

# Computer Programming Fundamentals

CS 152

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Time: MWF 10:00-10:50am

[https://handandmachine.cs.unm.edu/classes/CS152\\_Fall2021/](https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/)

**OPEN INTELLIJ  
CREATE A NEW PROJECT**

**OPEN INTELLIJ  
CREATE A NEW PROJECT**

**NAME IT Week4**

**CREATE A NEW JAVA CLASS  
NAME IT Monday**

# CREATE A MAIN METHOD

```
public class Monday {  
    public static void main(String[] args) {  
    }  
}
```

# WHILE LOOPS

# A SIMPLE PROGRAM

```
public static void main(String[] args) {  
    int x = 0;  
    while (x < 10) {  
        System.out.print(x);  
        System.out.print(" ");  
        x = x+1;  
    }  
}
```

0 1 2 3 4 5 6 7 8 9

# WHILE LOOPS

# STRUCTURE of WHILE LOOP in JAVA

```
key word “while”  
boolean expression  
in parentheses  
  
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

body of while loop  
inside curly brackets

# SIMILAR TO IF

The diagram illustrates the structure of an if statement in Java. The code is:

```
if (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

Annotations with pink arrows point to specific parts of the code:

- A pink arrow points to the word "if" with the label "key word ‘if’".
- A pink arrow points to the expression "(x < 10)" with the label "boolean expression in parentheses".
- A pink arrow points to the curly braces "{}" enclosing the body of the loop with the label "body of while loop inside curly brackets".

# HOW A WHILE LOOP WORKS

while the boolean expression is true

```
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

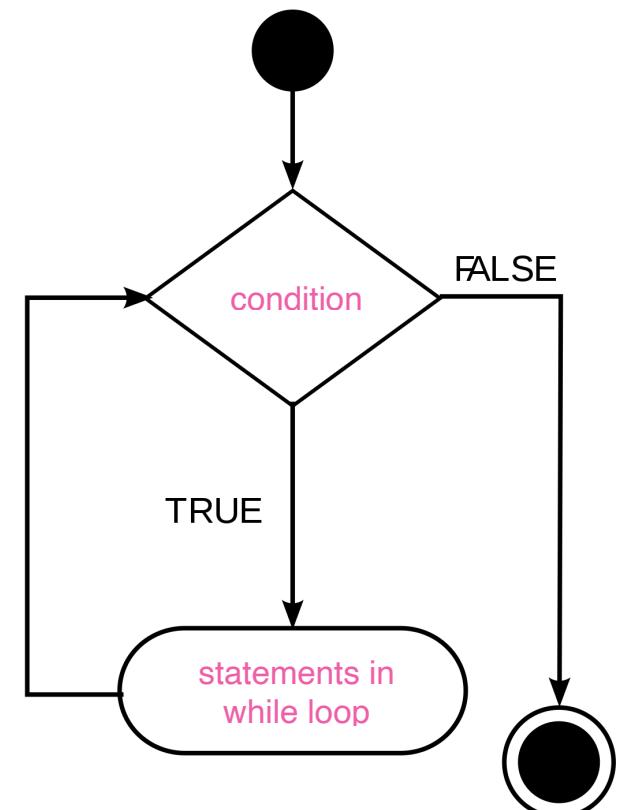
these statements will be executed

# HOW A WHILE LOOP WORKS

while the boolean expression is true

```
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

these statements will be executed

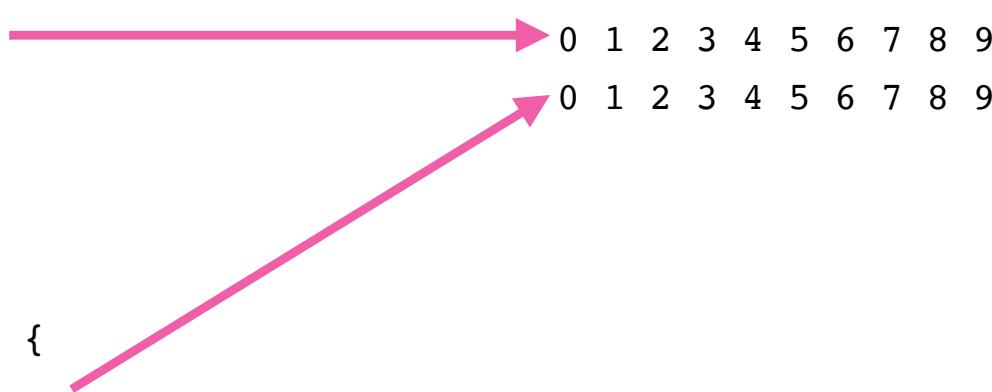


questions?

# FOR LOOPS

# A SIMPLE PROGRAM

```
public static void main(String[] args) {  
    int x = 0;  
    while (x < 10) {  
        System.out.print(x);  
        System.out.print(" ");  
        x = x+1;  
    }  
  
    System.out.println();  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```



The diagram illustrates the execution of the Java code. The first part of the code uses a while loop to print integers from 0 to 9, separated by spaces. The output is shown as a sequence of numbers: 0 1 2 3 4 5 6 7 8 9. A pink arrow points from the line 'System.out.print(x);' to this sequence. The second part of the code uses a for loop to print the same sequence of numbers. Another pink arrow points from the line 'System.out.print(i);' to the same sequence of numbers.

# STRUCTURE of FOR LOOP in JAVA

key word “for”

(declare variable; test variable; change variable)

```
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

body of for loop  
inside curly brackets

# WHILE vs FOR

```
int x = 0;  
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

```
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

# WHILE vs FOR

```
int x = 0;  
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

```
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

# WHILE vs FOR

```
int x = 0;  
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

```
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

# WHILE vs FOR

```
int x = 0;  
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

```
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

# FOR IS SAFER. WHY?

```
int x = 0;  
while (x < 10) {  
    System.out.print(x);  
    System.out.print(" ");  
    x = x+1;  
}
```

```
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

protection from accidental infinite loops

# NOTE ABOUT ADDITION

```
i++;
```

is the same as

```
i = i+1;
```

```
for (int i = 0; i<10; i++) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

# VARIABLES AND SCOPE

# VARIABLES AND SCOPE

```
for (int i = 0; i<10; i++) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

note how we use the variable i  
inside of the for loop

# VARIABLES AND SCOPE

```
for (int i = 0; i<10; i++) {  
    System.out.print(i);  
    System.out.print(" ");  
}  
System.out.println(i);
```

but, we can't use it  
outside of the for loop

```
java: cannot find symbol  
      symbol: variable i
```

# **ALL VARIABLES HAVE A “SCOPE”**

The part of the program in which they can be accessed

Determined by { }

They can only be used/accessed in the { } where they were declared.

# VARIABLE SCOPE

```
public static void main(String[ ] args) {  
    int x = 0;  
    while (x < 10) {  
        int y = 7;  
        System.out.print(x + y);  
        System.out.print(" ");  
        x = x+1;  
    }  
}
```

scope of x determined  
by these {}

x can be accessed  
anywhere inside them

including inside the while  
{} { }

# VARIABLE SCOPE

```
int x = 0;  
while (x < 10) {  
    int y = 7;  
    System.out.print(x+y);  
    System.out.print(" ");  
    x = x+1;  
}
```

scope of y determined  
by these {}

y can be accessed  
anywhere inside them

can't access y  
outside of them

# VARIABLE SCOPE

```
for (int i = 0; i<10; i++) {  
    int x = 0;  
    System.out.print(i);  
    System.out.print(" ");  
}
```

scope of i determined  
by these { }

can't access i  
outside of them

# VARIABLE SCOPE

```
for (int i = 0; i<10; i++) {  
    System.out.print(i);  
    System.out.print(" ");  
}
```

scope of i determined  
by these { }

can't access i  
outside of them

questions?

# RANDOM NUMBERS

# IMPORT THE MATH PACKAGE

```
import java.math.*;  
  
public class Monday {  
  
    public static void main(String[] args) {  
        int x = 0;  
        while (x < 10) {  
            System.out.print(x);  
            System.out.print(" ");  
            x = x+1;  
        }  
  
        System.out.println();  
  
        for (int i = 0; i<10; i=i+1) {  
            System.out.print(i);  
            System.out.print(" ");  
        }  
    }  
}
```

# GENERATE SOME RANDOM NUMBERS

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    while (x < 10) {  
        r = Math.random();  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println();  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

0.456664087914635  
0.5522273118627072  
0.9560459464748382  
0.9884410199488026  
0.180125784213781  
0.44572214756175343  
0.667412887988518  
0.2881990840791976  
0.9968151549045745  
0.26332520409160365

# Math.random()

name of class “Math”

```
Math.random( );
```

name of method, random()

returns a number (a double) that is greater than or equal to 0 and less than 1.

<https://docs.oracle.com/javase/8/docs/api/java/lang/Math.html>

# WHAT IS THE LARGEST r CAN BE?

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    while (x < 10) {  
        r = Math.random();  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println();  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

0.9999999999999999

# WHAT IS THE LARGEST r CAN BE?

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    while (x < 10) {  
        r = Math.random() * 10;           9.999999999999999  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println();  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

questions?

**LET'S COUNT HOW MANY  
TIMES WE GET A NUMBER  
THAT IS GREATER THAN 5**

# COUNTING $r > 5$

```
public static void main(String[] args) {
    double r;

    int x = 0;
    int count = 0;
    while (x < 10) {
        r = Math.random() * 10;
        System.out.println(r);
        x = x+1;
    }

    System.out.println();

    for (int i = 0; i<10; i=i+1) {
        System.out.print(i);
        System.out.print(" ");
    }
}
```

# COUNTING $r > 5$

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count);  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

**RUN THE PROGRAM A FEW TIMES**

# USING + IN PRINT STATEMENTS

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

questions?

# STRUCTURE OF OUR PROGRAM

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# STRUCTURE OF OUR PROGRAM

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# STRUCTURE OF OUR PROGRAM

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# PROBLEM??

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    while (x < 10) {  
        int count = 0;  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# PROBLEM??

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    while (x < 10) {}  
        int count = 0;  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
}  
  
System.out.println(count + " numbers were greater than 5");  
  
for (int i = 0; i<10; i=i+1) {  
    System.out.print(i);  
    System.out.print(" ");  
}  
}
```

Variable scope.  
Variable count declared  
in while loop.  
Can't be used outside of it.

# STRUCTURE OF OUR PROGRAM

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# STRUCTURE OF OUR PROGRAM

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1) {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# PROBLEM??

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1); {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

# PROBLEM??

```
public static void main(String[] args) {  
    double r;  
  
    int x = 0;  
    int count = 0;  
    while (x < 10) {  
        r = Math.random() * 10;  
        if (r > 5) {  
            count = count+1;  
        }  
        System.out.println(r);  
        x = x+1;  
    }  
  
    System.out.println(count + " numbers were greater than 5");  
  
    for (int i = 0; i<10; i=i+1); {  
        System.out.print(i);  
        System.out.print(" ");  
    }  
}
```

Misplaced semicolon  
Creates logic problem +  
Creates scope problem  
Variable i no longer in  
scope in for loop

questions?