The General Form of an **if** Statement:

```
if («test»)
{ «list of statements»
}
```

Examples:

```
if (karel.canPickThing())
{ karel.pickThing();
  karel.turnLeft();
}

if (this.frontIsClear())
{ this.move();
}
```

The General Form of a **while** Statement:

```
while («test»)
{ «list of statements»
}
```

Examples:

```
while (karel.canPickThing())
{ karel.pickThing();
  karel.turnLeft();
}

while (this.frontIsClear())
{ this.move();
}
```

While Loops Refresh

As we shall soon see, **while** loops are commonly used for **counting** and implementing **counters** inside of programs

While(<<BooleanExpression>>)
{ <<statement>>
}

While(<<BooleanExpression>>)
{
<<statement>>
<<statement>>
<<statement>>
}

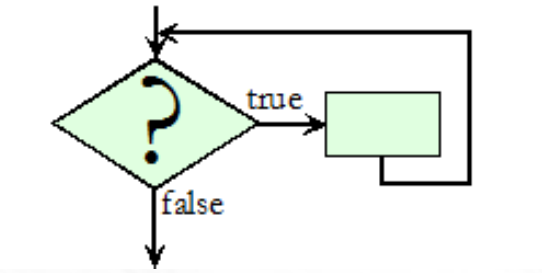
The General Form of a **while** Statement:

```
while («test»)
{ «list of statements»
}
```

Examples:

```
while (karel.canPickThing())
{ karel.pickThing();
  karel.turnLeft();
}

while (this.frontIsClear())
{ this.move();
}
```



Temporary Memory, Variables

Chapter 5.2 – Temporary Variables (Local Variables)

Data Types

A **data type** is nothing but the type of the data that will be stored in memory.

Different data types require smaller or larger amounts of **storage capacity**, so when you **declare** a data type you are telling the program upfront the size of the storage container you want to set aside in memory. The datatype also dictates how the values in that container are interpreted.

Example by Analogy:
If you want to store a quart of water, then you need a container that will *hold a quart*. If you want to store a gallon of water, then you need a container that will *hold a gallon*. In both cases, you need the container before you can put the water in it. *Declaring a data type is getting the container ready before you put anything in it—first the container, then what goes into it.*

byte **short** **int** **long**

Temporary Memory, Variables

```
int num = 0;          // int – gets the container ready
                      // num – tells which container  to use
                      // 0 – integer that is put into the container

int numThings = 0, numStuff = 1;
```

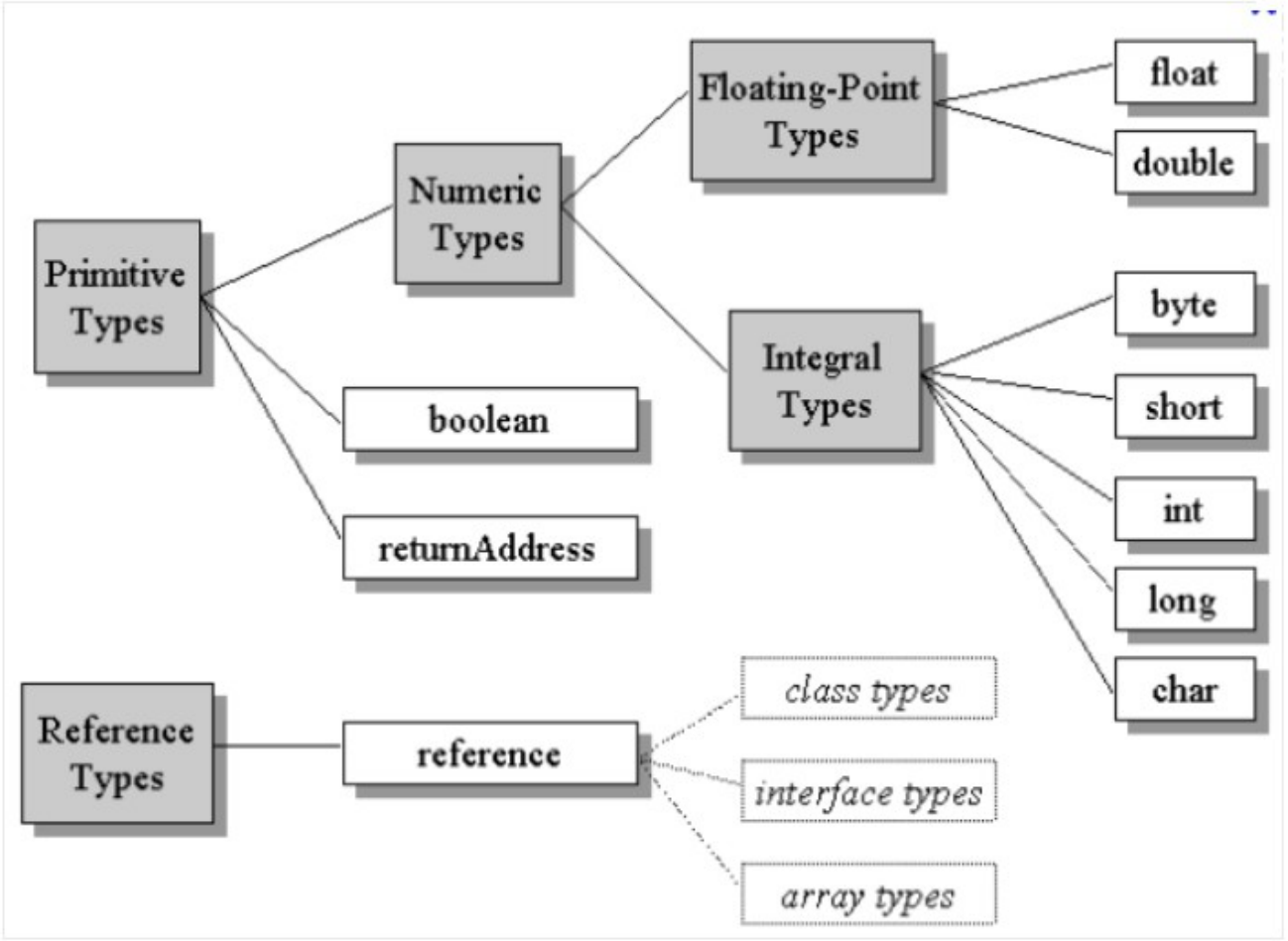
Data Types

A **variable** in Java MUST have certain **type** *associated* with it which tells us what kind of data a variable can store, and whether that storage requires a small "container" in memory or a larger "container" (i.e., number of bits making up the storage space).

Data Types in the *Java Programming Language* are classified into two main groups:

- **Primitive Data Types**
  - We will discuss Primitive Data Types briefly now
- **Reference Data Types**
  - We will discuss Reference Data Types later in the Quarter

Classification of Data Types in Java Programming Language



Binary (A Quick Look)

Byte (8 Bits)

8	7	6	5	4	3	2	1

128	64	32	16	8	4	2	1	
0	0	0	0	0	0	0	0	**0**

128	64	32	16	8	4	2	1	
1	1	1	1	1	1	1	1	**255**

Signed vs. Unsigned

"Two's Complement"

Binary Representation

128	64	32	16	8	4	2	1	
0	0	0	0	0	0	0	0	**0**

BYTE (Signed)

128								
1	0	0	0	0	0	0	0	**-128**

	64	32	16	8	4	2	1	
0	1	1	1	1	1	1	1	**127**

BYTE (Unsigned)

128	64	32	16	8	4	2	1	
1	1	1	1	1	1	1	1	**255**

Primitive Data Types

- Primitive data types are built into the Java language and are not derived from classes.
- There are 8 Java primitive data types:

- **byte** -128 to 127
- **short** -32,768 to 32,767
- **int** -2,147,483,648 to 2,147,483,647 (billion)
- **long** -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 (quintillion)
- **float** 127 digits after the decimal point
- **double** 1023 digits after the decimal point
- **boolean**

  True or False
- **char**

  Alphabetical characters stored as an ASCII numerical value
  (e.g., 'A' is 65, 'B' is 66)

Integer Data Types

- **`byte`**, **`short`**, **`int`**, and **`long`** are all integer data types.
- They can hold whole numbers such as 5, 10, 23, 89, etc.
- Integer data types cannot hold numbers that have a decimal point in them. (You need a **`float`** or **`double`** for that.)
- Integers embedded into Java source code are called *integer literals*. (You can also have *character literals*, such as 'a'.)

Variable Declarations

- Variable Declarations take the following form:
  - *<DataType> VariableName;*
    - `byte inches;`
    - `short month;`
    - `int speed;`
    - `long timeStamp;`
    - `float salesCommission;`
    - `double distance;`

Declaring an Integer Variable

Declaring an integer variable:

```
int counter = 0;
```

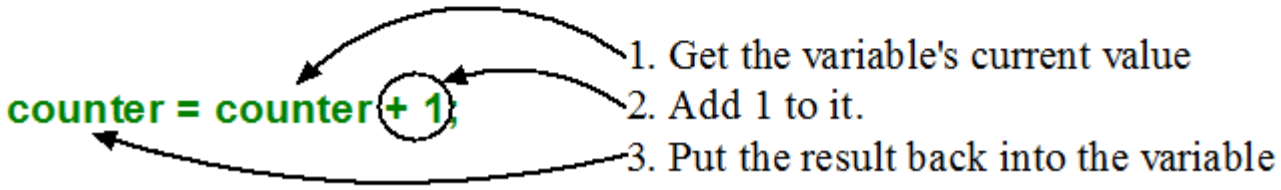
Using a variable's value:

```
if (counter == 0)
{ ...
}
```

```
while (counter > 0)
{ ...
}
```

```
this.myMethod(counter);
```

Changing a variable's value:



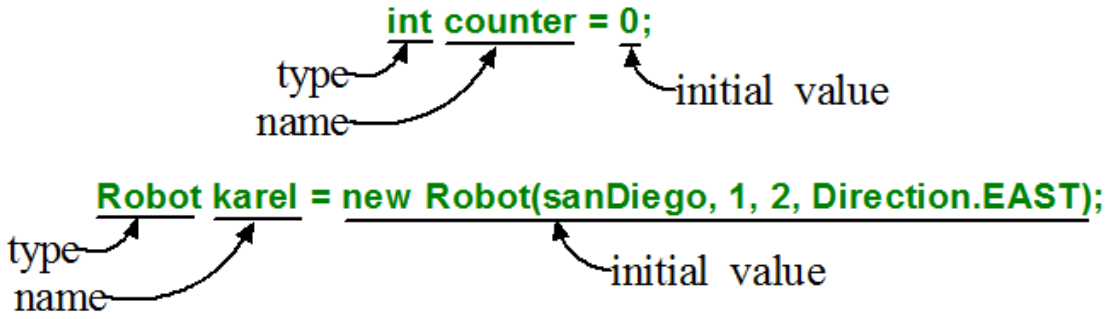
To Summarize:

Temporary Variables (Local Variables)

Temporary variables

- are also called "local variables."
- occur inside a method.
- store a value until the end of the method.
- have a type such as **Robot** or **int** that determines what kind of values may be stored in the variable.
- must be given an initial value.

Two examples:



A Quick Word About **Scope**

Scope is the region of the program in which a variable may be used.

Examples:

```
public void method()
{ int tempVar = 0;
  «statements»
}
```

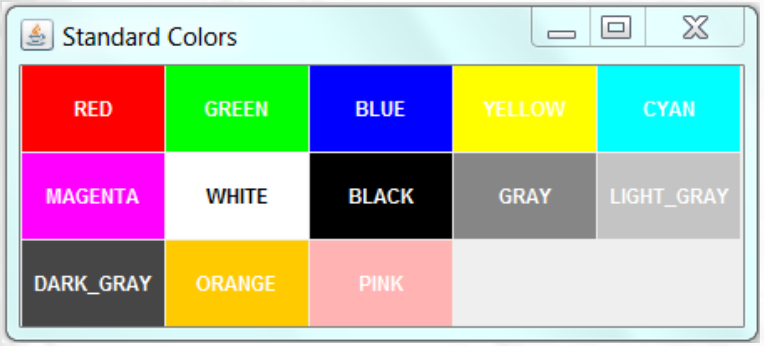
```
public void method()
{ «statements»
  int tempVar = 0;
  «statements»
}
```

```
public void method()
{ if («booleanExpression»)
  { «statements»
    int tempVar = 0;
    «statements»
  }
  «statements»
}
```

```
public void method()
{ «statements»
  int tempVar = 0;
  while («booleanExpression»)
  { «statements»
  }
  «statements»
}
```

Rule: Use a variable from where it is declared to the end of the smallest enclosing block (set of braces).

FYI (Just for fun)



If you want to give the Robot a label when the program runs, then you will have to do something like this:

```
mary.setLabel("Mary");
```

If you want to change the Robot's color, then you will have to include this at the top of your file

```
import java.awt.Color;
```

And then do something like this:

```
mary.setColor(Color.ORANGE);
```

Also, if you want to change the color of a wall, first give the wall a name, then color it according to that name:

```
Wall w1 = new Wall(bothell,2,1,Direction.NORTH);
w1.setColor(Color.BLUE);
Wall w2 = new Wall(bothell,2,2,Direction.NORTH);
w2.setColor(Color.GREEN);
```