



Java 2: Variables

The heart of computing



What Are Variables?

Variables are elements that can take on dynamic values. Variables are most used in programming since it adds a way to store values and manipulate them. Variables are also all given a type. The simplest types are called **Primitives** and those will be covered on the next slide. More advanced types come in the form of Objects, but we're still not ready for those.

For now consider a variable a unit that holds information, and we can manipulate that information in our program.



Primitive Data Types

Primitives are in almost all programming languages. Here are some examples

Abbreviation	Name	Size	Input
int	Integer	4 Bytes	-2147483648 to 2147483647
char	Character	1 Byte	Any single character
float	Float	4 Bytes	1.40129846432481707e-45 to 3.40282346638528860e+38 +/-
double	Double	8 Bytes	4.94065645841246544e-324d to 1.79769313486231570e+308d +/-
short	Short	2 Bytes	-32,768 to 32,767
long	Long	8 Bytes	-2^{63} to $2^{63}-1$.



Primitives, explained

The main two primitives you will use are int, double and char. You may be wondering, *Where is String?* Well, String is not a Primitive, and is technically an **Array** of chars. A String is technically an Object, but since it's used so much and so often, it is included by default in Java. That being said, we will learn something about String later that may shock you, but that's for another lesson. The main variables are int to store whole numbers, double to store numbers with a decimal such as real numbers, and char to store individual characters.

Lets cover something very important about variables... math...



Math (AKA Where People Stop)

It should come as no surprise that almost all of computing requires math. Right now the math is simple, but as you progress your skill, more difficult math will start to apply. For now lets go over basic math.

$+$, $-$, $*$, $/$, $\%$ are all basic operations you can apply to ints, doubles, and even chars.

These should all look familiar, except one is not what you expect. $\%$ does not mean “Percent” in programming, it means modulo. Modulo is a special operator that returns the remainder of a division. For example if we did $100 \% 105$ we get 5, since 10 goes into 100 10 times, with a remainder of 5. This is extremely useful, and you will see why soon.



A Basic Program

Let's modify our program from before to have some variables, this will also show you how variables are **Declared** in a program.

```
public class HelloWorld{
    public static void main(String args[]){
        System.out.println("Hello, World!");
        int x = 1;
        int y = 2;
        char z = 'z';
        double a = 1.5;
    }
}
```



Variable Declaration

As you can see in the previous slide, we declare things using this template

```
Type Name = Value;
```

Where type is our data type (int, float, double, char, long, short, etc) name is our variable name (remember names are case sensitive!) and finally value is the value we assign to the variable.

You may also notice everything ending in ‘;’ You can think of a semicolon as a period for programming, since it essentially says “this is the end of the instruction.” Let’s modify our program to do some math, and output it to the console.



Math :(

```
public class HelloWorld{  
    public static void main(String args[]){  
        int x = 1;  
        int y = 2;  
        int z = x + y;  
        System.out.println(z);  
    }  
}
```




Data Types Can Change

First notice we can declare a variable based on the addition of those two variables. This is true for anything and is how we would store the result just make sure you use the correct data type to store the result! The other thing is that we put 'z' into our "println" statement. You may be wondering *Didn't we say that was only for Strings?* And you would be right. Java though is smart, and it can see that you want to print the value of 'z', so it converts 'z' to a String temporarily for you.

With this you have now discovered Math! It may not seem like it, but that's the most important part of programming.



Next: Conditions

We now have learned how to declare variables and use them to do math. Remember too that you don't have to always use variables in your math, you can even use numerical values. Imagine you wanted a specific value below another variable, you could do something like

```
int z = x - 5;
```

Like last time, experiment! Try the other operators, data types, and more. See how chars interact with math and how their output is influenced. All chars are based on ASCII, so keep that in mind!

Next we will talk about conditional statements, which is essentially the decision making of your program.



Definitions

Primitive - A data type that has been around since the beginning, and is typically in every programming language

Array - A section of continuous memory that holds variables

Declare - Stating the existence of a variable