    System.out.println(a);
}
```

Output:
```
5
6
7
8
```

```java
int a = 4;
while (a < 8) {
    System.out.println(a); // Corrected the loop condition
    a--; // Corrected the decrement operation
}
```

Output:
```
8
10...
INFINITE LOOP
```

```java
int a = 4;
while (a <= 5) {
    System.out.println(2*a); // Corrected the multiplication operation
    a++; // Corrected the increment operation
}
```

Output:
```
8
10
```

```java
int a = 4;
while (a < 14) {
    System.out.println(a); // Corrected the loop condition
    a = a + 3; // Corrected the assignment operation
}
```

Output:
```
4
7
10
13
```
4. [    /20] Let's look at the problem of repeatedly obtaining input and performing a calculation, for example, computing the circumference of a circle given its radius, using the following algorithm:

Variables:
- radius, circ

Algorithm:
- input radius
- circ = 2 * radius * PI
- print circ

Rewrite this algorithm, modifying it so that it uses a while structure to repeat the processing of each input in two different ways.

a) Keep computing circumferences and ask each time whether to keep going.

Variables:
- radius, circ, ans

Algorithm:
- ans = 1
- while (ans equals 1)
  - input radius
  - circ = 2 * radius * PI
  - print circ
  - print “do another?”
  - input ans

b) Compute the circumferences of 10 circles (exact count).

Variables:
- radius, circ, count

Algorithm:
- count = 1
- while (count <= 10)
  - input radius
  - circ = 2 * radius * PI
  - print circ
  - count = count + 1
Construct an algorithm that inputs 10 positive numbers and prints the maximum of these numbers.

Example: If the numbers input are 44 7 31 22 53 16 21 48 72 60, the output should be:
max = 72

Directions:
Write your algorithm by rearranging and structuring elements chosen from the list below, using indentation to show structure. Do not use anything else and note that not all of these are needed, but you may use one of them more than once, if necessary.

num = 0
count = 0
count = 1
max = 0
count = count + 1
num = max
max = num
print “max = " max
input num
input max
input count
if (num > max)
if (count < max)
else
while (count <= 10)
while (count < 10)
while (num < max)
while (num != max)

count = 0
max = 0

while (count < 10)
    input num
    if (num > max)
        max = num
    count = count + 1

print “max = “ max

ALTERNATIVELY we can count from 1 to 10:
count = 1
max = 0
while (count <= 10)
    input num
    if (num > max)
        max = num
    count = count + 1
print “max = “ max
6. [_____/ 20] Finish writing the Java code below that asks the user to input an integer representing a number of days and then calculates and prints the equivalent as a number of weeks and days. For example, if the user inputs 18 for the number of days, the output should state that it is equivalent to 2 weeks and 4 days.

You are NOT required to write comments on this code.

```java
import java.util.Scanner;

public class Days {

    public static void main(String[] args) {
        Scanner scan = new Scanner(System.in);
        int days = scan.nextInt();
        int weeks = days / 7;
        days = days % 7;
        System.out.println(weeks + " " + days);
    }
}
```
CSC 1051 Algorithms and Data Structures I

Test 1
September 23, 2019

Name: ___KEY__B_____

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1. [ /20]

a) What gets printed by the following program?

```
// Guess what this does
public class Midterm {
    public static void main(String args[]) {
        int x = 1;
        int a = 2;
        int b = 3;
        x = a;
        a = b;
        b = 4;

        String mood = "happy";

        System.out.println(" Welcome to the \nTest 1 \"experience\"");
        System.out.println(" x = " + x + " a = " + a + " b = " + b);

        System.out.println(" Try this: " + 2 + 3);
        System.out.println(" and this: " + (2 + 3));
        System.out.println(" and this also: " + "2 + 3");

        System.out.println(" This is a " + mood + " " + mood + " day!");
    }
}
```

**Output**

```
Welcome to the
Test 1 "experience"
x = 2 a = 3 b = 4
Try this: 23 and this: 5 and this also: 2+3
This is a happy happy day!
```

b) Write a single `println` statement that would output:

```
"Hello" there
```

```
System.out.println ("\"Hello\"\n\ttthere");
```
2. [20] Short answer questions.

- For each of the following expressions, indicate the order in which the operations are performed by writing a number beneath each operator.

\[
\begin{align*}
 a - b + d / e / f & \\
3 & 4 & 1 & 2 \\
 b + e + a + f + c & \\
1 & 2 & 3 & 4 \\
\end{align*}
\]

- Consider the following code fragment:

```java
if (a>0)
    if (b<0)
        x = x + 5;
    else
        if (a>5)
            x = x + 4;
        else
            x = x + 3;
    else
        x = x + 2;
```

If x is currently 0, a = 1 and b = -1, what will x become after the above statement is executed?

\[x = 5\]

- For each of the following Java code fragments, mark the error and show how to correct it. What do you need to do to fix it so that it works as appears to be intended?

a) ```java
if (value = 0)
    System.out.print ("Right!");
```

Error in condition: change (value = 0) \(\Rightarrow\) (value == 0)

b) ```java
if (value > 0);
    System.out.print ("Right!");
```

Semicolon after condition needs to be removed. Will always print “Right”

c) ```java
if (value > 0)
{
    System.out.print ("Right!");
    System.out.println(" value is positive");
}
```

Need braces around both statements, otherwise it will ALWAYS print “value is positive” (for whatever value)
3. [ /20]
What gets printed? Please show output as it will appear or indicate “NO OUTPUT”.
If it’s an infinite loop, be sure to show some of the output followed by “INFINITE LOOP.”

```java
int a = 4;
while (a > 0)
{
    System.out.println(a);
    a++;
}
```

Output:
4 5 6 ...
... INFINITE LOOP

```java
int a = 4;
while (a > 0)
{
    System.out.println(a);
    a = a - 2;
}
```

Output:
4 2

```java
int a = 1;
while (a < 4)
{
    a++;
    System.out.println(a);
}
```

Output:
2 3 4

```java
int a = 4;
while (a < 4)
{
    System.out.println (a);
    a++;
}
```

Output: NO OUTPUT
4. [20] Let’s look at the problem of repeatedly obtaining input and performing a calculation, for example, computing the area of a circle given its radius, using the following algorithm:

```
Variables:  
  radius, area

Algorithm:
  input radius
  area = radius * radius * PI
  print area
```

Rewrite this algorithm, modifying it so that it uses a while structure to repeat the processing of each input in two different ways.

a) Compute the areas of 5 circles (exact count).

```
Variables:  
  radius, area, count

Algorithm:
  count = 1
  while (count <= 5)
    input radius
    area = radius * radius * PI
    print area
    count = count + 1
```

b) Keep computing circle areas until user inputs -1 for the radius (sentinel value)

```
Variables:  
  radius, area

Algorithm:
  input radius
  while (radius != -1)
    area = radius * radius * PI
    print area
    input radius
```
5. [_____/ 20]
Construct an algorithm that inputs a number num and then prints “Hello” that many times. After the “Hello”s are printed, print a goodbye message.

Example: If num (i.e., the input) is 5, the algorithm should print something like this:
Hello
Hello
Hello
Hello
Hello
Goodbye

Directions:
Write your algorithm by rearranging and structuring elements chosen from the list below, using indentation to show structure. Do not use anything else and note that not all of these are needed, but you may use one of them more than once, if necessary.

input num
input count
count = 1
count = 0
count = count + 1
num = num + 1
if (count < num)
else
while (count <= num)
while (count != 5)
while (count <= 5)
print “Hello ”
print num
print “Goodbye”

input num
count = 1
while (count <= num)
    print "Hello"
    count = count + 1
print "Goodbye"
6. [________/ 20] Finish writing the Java code below that asks the user to input a value representing a number of seconds, and then prints the equivalent amount of time as a combination of hours, minutes, and seconds. (For example, 9999 seconds is equivalent to 2 hours, 46 minutes and 39 seconds.)

Be sure to write a complete Java program, including class definition, variable and constant declarations, as appropriate, comments, and proper indentation, to make it readable.

```java
import java.util.Scanner;

public class Seconds {

    public static void main(String[] args) {

        Scanner scan = new Scanner(System.in);
        int seconds = scan.nextInt();

        int hours = seconds / 3600;
        seconds = seconds - (hours * 3600);
        int min = seconds / 60;
        seconds = seconds - (min * 60);

        System.out.print(hours + " " + min + " " + seconds);

    }
}
```