☼Hi, welcome to Basic Program Structure

Part B1: Data Type, Variable.

☼At the end of this lesson, you should be able to:

- Explain the following concepts:

    - Variables

    - Assignment operator

    - Arithmetic operators

    - Basic numeric data types

After that, you should be able to know the theory of how to Use them in coding.☼We will go through them one by one, variables, assignment operator, arithmetic operators, and basic numeric datatypes.

☼Let's look at a familiar scenario, and examine the basic process of finding the travel Distance from A to B.

☼To make the problem easier, we assume that the person can only travel horizontally or vertically. So we count the blocks of the horizontal movement first, which is 4. Then count those of the vertical movement, which is 3. add them together, we get the total travel distance from home to the coffee shop, which is 7.

Sounds super easy. But how do we make computers understand our instructions? When it comes to coding, we have to use computational thinking concepts.

☼In most computer programs, we need data storage to represent and store data temporarily.

In the previous scenario, we have three numbers, 4, 3, and 7,which all link to something. 4 is the distance of the horizontal movement, 3 is the distance of vertical movement, 7 is the total travel distance. Each of this "something", is what we call a variable.

A variable is like a labeled box that contains a value inside it.

This is the abstraction concept in computational thinking. Why is there a need for abstraction? First, we can reuse the names instead of values.

It is Helpful in keeping track of useful information without needing to remember a bunch of numbers.

Let's take an example in our real life. If you were in a food court for lunch, you want to buy chicken rice and a cup of coffee. Can you tell me the exact amount of money in your wallet without taking out your wallet and count the notes and coins? Normally, we do not bother to remember it clearly, we simply take out the wallet, pay our delicious chicken rice, and coffee, then we know that there must be some balance in the wallet. Definitely, the value changes; it is different from the previous one.

This is the model of our daily life, we put something in a container, like water in the cup, our money in our bank accounts they might change from time to time, but it is not necessary for us to remember those numbers.

Second, if we use a name instead of a value, it is easier to change the code later. For example, if the price of chicken rice increases from S$2.8 to S$3.2, instead of changing the value of every occurrence of chicken rice in a program, we only need to change the first occurrence, then all the following occurrences will be affected accordingly.

In the example, *moneyInWallet , priceOfChickenRice, and priceOfCoffee are all variables.*

☼Each variable has its name and value. We take the variable priceOfChickenRice as an example, the name of the variable is priceOfChickenRice, the current value linked to the variable is 2.8

☼From the wallet example, we can see that the value comes not only from a single number, but also from anything that produces a value. E.g., currentmoneyInWallet – priceOfChickenRice – priceOfCoffee returns a value to be the new money amount in wallet., This "anything", which is a combination of values and operations, is called an expression.

Here are some more examples of expressions. A single number 3.14, which is a literal.

- *An expression 100*15, two literals connected by an operator*

- *An expression Result *100, one variable and one literal connected by an operator*

☼Now we have both variable name and value. how do we bind them together? The answer is, Through assignment operator. The '=' sign is the assignment operator, not the equality in mathematics.

Let's look at the following three examples:

When we see x = 7.1, it does not mean the answer of your algebra question, that is x equals to 7.1, It means We have a variable called x and a value of 7.1 assigned to it.

x = 7 * 2 – 5 means We evaluate the value of the expression (7*2 -5), that is 9 and assign a value of 9 to x.

x = x + 7 means We recall the value of x, add 7 to it, and assign the expression result to x.

☼A quick summary of the syntax of Assignment Operator. Left Hand Side is the variable name, Right Hand Side is an expression. To execute the statement, the first step is to evaluate the expression on Right Hand Side, then take the resulting value and assign it to the variable on the Left Hand Side.

How many types of values can we store and process? Quite a few.

☼Let's start with the most commonly used types. Look around. How do we count the number of people? the number of mobile phones? We use whole numbers. In programming, the easiest numeric datatype is integer, it is like any of the whole numbers, including the negative numbers.

As we know, in our daily life, besides prices, a lot of measurement readings like length, width, or height, allows fraction. In programming, float datatype represents real numbers, which allow fractions

So as for data type, we start from Basic Numeric Data Types: Integer and Float.

☼ for operators, we also have something that we are very familiar with, they are the Arithmetic Operators.

The operators are used in common arithmetic since primary school.

Each arithmetic operator is a **mathematical** function that takes one/ two operand(s) and performs a calculation on them

Most computer languages contain a set of such operators that can be used within equations to perform a number of types of sequential calculation

Please note that *Different programming languages support arithmetic operators in different ways.*

☼ We will move on to real coding of Scenario 3 in next lesson. That is to implement the flowchart step by step.

Read in the horizontal travel Distance

Read in the vertical travel Distance

get the sum of the horizontal travel Distance and vertical travel Distance to be the total travel distance

Display travel distance between these two points

☼*In order to prepare for that,* think about the following questions. How many variables should you define? What is the data type of each variable? Do you need assignment operator in your program? Do you need arithmetic operators in your program?

☼ A quick summary of this lesson:

four knowledge points:

Variable contains name and value:

The assignment operator binds the value to variable

The most commonly used numeric datatypes are integer and float

The meaning of arithmetic operators are same as what we have learnt in our math class. However, *different programming languages might support arithmetic operators in different ways.*