Java Programming

— Basics of Java Programming:
Variable · Data type · Arithmetic Operators · Input—

Waseda University

Example

Problem

When height is 173.0cm, calculate the standard weight using the following equation and output the result to the display.

$$\text{Std. wight(kg)} = \text{Height(m)}^2 \times 22$$

Example Program

```
public class Weight{
  public static void main(String[] args){
    System.out.println("Height : 1.73m");
    System.out.println("Standard weight : "+ (1.73*1.73*22) + "kg");
  }
}
```

- When we change the height 173cm to 180cm, in the above program, we must write 180cm instead of all RED parts.
- We understand variables. Variables are used to represent values that may be changed in the program.

Variable and data type (1)

Variables

- A variable as a container or box which contains a value and a characteristic.
- In order to store a value and a characteristic, the program needs to declare a symbol called a variable.
- Every variable has a "**data type**". That is, according to the kind of data stored in a variable, whether integer, real number, or something, we must choose the suitable data type.
- There are variables as shown in the table.
- When we deal with a value, we use `int` type to store integers, we use `double` type to store real numbers (floating point numbers).

Data type name	Content of data type
`boolean`	true/false values (`true` or `false`)
`char`	character
`short`	Integer (narrow range)
`int`	Integer
`long`	Integer (wide range)
`float`	single floating point number
`double`	double floating point number

Variable and data type (2)

Rules of variable name

- Variable names must start with a letter of the alphabet or an underscore. (**Example:** `Abc_def`)
- It cannot start with a number. After second letter, it can use 0 $\sim$ 9. **(Example:** `Abc01`**)**
- A variable name cannot be a **reserved word**.
- Uppercase and lowercase letters are distinguished. **(Example:** `Abc` and `abc`**)**

Reserved words in Java

abstract	boolean	break	byte	case	catch
char	class	const	continue	default	do
double	else	enum	extends	final	finally
float	for	goto	if	implements	import
instanceof	int	interface	long	native	new
package	private	protected	public	return	short
static	strictfp	super	switch	synchronized	this
throw	throws	transient	try	void	volatile
while					

Variable and data type (3)

Declaration of variable

```
int a;
double x, y, z;
```

- Variable names are written after data type.
- We can declare a list of variable names separated by commas ",".

Assignment1

```
a = 11;
```

- To store a value in a variable is called "assignment".
- The equal sign "=" is used as the assignment operator.
- To assign a value to a variable, you must place the variable name to the left of the assignment operator.
- In this assignment statement, 11 is assigned to a.

Variable and data type (4)

Assignment2

```
x = y = z = 12.34;
```

- `12.34` is assigned to all of `x`, `y` and `z`.

Assignment3

```
int a = 11;
```

- Declare an int type variable `a` and give it an initial value at the same time.
- This is called initialization.

Arithmetic operator

Arithmetic operator (int)

```
int a, b, c;
a = 11;

b = a + 4;      → b is 15
c = a * b;      → c is 165
c = c / 10;     → c is 16
c = c % 10;     → c is 6
```

Operators	Arithmetic
+	addition
-	subtraction
*	multiplication
/	division
%	remainder

- When both operands of a division are integers, the result of the division is the quotient and the fractional part is truncated.

Arithmetic operator (2)

Arithmetic operators (int and double)

```
int a = 1234;
double x = 123.4, y;

y = a / 10;        → int / int.        y is 123.0.
y = a / 10.0;      → int / double.     y is 123.4.
y = x / 10;        → double / int.     y is 12.34.
y = x / 10.0;      → double / double.  y is 12.34.
```

- When the computer actually calculates one of these operations, the two values that it combines must be of the same type.
- When calculation of mixed data types (`int` type and `double` type) is performed, the result is `double` type.
- To put "`.0`" like "`10.0`", the value is regarded as `double` type.

Arithmetic operator (3)

Arithmetic operator (Order of operations)

```
int a = 1, b = 2, c;

c = a + b * 3;          → c is 7.
c = (a + b) * 3;        → c is 9.
```

- There is order of operations (operator precedence).
- Parentheses ( ) can be nested, in which case the expression in the inner parentheses is evaluated first.

Arithmetic operator (Output to a display)

```
double x = 123.0, y = 10.0;

System.out.println(x/y);
```

- We can use arithmetic operations in `println`.

Example Program using variables

Problem

When height is 173.0cm, calculate the standard weight using the following equation and output the result to the display.

$$\text{Std. wight(kg)} = \text{Height(m)}^2 \times 22$$

Example Program

```
public class Weight2{
  public static void main(String[] args){
    double heigh, wight;
    height = 1.73;
    System.out.println("Height :" + height + "m");
    weight = height*height*22;
    System.out.println("Standard weight : "+ weight + "kg");
  }
}
```

[Result]

```
height : 1.73m
Standard weight : 65.8438kg
```

Example Program using variables

Problem

When height is 173.0cm, calculate the standard weight using the following equation and output the result to the display.

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Example program

```
public class Weight2{
  public static void main(String[] args){
    double heigh, wight;
    height = 1.73;
    System.out.println("Height :" + height + "m");
    weight = height*height*22;
    System.out.println("Standard weight : "+ weight + "kg");
  }
}
```

- When we change the value of height in the source file, we must compile it again.
- We'll enable to input a value by a keyboard.

Input by a keyboard (1)

Program to input and output an integer

Example program

```
import java.util.Scanner;

public class TestInput{
  public static void main(String args[]){
    System.out.println("Input an integer");
    Scanner scan = new Scanner(System.in);
    int a = scan.nextInt();
    System.out.println("Inputted integer: "+ a);
  }
}
```

- In this program, we use input method by keyboard in Scanner class.

Input by a keyboard (2)

```
int a = scan.nextInt();
```
: Input an integer

```
double a = scan.nextDouble();
```
: Input a real number

Input an integer

```
System.out.print("Input an integer:");
int a = scan.nextInt();
System.out.println("a =" + a);
```

```
Input an integer: 3
a = 3
```

Input a real number

```
System.out.print("Input a real value:");
double a = scan.nextDouble();
System.out.println("a =" + a);
```

```
Input a real value: 3.1
a = 3.1
```

Example program to input a number by a keyboard

Problem

Input a height(m), calculate the standard weight using the following equation and output the result to the display.

$$\text{Std. weight(kg)} = \text{Height(m)}^2 \times 22$$

Example program

```
import java.util.Scanner;

public class Weight3 {
  public static void main(String[] args)  {
    double height;
    Scanner scan = new Scanner(System.in);
    System.out.print("Input Height (m) : ");
    height = scan.nextDouble();
    System.out.println("Standard weight : "+ (height*height*22) + " kg");
  }
}
```