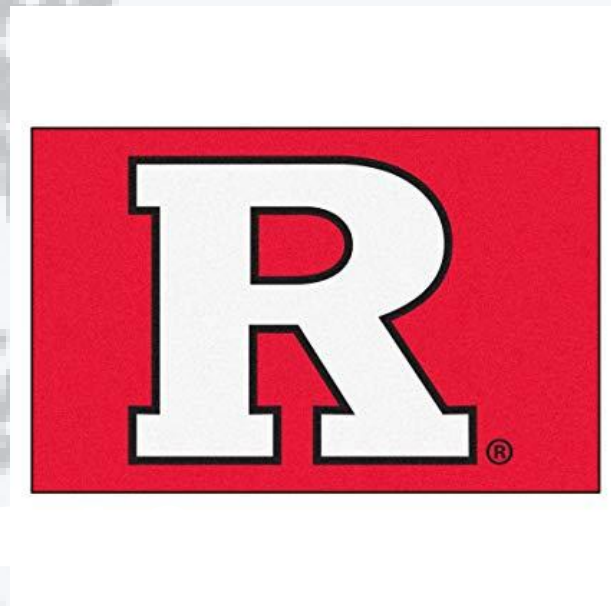


4. Conditionals and Loops – Part 2



Questions from Socrative

- Record all lectures????
 - *HOW????*
- *Count operations – LOOPS*
- *Pseudocode*
 - Find the average of the numbers from 1 to N (input by user) –
 - *Java*
 - Find the sum of the odd numbers from 1 to N (input by user) – *while loop and then for loop*
- *Practice Exam*
 - *FALL 2023, page 2, count operations – can't use $\max - \min + 1$*

CONTINUATION.....

- Conditionals
- Counting Operations
- Loops!!!
- More Loops!

Write the Java code; Test for your Test Cases; Count operations in your algorithm.

Problem. A cake up to 6" cost \$10, 6"-12" cost \$15, greater than 12" cost \$20. Given the diameter of the cake, find the cost.

Solution Design. Input: diameter of the cake (integer)
Output: the price
Error: diameters less than or equal to 0

One possibility

```
public class Cake{
    Run | Debug
    public static void main(String[] args){
        double diameter = Double.parseDouble(args[0]);
        double price = 0.0;
        if (diameter <= 0){
            System.out.println("Error");
        }
        else if (diameter < 6){
            price = 10;
        }
        else if (diameter <= 12){
            price = 15.0;
        }
        else{
            price = 20.0;
        }
        System.out.println("Price of cake is $" + price);
    }
}
```

Number of operations?

Min =

Max =

WHILE loop

Java Reference Guide

<https://rutgers.app.box.com/file/533536224328?s=y3rfunryi4ilnzevy5ieombwbdjm6rv5>

Loops

```
while (condition)  
{  
    ....  
}
```

Coding with while loops must include:

1. Initialization of variable used in test
2. Test
3. Update of variable

Q. Anything wrong with the following code?

```
public class PQwhile
{
    public static void main(String[] args)
    {
        int n = Integer.parseInt(args[0]);
        int i = 0;
        int v = 1;
        while (i <= n)
            System.out.println(v);
            i = i + 1;
            v = 2 * v;
        }
    }
```

Q. Anything wrong with the following code?

```
public class PQwhile
{
    public static void main(String[] args)
    {
        int n = Integer.parseInt(args[0]);
        int i = 0;
        int v = 1;
        while (i <= n)
        {
            System.out.println(v);
            i = i + 1;
            v = 2 * v;
        }
    }
}
```

A. Yes! Needs braces.

Q. What does it do (without the braces)?

A. Goes into an *infinite loop*.

```
% java PQwhile 6
1
1
1
1
1
1
1
1
1
1
1
```

KNOW HOW TO STOP AN ENDLESS LOOP ON YOUR COMPUTER! (control Z on mine!)

← challenge: figure out
how to stop it
on your computer



Write Java code to solve the following problem. Use a WHILE loop in your solution.

Find the largest digit in an integer input by the user. Assume the input >0.

Write Java code to solve the following problem. Use a WHILE loop in your solution.

Find the largest digit in an integer input by the user. Assume the input >0.

```
public class LargestDig{
    Run | Debug
    public static void main(String[] args){
        int num = Integer.parseInt(args[0]);
        int largest = 0;
        while (num > 0){
            int dig = num % 10;
            if (dig > largest){
                largest = dig;
            }
            num = num / 10;
        }
        System.out.println("The largest digit is: " + largest);
    }
}
```

Conditions

- What's wrong?
- What one change in the code below would cause in an infinite loop?

Example:

```
int i = 0;
while ( i > 1) {
    System.out.println(i);
    i++;
}
```

Conditions

- What's wrong?

Example:

```
int i = 10;  
while ( i > 1) {  
    System.out.println(i);  
    i++;  
}
```

← The value of i is always greater than 1

FOR loop

Java Reference Guide

<https://rutgers.app.box.com/file/533536224328?s=y3rfunnyri4ilnzevy5ieombwbdjm6rv5>

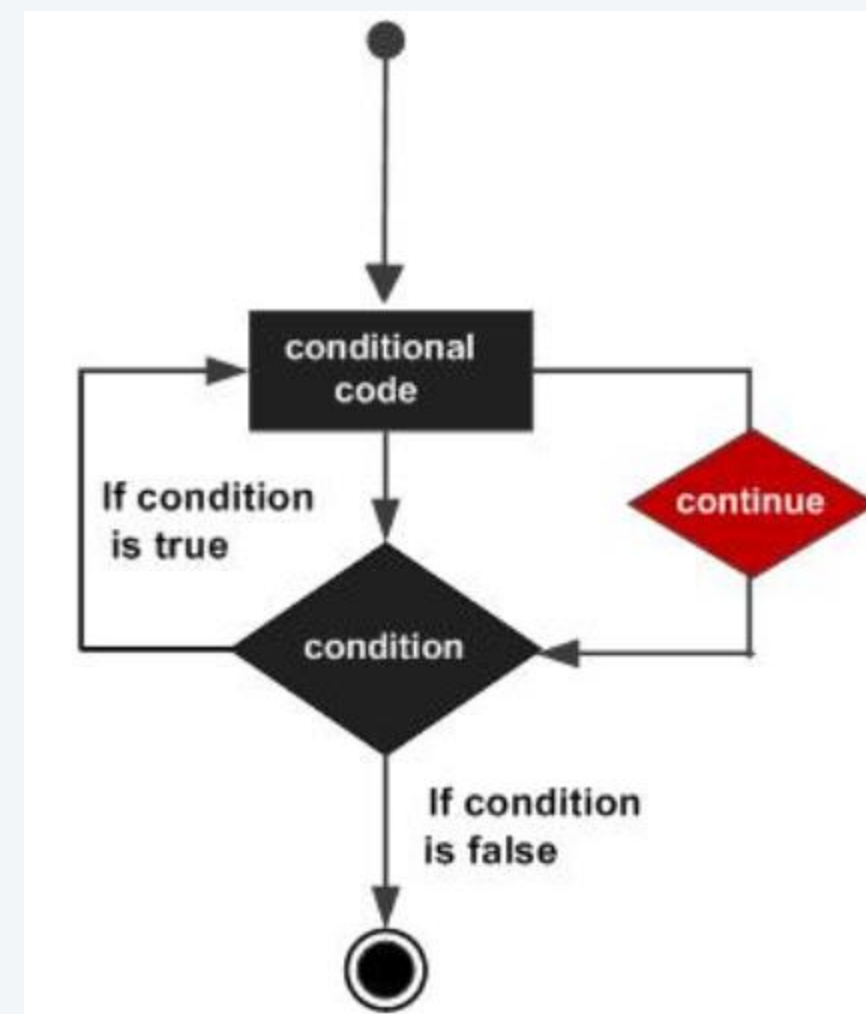
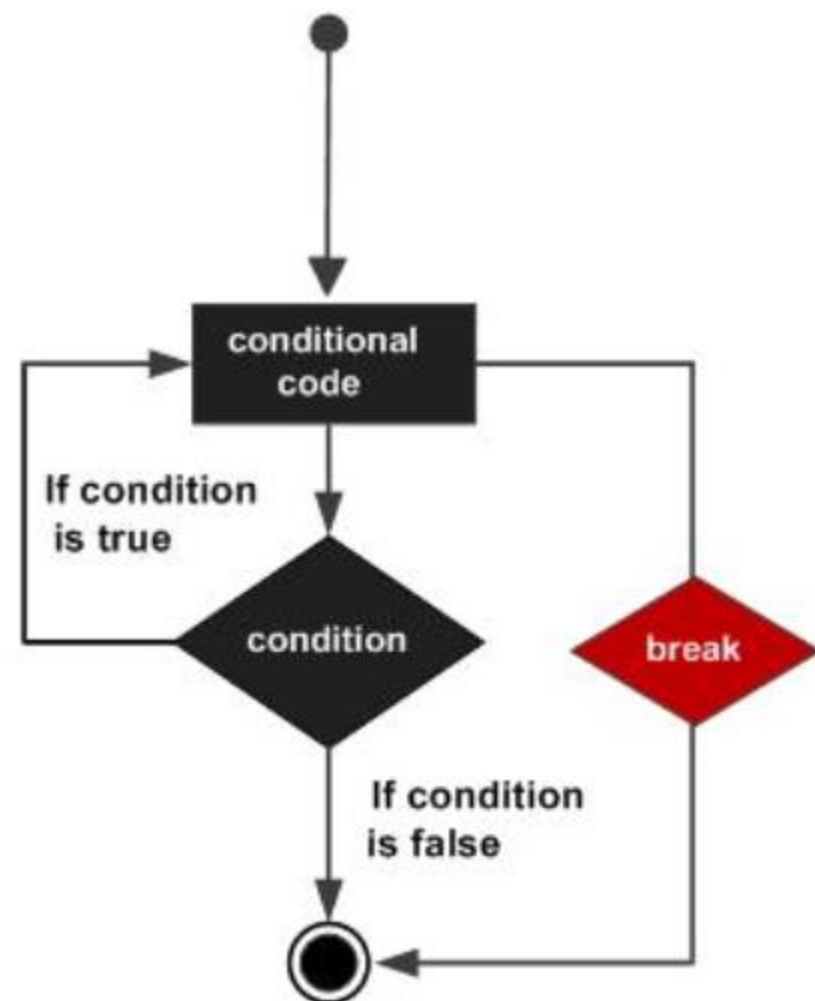
```
for (initialization ; condition ; update)  
{  
    ....  
}
```

Coding with for loops SHOULD include:

1. Initialization of variable used in test
2. Test condition
3. Update of variable

break: exit the loop

continue: skip to end of the loop and continue to the next iteration



```
for (int i=0; i < n ; i++) {  
    if ( i == 11)  
        continue;  
    System.out.println(i);  
}
```

```
for (int i=0; i < n ; i++) {  
    if ( i == 11)  
        break;  
    System.out.println(i);  
}
```

break is executed when i is 11
which forces the end of the loop
(exit the loop)

Loop skips printing 11

Example with BREAK and CONTINUE

Write a Java a program that displays all numbers between 1 and n that are divisible by 3 but not by 2. Use a **for** loop with **continue**.

Modify your program stop checking numbers when it finds a number divisible by 11 (using **break**).

```
$ javac WithContBreak.java
$ java WithContBreak 50
3 9 15 21 27
```

```
public class WithContBreak{
    Run | Debug
    public static void main(String[] args){
        int n = Integer.parseInt(args[0]);
        for(int i = 1; i <= n; i++){
            if(i % 3 == 0){
                if (i % 11 == 0){
                    break;
                }
                if (i % 2 == 0){
                    continue;
                }

                System.out.print(i + " ");
            }
        }
        System.out.println();
    }
}
```

4. Conditionals & Loops

- Conditionals: the if statement
- Loops: the while statement
- An alternative: the for loop
- **Nesting**
- Debugging

Q. In each of these cases, find an appropriate control structure

1. Given 3 integers, find the max value
2. Given n integers, find the max value
3. Print a n x n grid of integers

← nested if statements **maxNum.java**

← nested while-if statements (or for-if statements) **maxNumOfN.java**

← nested while-while (or for-for) statements **Grid.java**

Selecting appropriate Loop

FOR LOOP:

You know exactly how many times you are to execute something

WHILE LOOP:

You DON'T know exactly how many times to execute something.

Write a segment of code to produce the following: *Use nested Loops – Nest 1*

1	2	3	4
2	4	6	8
3	6	9	12
4	8	12	16
5	10	15	20

Questions to ask:

- How many rows?
- How many columns?
- Is the value in each position related to the row number or the column number?

Write a segment of code to produce the following: *Use nested Loops- Nest2*

```
1      1      1      1
2      2      2      2
3      3      3      3
4      4      4      4
5      5      5      5
```

Questions to ask:

- How many rows?
- How many columns?
- Is the value in each position related to the row number or the column number?

Write a segment of code to produce the following: *Use nested Loops – nest3*

```
1      2      3      4
1      2      3      4
1      2      3      4
```

Questions to ask:

- How many rows?
- How many columns?
- Is the value in each position related to the row number or the column number?

Write a segment of code to produce the following: *Use nested Loops – nest4*

```
1
2   2
3   3   3
4   4   4   4
5   5   5   5   5
```

Questions to ask:

- How many rows?
- How many columns?
- Is the value in each position related to the row number or the column number?

Write a segment of code to produce the following: *Use nested Loops – nest5*

```
5      5      5      5      5
4      4      4      4
3      3      3
2      2
1
```

Questions to ask:

- How many rows?
- How many columns?
- Is the value in each position related to the row number or the column number?

Determine if a positive integer is a palindrome.

Does the number read the same in reverse?

Hints (NUMERICAL algorithm)

- What if the number is only one digit?
- How do I reverse the digits in a number?

num = 123

rev = 0

dig = num%10 = 3

rev = 10 * rev + dig = 0 + 3 = 3

num = num/10 = 12

dig = num%10 = 2

rev = 10 * rev + dig = 30 + 2 = 32

num = num/10 = 1

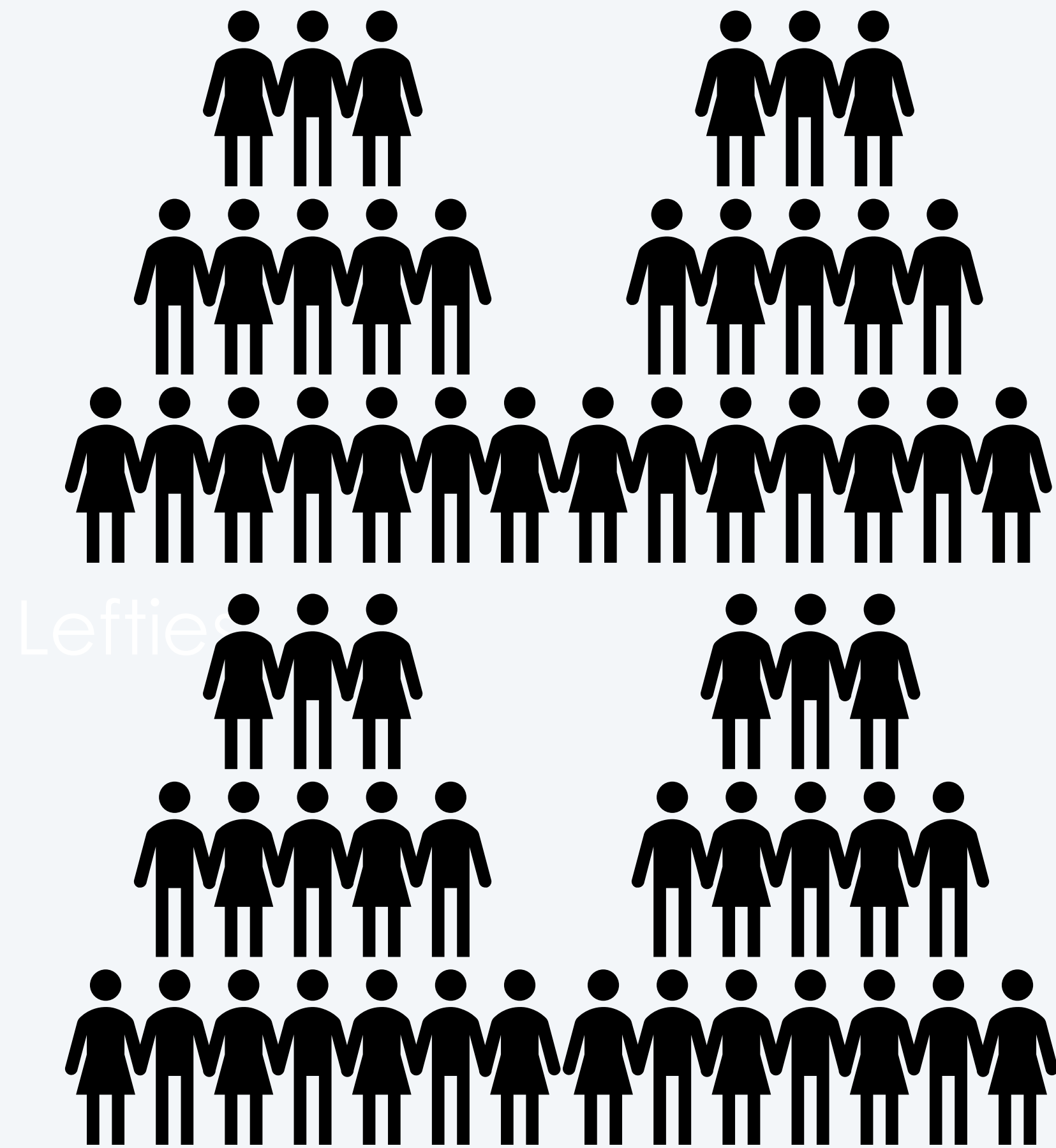
dig = num%10 = 1

rev = 10 * rev + dig = 320 + 1 = 321

num = num/10 = 0

rev = 321

Nesting loops



- I know that 10% of the population is left-handed.
- To test this, I walk around campus and ask folks if they are left-handed or not. I conduct **100 trials** with each trial consisting of 20 people. I am interested in knowing **how many trials** resulted in 10% or more left-handed people in the group of 20.

JUST DO IT!! (*Lefties.java*)

4. Conditionals & Loops

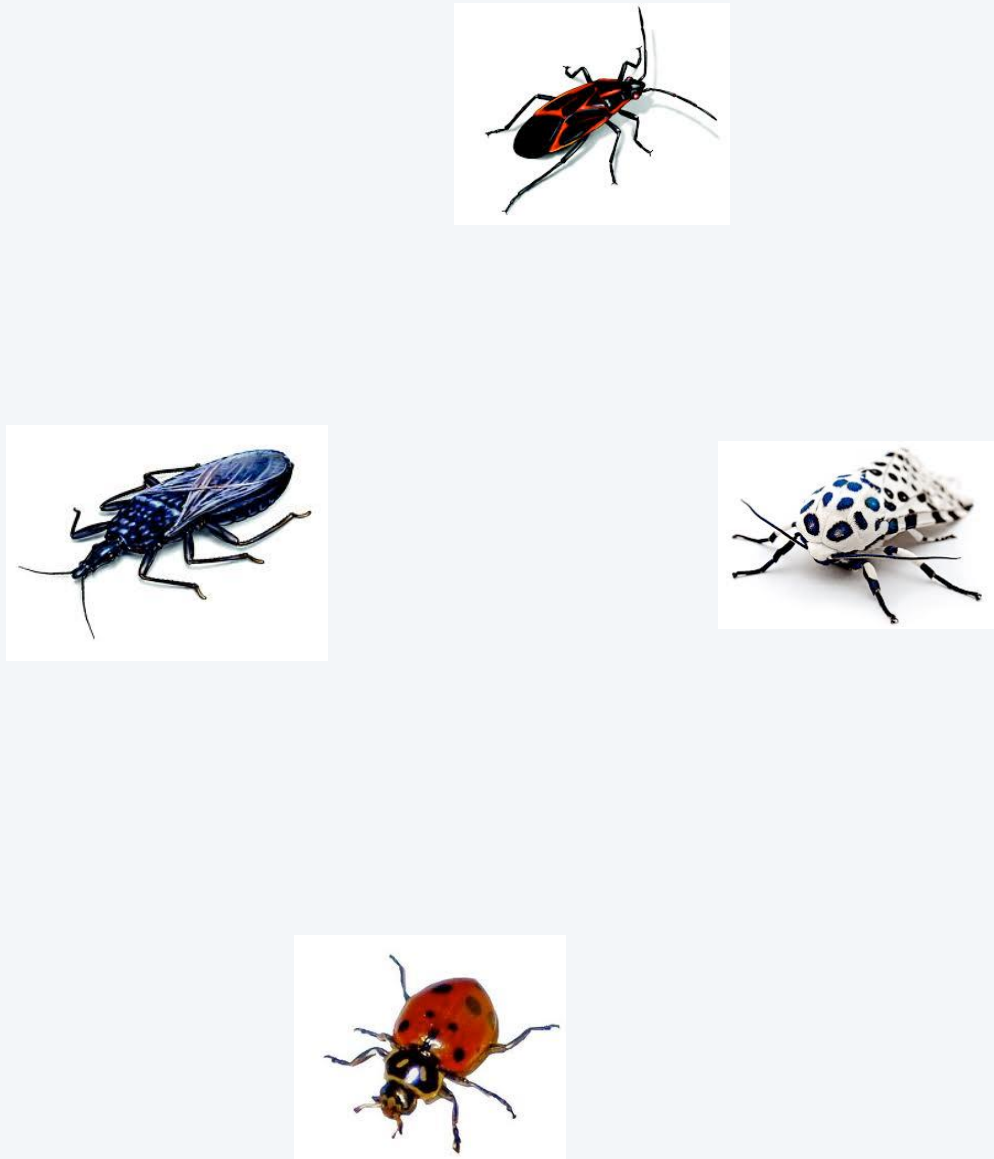
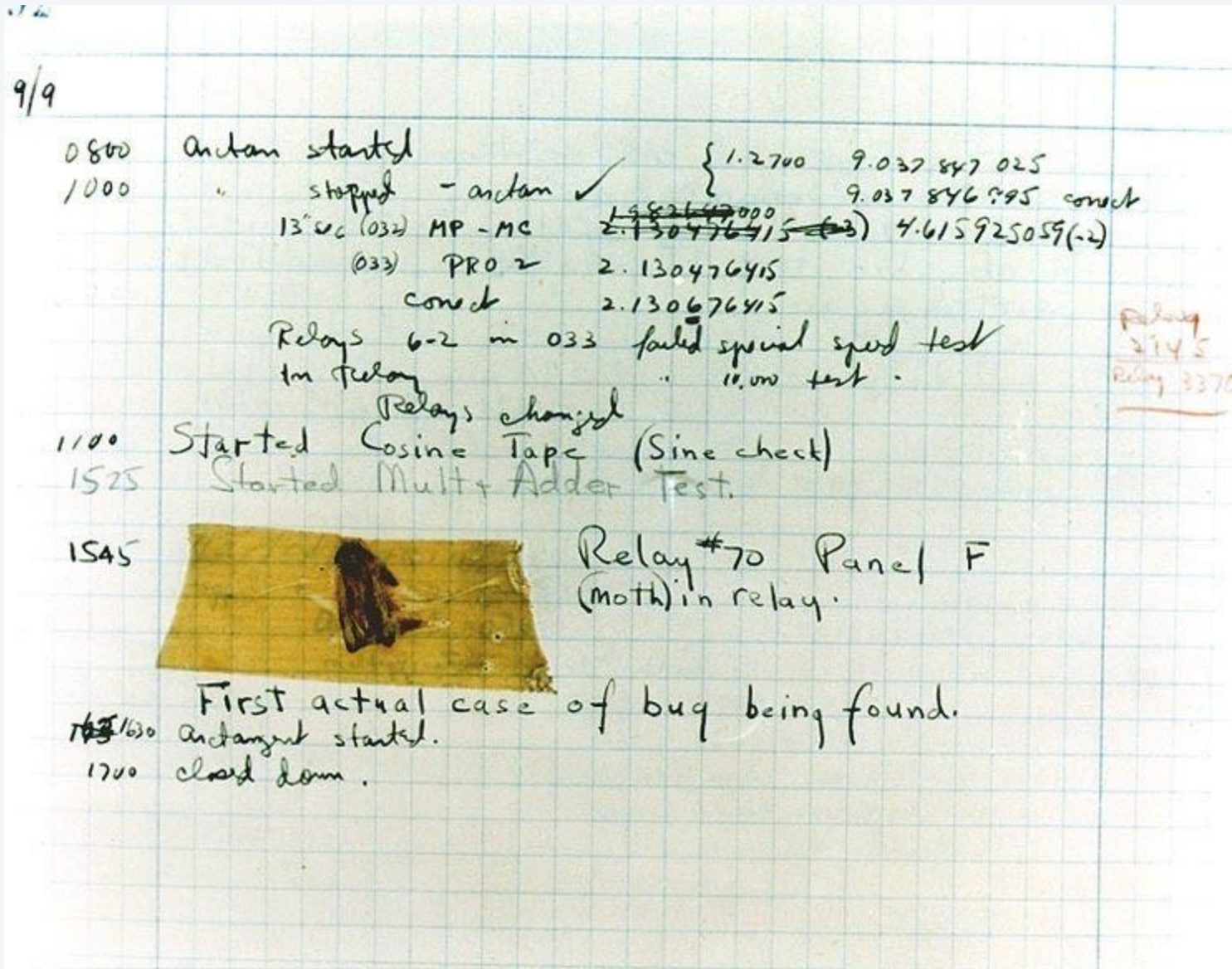
- Conditionals: the if statement
- Loops: the while statement
- An alternative: the for loop
- Nesting
- Debugging

Debugging

is 99% of program development in any programming language, *even for experts.*



Grace Hopper



Q. For each of the variables in the code, identify the scope of each variable

Scope of n is the main program

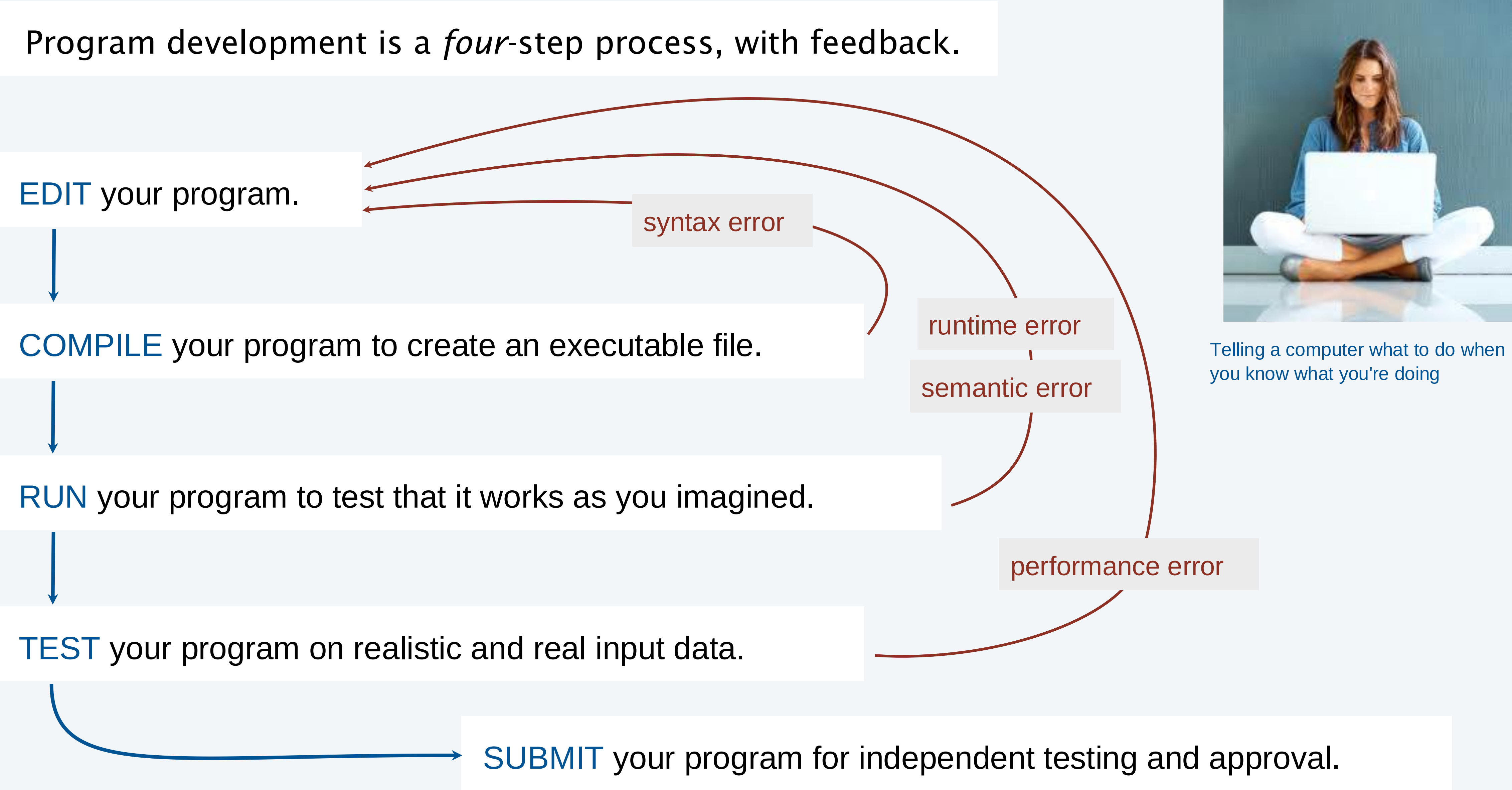
Scope of i is the for-loop body

Scope of num is the while-loop body

```
public class Factors
{
    public static void main(String[] args)
    {
        long n = Long.parseLong(args[0]);
        for ( int i = 2; i <= n/i; i++)
        {
            while (n % i == 0)
            {
                int num = i;
                System.out.print(num + " ");
                n = n / i;
            }
        }
        if (n > 1) System.out.println(n);
        else     System.out.println();
    }
}
```

Caution. Not understanding scope of a variable might lead to many wasted debugging hours

Debugging your program: summary



Craps.... *A Final Challenge*

Involves a while loop and conditionals

Rules for the game: In the game of *Craps*, players roll a pair of dice. Only the sum of the spots matters: a number between 2 and 12. The *roller* does the rolling. Below, *win* or *loss* refers to the roller.

Roller rolls two dice to get the **first sum**

If the **first sum** is 2, 3, or 12, roller loses

Otherwise, if the **first sum** is 7 or 11, roller wins

Otherwise, the **first sum** becomes the **point**

Now keep rolling again and again:

Roller rolls two dice to get the **new sum**

If the **new sum** equals the **point**, roller wins

Otherwise, if the **new sum** equals 7, roller loses

Otherwise, roller rolls again

The above is the simplest form of *street craps*. – *Craps.java*

Image sources

http://playatlantic.com/sites/default/files/good%20looking%20girl%20on%20laptop_0.jpg

http://en.wikipedia.org/wiki/Edsger_W._Dijkstra#mediaviewer/File:Edsger_Wybe_Dijkstra.jpg

<http://pixabay.com/en/hourglass-clock-timer-sand-time-152090/>

Image sources

http://commons.wikimedia.org/wiki/File:Calculator_casio.jpg

<http://en.wikipedia.org/wiki/File:Buzz-lightyear-toy-story-3-wallpaper.jpg>

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2789164/#!po=30.0000> [181e306f1.jpg]

Image sources

<http://www.sciencecartoonsplus.com>

http://en.wikipedia.org/wiki/Isaac_Newton

<http://www.onlinemathtutor.org/help/wp-content/uploads/math-cartoon-28112009.jpg>

Image sources

<http://pixabay.com/en/atlantic-city-ocean-holiday-316301/>

http://en.wikipedia.org/wiki/Christiaan_Huygens#mediaviewer/File:Christiaan_Huygens.jpg

4. Conditionals & Loops

- Conditionals: the if statement
- Loops: the while statement
- An alternative: the for loop
- Nesting
- Debugging

4. Conditionals and Loops

