Java: Variables and Data Types

Variables and Data Types are two important concepts in the Java programming language. "Variables" are terms that represent a given piece of data, whether from the user or hard coded in the program. A "Data Type" refers to the category the programmer intends to assign to a particular piece of data. This handout will further explain what each of them are, how they work, and when to use them.

Variable Guidelines/Rules

The process of creating variables with data is referred to as "assignment." A variable assignment usually consists of a name, followed by an equal sign, =, and the value assigned by the programmer. The data is not actually assigned to the variable itself, but rather the variable is a reference to the given data. Once assigned, variables can have a wide variety of characteristics, however, there are a few restrictions.

There are guidelines that should be followed to produce a variable that is efficient for a program. For example, when naming a variable, it is important to ensure that the name is meaningful for the data to which it is assigned; otherwise, the program might be confusing to another programmer if they need to review the code later. The following guidelines should be used for variable names:

- Names can contain letters, digits, underscores, and dollar signs.
- Names must begin with a letter.
- Names should start with a lowercase letter, and it cannot contain whitespace.
- Names can also begin with $ and _.
- Names are case sensitive ("myVar" and "myvar" are different variables).
- Reserved words (like Java keywords, such as int or boolean) cannot be used as names.

Example:

```
9      //variableName = value;
10       int num1 = 3;
11       int num2 = 12;
12
13       int product = num1 * num2;
14
```

The code in italicized font written after the two forward slashes (line number 9) is called a "comment." Comments are used to explain the programmer's intention or the intended function of the line(s) of code. The comments ignored by the compiler when the code is written and can be helpful when a programmer wants to review the purpose of their original code. Comments are also useful if another programmer wants to look at the program and understand how it works.

In the example code, there are three variables. Two of them are assigned values directly, and the third is assigned the value of the first two multiplied together. If the programmer decided to print the third variable, the number 36 would be displayed.

Data Types

Data Types are crucial and specific to the Java programming language. Every variable and method header requires a data type, and the different types can vary. For example, there is a difference between "Seven," 7, and 7.0, which are the data types String, int (integer), and double (floating-point number).

Data types are used with variables to let the computer know how to process given data. The creation of a variable with a data type is known as a declaration. If the programmer wants to request a number from the user, they will use either the int or double data types, but if they required a sentence or another series of characters, then they would use the String data type.

Different Data Types and Their Uses

A table of different data types is listed below that includes examples of how they are used. Below the table is a list of the common data types and their definitions.

Example	Data Type
String x = "Hello World";	String
char x = 'A';	char
int x = 20;	int
double x = 20.5;	double
boolean x = true;	boolean
String[] x = {"apple", "banana", "cherry"};	array

String Data Type is used when the programmer wants the data to be represented as exact words that are either hard coded into the program or gained from the user. A String data type is always enclosed in quotation marks (i.e., "apple").

Char Data Type is used as a miniature version of a String. It is used when the user only wants to represent a single character, and it is always enclosed in single quotation marks (i.e., 'a')

int (Integer) Data Type is used when the programmer wants the data to be represented by a whole numerical number.

double Data Type is used similarly to the int data type, except instead of being represented as a whole number, the data would be represented by a decimal or floating-point number.

boolean Data Type is used when the programmer wants only two possible answers, which are automatically labeled as "true" and "false."

array Data Type is used to represent and organize a series of data, whether they are numbers, letters, or words, and assign them to a single variable.

Example:

```
9      //variableName = value;
10     //System.out.printIn(variableName);
11
12      String testVariable = "Hello";
13      System.out.printIn(testVariable);
14
15      Int testVariable2 = 12;
16      System.out.printIn(testVariable2);
```

Not only are variables important when writing code, but declaring the desired variable type is also an important concept to keep in mind. Doing so, specifies how to store or display the value(s) when the program reads it, which makes the whole code easier to understand. The code in the example will print "Hello" and "12" respectively, and since "Hello" is a String, and 12 is an integer, the data types String and int are used.

The Academic Center for Excellence (ACE) offers free on-campus and online tutoring appointments for software design. For further assistance with programming concepts, please call ACE at (540) 891-3017 or email ACE@germanna.edu.