Set 3: Numeric Operations

Skill 3.1: Declare and/or initialize variables on a single line
Skill 3.2: Apply the fundamental arithmetic operations to int variable types
Skill 3.3: Apply unary operators
Skill 3.4: Apply compound operators
Skill 3.5: Apply PEMDAS to arithmetic operations

Skill 3.1: Declare and/or initialize variables on a single line

Skill 3.1 Concepts

Recall that the assignment operator is the standard equal sign (=) and is used to "assign" a value to a variable.

Consider the following example,

Code

```
int i = 3; //OK. Assigns the value of 3 to i. Notice the direction of data flow.
3 = i; //Illegal. Data does not flow this way.
double p;
double j = 47.12;
p = j; //OK. Assigns the value of j to p. Both p and j are now equal to 47.12
```

It is possible to declare several variables of the same type on one line. In the below example, i, x, y, and z are all declared as int type variables.,

Code

```
int i, x, y, z;
```

We can also declare and initialize variables on one line. In the example below, w and j, are both declared and initialized. g however is just declared.

Code

```
int w = 1000, j = 2000, g;
```

Skill 3.1 Exercise 1

Skill 3.2: Apply the fundamental arithmetic operations to int variable types

Skill 3.2 Concepts

The basic arithmetic operations are as follows,

Operator	Description
+	addition
-	substraction
*	multiplication
/	division
%	modulus

Examples of how each of the above operators can be applied are illustrated below,

Addition	Output

`int x = 1;`
`int y = 2;`
`int z = x + y;//3 is assigned to z`
`x = x + z;//4 is re-assigned to x`
`System.out.println(z);`
`System.out.println(x + y);`
`System.out.println(x + 10);`
`System.out.println(10 + 10);`
	3
	6
	14
	20

Subtraction	Output

`int x = 1;`
`int y = 2;`
`int z = x - y;//-1 is assigned to z`
`x = x - z;//0 is re-assigned to x`
`System.out.println(z);`
`System.out.println(x - y);`
`System.out.println(x - 10);`
`System.out.println(10 - 10);`
	-1
	-2
	-10
	0

Multiplication	Output

`int x = 1;`
`int y = 2;`
`int z = x * y;//2 is assigned to z`
`x = x * z;//2 is re-assigned to x`
`System.out.println(z);`
`System.out.println(x * y);`
`System.out.println(x * 10);`
`System.out.println(10 * 10);`
	2
	4
	20
	100

The below example illustrates how int type variables are treated. If the result of the division is a fraction, the decimal places are "cut off" - *int variable types do not round*.

Division	Output

`int x = 1;`
`int y = 2;`
`int z = y/x;//2 is assigned to z`
`x = z/x;//2 is re-assigned to x`
`System.out.println(z);`
`System.out.println(x/y);`
`System.out.println(x/10);`
`System.out.println(10/10);`
	2
	1
	0
	1

Modulus prints the remainder of a division operation. For example, System.out.println(5%3); will print 2. This is because when 5 is divided by 3, the remainder is 2. Modulus gives the remainder. Modulus also handles negatives. The answer to a%b has the same sign as a. The sign of b is ignored.

Modulus	Output

`int x = 1;`
`int y = 2;`
`int z = x%y;//1 is assigned to z`
`x = x%z;//0 is re-assigned to x`
`System.out.println(z);`
`System.out.println(x%y);`
`System.out.println(x%10);`
	1
	0
	0

Skill 3.2 Exercise 1

Skill 3.3: Apply unary operators

Skill 3.3 Concepts

The unary operators are operations that require only one operand; they perform various operations such as incrementing/decrementing a value by one, negating an expression, or inverting the value of a boolean.

Incrementing a value by 1

The code below illustrates how to increment the variable x by 1

Code

```
int x = 1;
x = x + 1;//x is now 2
```

Incrementing a value by 1 can also be done using the *++* operator,

Code

```
int x = 1;
System.out.println(x++);//1 is printed to the consol, then x is incremented
System.out.println(++x);//x is incremented first, then it's value, 3, is printed to the consol.
```

Output

```
1
3
```

Notice in the above example that *++* can come before or after the variable. If it comes *before* the variable, the variable is first incremented then printed. If it comes *after* the variable, the variable is first printed then incremented.

Decrementing a value by 1

The code below illustrates how to decrement the variable y by 1

Code

```
int y = 10;
y = y - 1;//y is now 9
```

Decrementing a value by 1 can also be done using the -- operator,

Code

`int y = 10;`
`System.out.println(y--);//10 is printed to the consol, then y is decremented`
`System.out.println(--y);//y is decremented first, then it's value, 8, is printed to the consol`

Output
10 8

Notice in the above example that -- can come before or after the variable. If it comes *before* the variable, the variable is first decremented then printed. If it comes *after* the variable, the variable is first printed then decremented.

Skill 3.3 Exercise 1

Skill 3.4: Apply compound operators

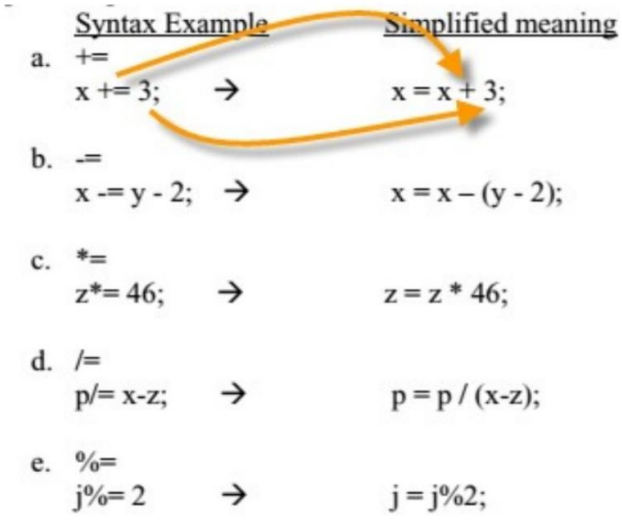
Skill 3.4 Concepts

A compound assignment operator is an operator that performs a calculation and an assignment at the same time. In the below example, x can be re-assigned explicitly using *x = x + 5*; x can also be re-assigned using the addition compound operator.

Code

`int x = 10;`
`x = x + 5;//x is 15`
`x += 5;//x is now 20`

Compound operators can be applied to all the arithmetic operations. How this is done is illustrated below,



Skill 3.4 Exercises 1

Skill 3.5: Apply PEMDAS to arithmetic operations

Skill 3.5 Concepts

The algebra rule, PEMDAS, applies to computer computations as well. (PEMDAS stands for the order in numeric operations are done. P = parenthesis, E = exponents, M = multiply, D = divide, A = add, S = subtract. Actually M and D have equal precedence, as do A and S. For equal precedence operation, proceed from left to right. A mnemonic for PEMDAS is, "Please Excuse My Dear Aunt Sally)

The example below illustrates PEMDAS

Code

```
System.out.println(5 + 3 * 4 - 7);
System.out.println(8 - 5 * 6 / 3 + (5 - 6) * 3);
```

Output

```
10
-5
```

Skills 3.5 Exercise 1