Variables and Data Types

A variable is named storage location in computer memory that can hold data while data types define the kind of data a variable can hold.
Variables and data types are the key base components of any programming language. This is because they represent the data to be manipulated. All operations are performed on variables, which are instances of specific data types.
A variable acts as a symbolic name for a value and allows programmers to work with data in a more meaningful way. Variables, as described in their naming, can change in value during execution as long as the new values are of the same data type as the initialized ones.
Variables have associated memory locations and the data types determine the amount of memory allocated at those locations as illustrated below in the list of data types.
There are several pre-defined data types from which variables can be declared and some of the common ones include:

- **Integers -** Represent whole numbers ranging between -2^31 to +2^31. An integer variable is usually 4 bytes in size.
- **Doubles -** Represents a large range of decimal values with a precision of approximately 15-17 decimal digits. A double variable is usually 8 bytes in size.
- **Floats -** Represents a smaller range of decimal values compared to double variables with a precision of about 7 decimal digits. A float variable is usually 4 bytes in size.
- **Characters -** Represents a single character such as, an alphabet letter, a digit or a special symbol. A character variable is usually 1 byte in size.
- **Booleans -** Represents a truth value, that is, either true or false. A boolean variable is usually 1 byte in size.

Programs use the data stored in variables to perform calculations, alter states based on certain conditions or output manipulated data in different formats as requested by the programmer. Since variables can change with time, programs can be made more complex by implementing logic that changes these variables in a very specific manner based on stated conditions or conditions met when different variables are compared.
This is made possible by operators which either manipulate or compare data from variables. Some types of operators that work on variables include:

- **Arithmetic operators -** Used for mathematical operations. Examples; + , - , / , %
- **Comparison operators –** Compare 2 or more variables and return a boolean result. Examples; == , != , < , > , <= , >=
- **Logical operators -** Perform logical operations to boolean values. Examples; && , || , !
- **Assignment operators –** Used to assign values to variables. Examples; = , += , -= , *= , /=
- **Bitwise operators –** Perform operations on individual bits. Examples; & , | , ^ , ~ , << , >>

Variables and data types are fundamental building blocks in programming which enable programmers and developers to work with a wide range of data and perform operations on it like the ones shown above. When utilized well, reliable computer programs can be created to counter the problems the programs were being developed to solve.