Lab 5 Working with Loops
Due Date: Oct 12th 6 pm.

Forming Group	Start time:9:11

In this lab, you work in teams of 3–4 students to learn new programming concepts.

Content Learning Objectives

1. Identify the three main components of a *while* loop.
2. Write nested loops.
3. Implement a *for* loop.

Process Learning Objectives

- Leveraging knowledge and experience of other students (Teamwork).

Study the roles given below. Decide who will be what role for today and write the names in the table below; we will rotate the roles each week. If you have only three people, one should have two roles. If you have five people, two may share the same role.

Role	Name
Manager: reads the questions aloud, keeps track of time and makes sure everyone contributes appropriately.	Magdalena Metodieva
Presenter: talks to the instructor and other teams. The Presenter reports out the highlighted questions to the TA or to other teams.	Ryan Cai
Recorder: **records all answers in Google doc** and ensures the team agrees on responses.	Samuel Anderson
Reflector: Considers how the team could work and learn more effectively and provides team reflection to team & instructor. The Reflector has an additional questionnaire to fill in Moodle.	Nishant Parhi

The Manager

1. **Clicks on the worksheet link in Moodle**
2. **Logs in with UMASS email account**
3. **Clicks on *FILE-> MAKE A COPY***
4. **Shares the copy with all the other team members through UMass email address**

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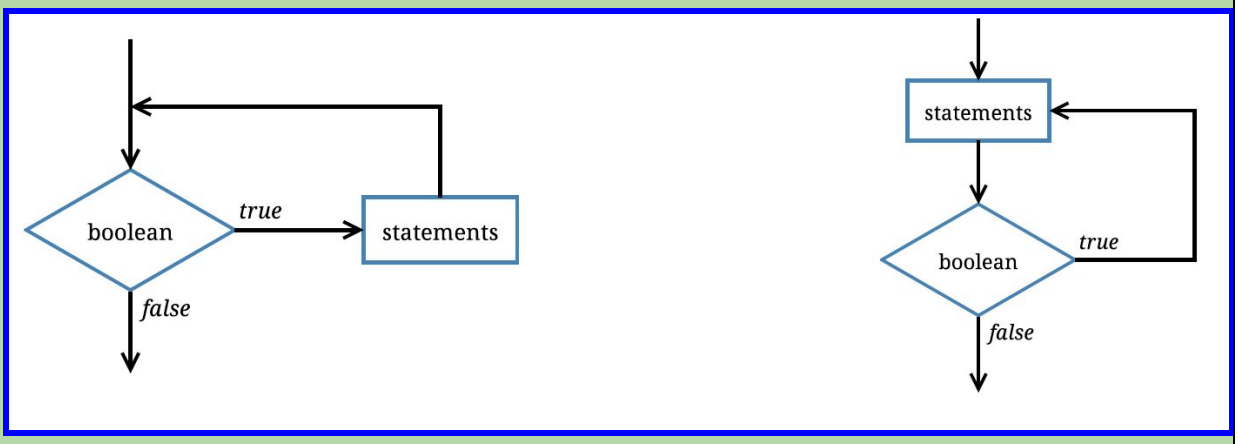
(15 min) Activity 1. Working with WHILE and DO loops	Start time:9:12

A loop is a set of instructions that are to be repeated. All loops have three main components: *initialize, test*, and *update*. With your team identify each of these components in the two example loops below.

```
// pre-test loop
int number = 1;
while (number <= 10) {
   System.out.println(number);
   number++;
}
```

```
// post-test loop
int number = 1;
do {
   System.out.println(number);
   number++;
} while (number <= 10);
```



1.1. Which loop component always happens first (initialize, test, or update)? Why?

Answer: Initialize happens first in the loop component. This is because you need a variable as a condition for the loop.

1.2. Discuss and explain why the *while* loop is called a pre-test and the *do-while* loop is called a post-test.

Answer: The while loop looks at the condition before executing the code whereas the do-while loop tests after. The do-while will always execute the code once even if the conditional is false.

1.3. In the examples given, what is the output (to the screen) by each loop?

Answer:

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

1.4. What is the final value of `number` at the end of each loop?

Answer: The value of number will be 11 at the end of each loop.

1.5. What is the output if you swap the `println` and `number++` statements?

Answer: The outputs would start with 2 rather than 1 and print 11 as the last number instead of 10.

1.6. What is the output if you remove the **`number++`** statement?

Answer: The output would infinitely print 1.

Study the following loop:

```
public class Error {
   public static void main (String[] args) {
      int i = 0;

      while (i < 10) {
         int tempSum = 0;
         tempSum = tempSum + i;
         System.out.println("tempSum: " + tempSum);
         i = i + 1;
      }
   }
}
```

1.7. The output for each iteration of the above loop is supposed to be 0, 1, 3, 6, 10 and so on for the remaining iterations.
Each iteration of the loop is supposed to print the cumulative sum of variable 'i' upto that iteration i.e. 0 = 0, 1 = 0+1, 3 = 0+1+2, 6 = 0+1+2+3, 10 = 0+1+2+3+4.
What is printed for each iteration is 1, 2, 3, 4 and so on. What mistake was made? Discuss and answer.

Answer: The mistake that was made is, every iteration of the loop makes tempSum 0 again. Therefore the loop just prints 1-9.

Report to your TA that all team members have finished Activity 1. Otherwise, help each other!

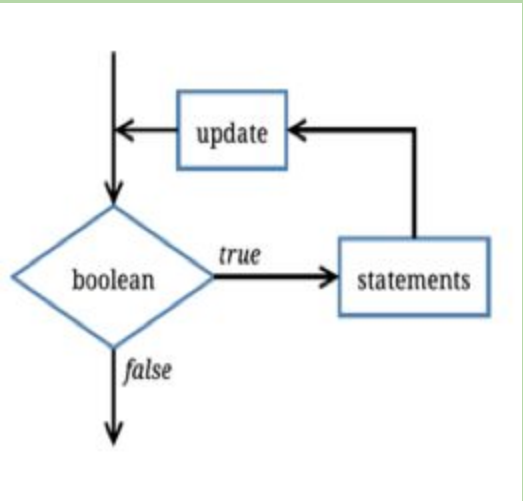
(15 min) Activity 2 Using FOR loops	Start time:9:25

A *for* loop combines initialize, test, and update into one line of code. See the example below:

```
int number;

for (number = 1; number <= 10;
number++) {
   System.out.println(number);
}

for (number = 10; number >= 1;
number--) {
   System.out.println(number);
}
```



Q2.1 <u>Describe</u> (in your own words) what each of the *for* loops output to the screen?

Answer: The first for loop prints out the numbers 1-10, with a newline after every number. The second for loop prints out the numbers 10-1, with a newline after every number.

Q2.2 <u>Describe</u> (in your own words) how to make these loops display *even* numbers only (2 4 6 8 10 and 10 8 6 4 2).

Answer: The first for loop would have number = 2; number <=10; number+=2. The second for loop would have number = 10; number >0; number-=2.

Study the output below:

```
H
e
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l
o

t
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r
e
!
```

Q2.3 Write a *for* loop that prints each character of the string below on a separate line. Hint: You will need to invoke the `length()` and `charAt()` methods . See https://docs.oracle.com/javase/10/docs/api/java/lang/String.html

Answer:

```
String word = "Hello there!";

for(int i = 0; i < word.length(); i++){
     System.out.println(word.charAt(i));
}
```

Q2.4 Rewrite the *for* loop you wrote above as a *while* loop that prints each character of the string below on a separate line.

Answer:

```
String word = "Hello there!";
int i = 0;
while(i < word.length()){
    System.out.println(word.charAt(i));
    i++;
}
```

Report to your TA that all team members have finished Activity 2. Otherwise, help each other!

(20 min) Activity 3 Nested Loops	Start time:9:33

A nested loop is one that exists within the scope of another loop. This construct is often used when there are two variables for which all combinations must be examined. See the example below:

```
 for (int i = 1; i <= 10; i++) {
       for (int j = 0; j <= 10; j++) {
          System.out.println("The product of " + i + " and " + j
+ " is " + i * j);
       }//end for
 }//end for
```

The output runs from

```
The product of 1 and 0 is 0
The product of 1 and 1 is 1
```

to

```
The product of 10 and 9 is 90
The product of 10 and 10 is 100
```

Download `NestedLoops.java` and open and compile it in jGRASP.
Run `NestedLoops.java` and observe the output.

Q3.1. Write *for* loops in `NestedLoops.java` to reverse the output so that it starts with "`The product of 10 and 0 is 0`" and ends with "`The product of 1 and 10 is 10`". Copy and paste the code as your answer.

Answer:

```
for(int i = 10; i <= 1; i--){
      for(int j = 0; j >= 10; j++){
         System.out.println("The product of " + i + " and " + j
+ " is " + i * j);
      }
}
```

Q3.2. Write for loops in `NestedLoops.java` to reverse the output so that it starts with "`The product of 10 and 10 is 100`" and ends with "`The product of 1 and 1 is 1`".

Answer:

```
   for(int i = 10; i <= 1; i--){
      for(int j = 10; j <= 1; j--){
         System.out.println("The product of " + i + " and " + j
+ " is " + i * j);
      }
   }
```

(20 min) Activity 4 Debugging Loops	Start time:9:41

Open, compile, and run `Purchase.java`.

Q3.2. Fix the program so that it runs correctly when the user enters "yes" or "no". Copy the correct answer below. Hint: Check the lecture slide for how to stop a loop from running.

Answer:

```
do{
      System.out.println("Enter price $");
      price = keyboard.nextDouble();
      System.out.print("Enter number purchased:");
      number = keyboard.nextInt();
      System.out.println(number + " items at $" + price);
      System.out.println("Total cost $" + price*number);
      System.out.println("Want to make another purchase?");
      System.out.println("Enter yes or no");
      answer = keyboard.next();
      if(answer.equals("no")){
         moreNumbers = false;
      }
    } while (moreNumbers);
```

Report to your TA that all team members have finished Activity 3. Otherwise, help each other!

Good job! You now have worked with while, do-while, and for loops.
Create a pdf of this worksheet file and upload in MOODLE. There is no need to upload the java files.

****Remember EACH member of the group needs to do this individually, not just the manager!**

*****The Reflector has to fill in the Reflector's Questionnaire in Moodle!**

It is also OK if you could not complete the lab. The grace period is Oct 12th 6pm (the Moodle assignment will not accept submissions after this date or time).

Challenge	Start time:

Complete the program named `DigitCounter` which counts the number of digits in a line of text entered by a user (the digits are: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9).
The program prompts the user to enter a line of text with this message:

```
Enter a line of text, then press return.
```

The program then reads in the line from the keyboard. It counts the number of digits in the text and prints the number of digits found.
For example: if the text input was:

```
"Let's 86 the spam cans with dates 12-30-1997 and 9-19-1976."
```

The program would print:

```
There are: 17 digits.
```

If there are no digits in the input text the program would print:

```
There are: 0 digits.
```

Hint: use the `Character.isDigit(char c)` method in your code.

Now complete the java code below.

Answer:

```
import java.util.Scanner;
public class DigitCounter {
   public static void main(String[] args){
    Scanner scan = new Scanner(System.in);
      System.out.println("Enter a line of text, then press return.");
      String inputStr = scan.nextLine();
      int count = 0;

              ….. Write missing code here


      System.out.println("There are: "+count+" digits.");
   }
}
```