Chapter 2: Java Fundamentals

Operators

Content

Operators

- Operators are special symbols used for:
  - mathematical functions
  - assignment statements
  - logical comparisons
- Examples of operators:
  - 3 + 5   // uses + operator
  - 14 + 5 – 4 * (5 – 3)   // uses +, -, * operators
- Expressions: can be combinations of variables and operators that result in a value

Groups of Operators

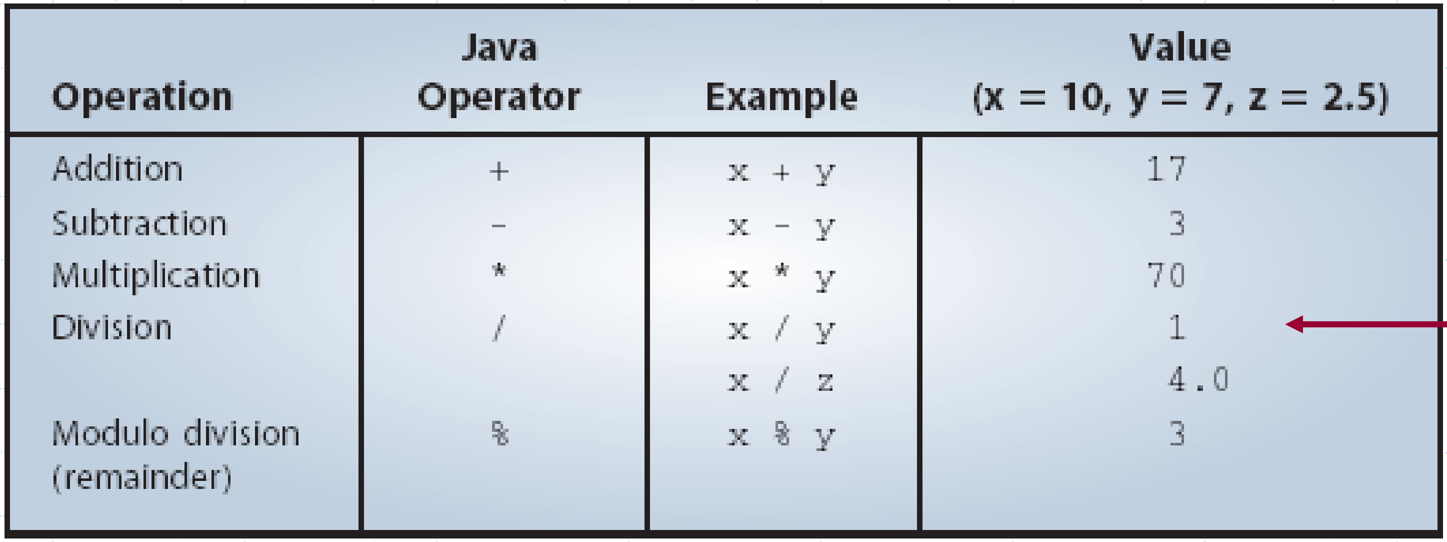
- There are 5 different groups of operators:
  - Arithmetic Operators
  - Assignment Operator
  - Increment / Decrement Operators
  - Relational Operators
  - Logical Operators

Java Arithmetic Operators

Addition	+
Subtraction	–
Multiplication	*
Division	/
Remainder (modulus)	%

Arithmetic Operators

- The following table summarizes the arithmetic operators available in Java.



Operation	Java Operator	Example	Value (x = 10, y = 7, z = 2.5)
Addition	+	x + y	17
Subtraction	-	x - y	3
Multiplication	*	x * y	70
Division	/	x / y	1
		x / z	4.0
Modulo division (remainder)	%	x % y	3

This is an integer division where the fractional part is truncated.

Example

Example of division issues:

10 / 3 gives 3

10.0 / 3 gives 3.33333

As we can see,

- if we divide two integers we get an integer result.
- if one or both operands is a floating-point value we get a floating-point result.

Modulus

- Generates the remainder when you divide two integer values.

  5%3 gives 2   5%4 gives 1

  5%5 gives 0   5%10 gives 5

- Modulus operator is most commonly used with integer operands. If we attempt to use the modulus operator on floating-point values we will garbage!

Order of Precedence

( ) evaluated first, inside-out

*, /, or % evaluated second, left-to-right

+, – evaluated last, left-to-right

Basic Assignment Operator

- We assign a value to a variable using the basic *assignment operator (=)*.
- Assignment operator stores a value in memory.
- The syntax is

```
leftSide = rightSide ;
```

Allways it is a *variable identifier.*

It is either a *literal* | a *variable identifier* | an *expression.*

Examples:

```
i = 1;
start = i;
sum = firstNumber + secondNumber;
avg = (one + two + three) / 3;
```

The Right Side of the Assignment Operator

- The Java assignment operator assigns the value on the right side of the operator to the variable appearing on the left side of the operator.
- The right side may be either:
  - Literal: ex. `i = 1;`
  - Variable identifier: ex. `start = i;`
  - Expression: ex. `sum = first + second;`

Assigning Literals

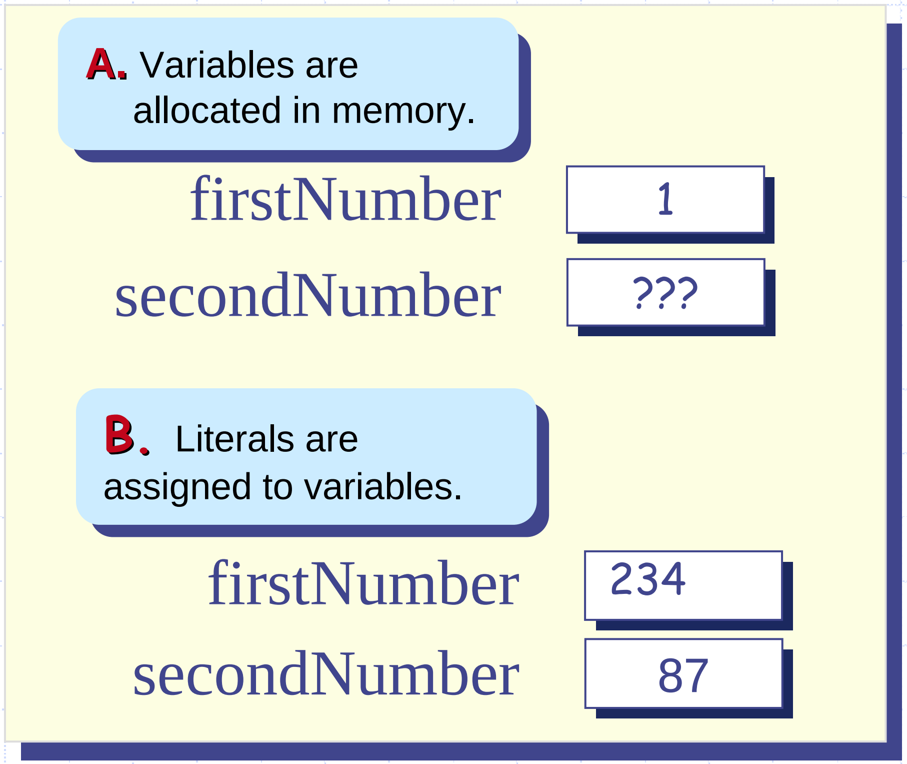
- In this case, the literal is stored in the space memory allocated for the variable at the left side.

A

```
int firstNumber=1, secondNumber;
firstNumber  = 234;
secondNumber = 87;
```

B

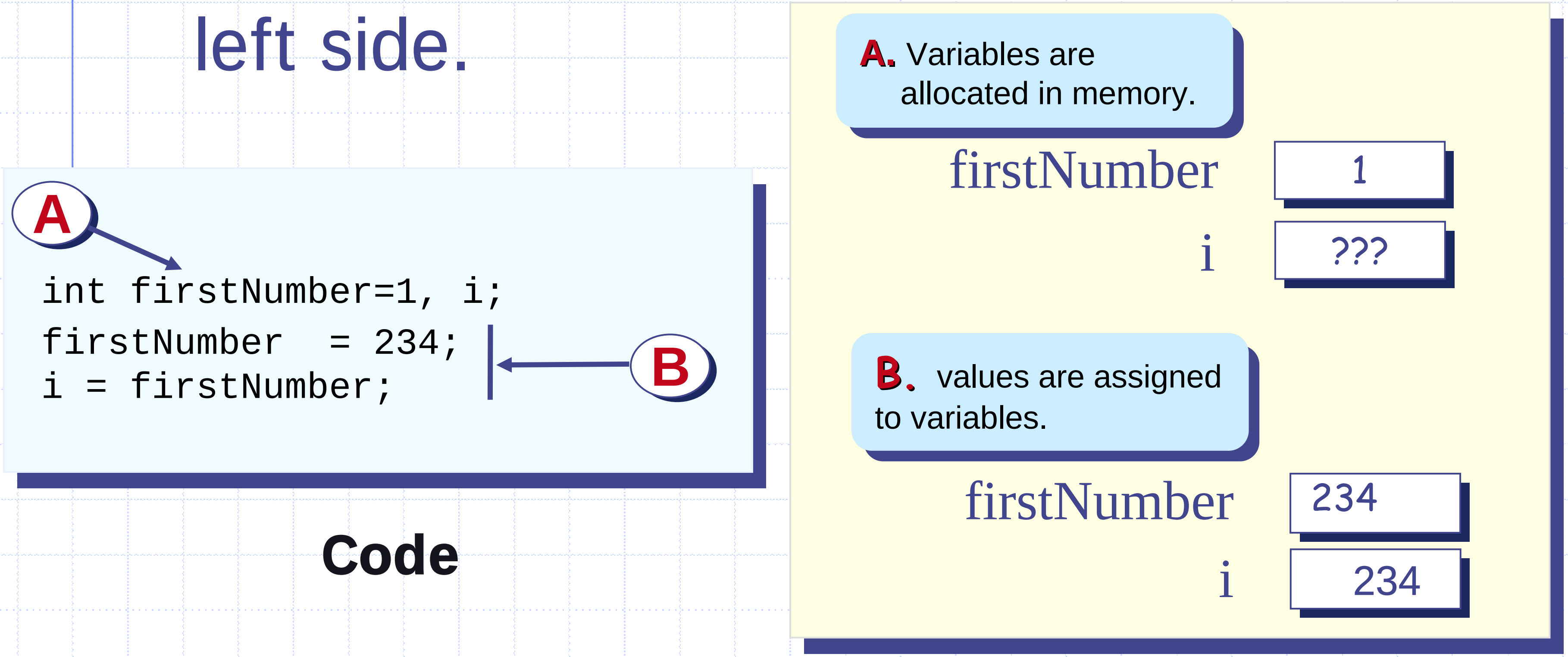
Code


A. Variables are allocated in memory.
firstNumber
1
secondNumber
???
B. Literals are assigned to variables.
firstNumber
234
secondNumber
87

State of Memory

Assigning Variables

- In this case, the value of the variable at the right side is stored in the space memory allocated for the variable at the left side.



```
int firstNumber=1, i;
firstNumber  = 234;
i = firstNumber;
```

A
B
A. Variables are allocated in memory.
firstNumber
1
i
???
B. values are assigned to variables.
firstNumber
234
i
234

Code

State of Memory

Assigning Expressions

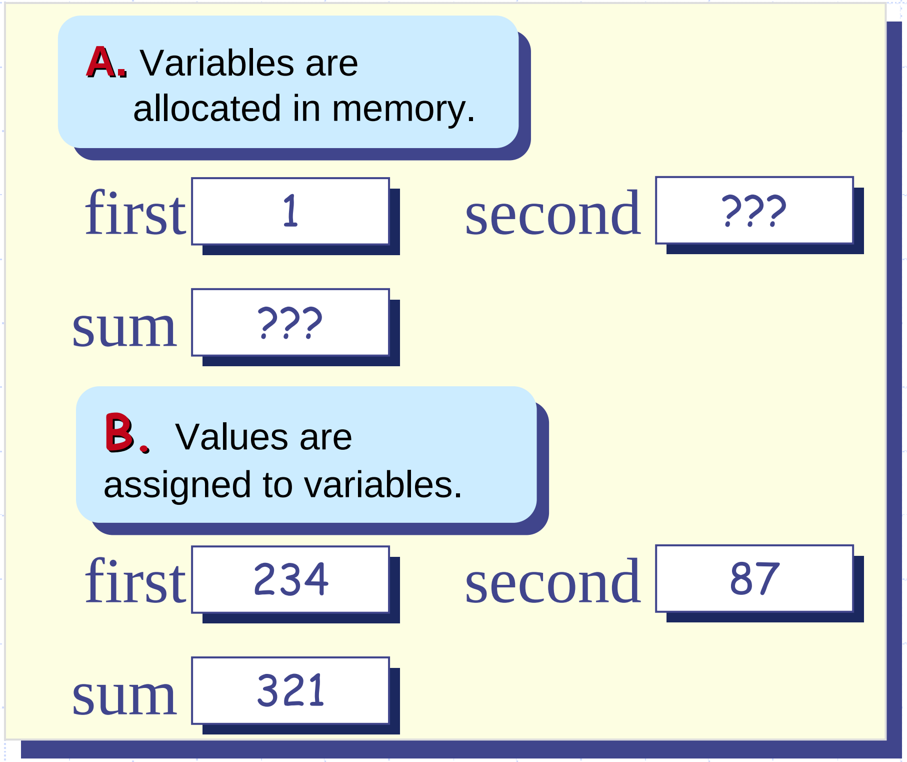
- In this case, the result of the evaluation of the expression is stored in the space memory allocated for variable at the left side.

A

```
int first, second, sum;
first  = 234;
second = 87;
Sum = first + second
```

B

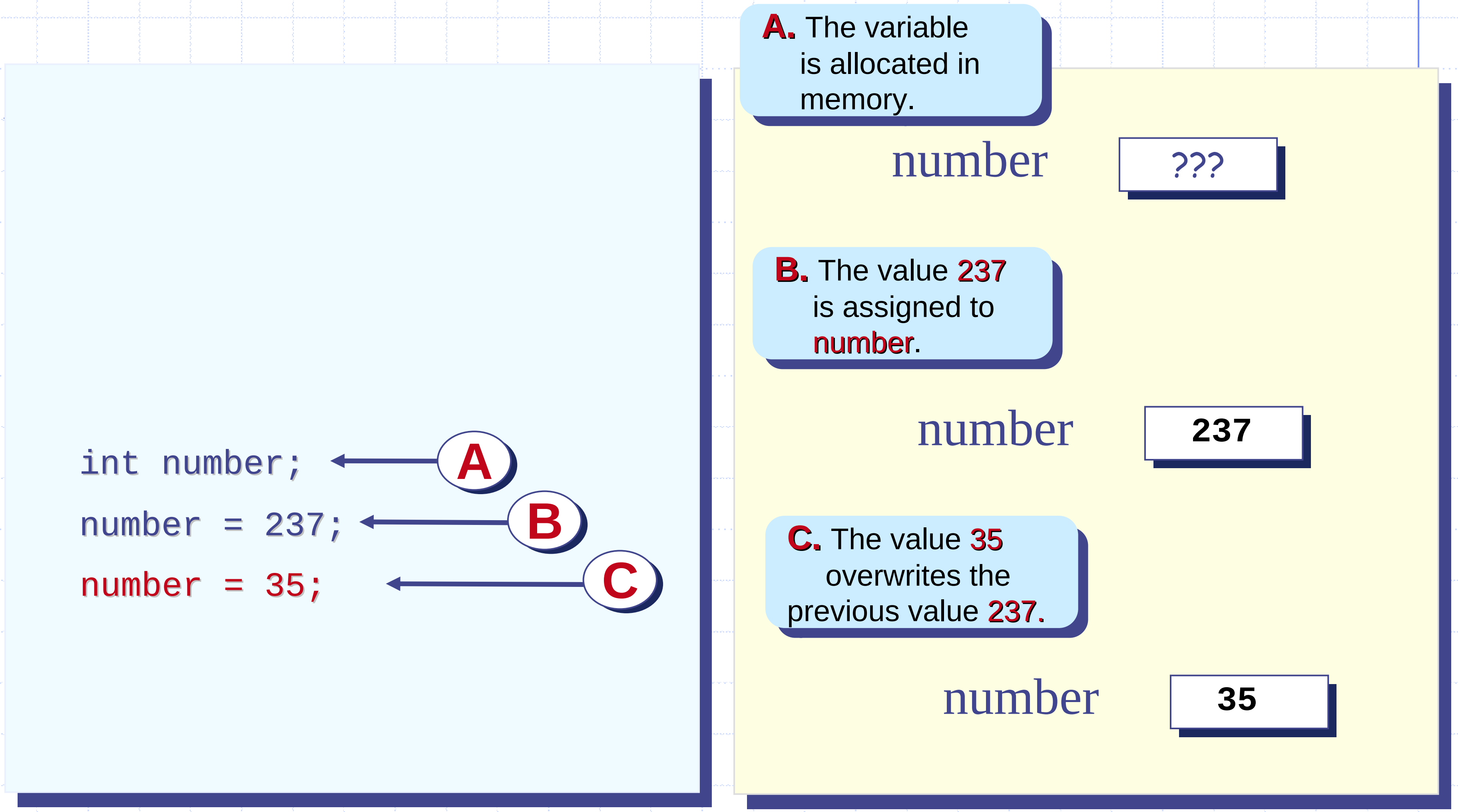
Code



A. Variables are allocated in memory.
first 1
second ???
sum ???
B. Values are assigned to variables.
first 234
second 87
sum 321

State of Memory

Updating Data



```
int number;
number = 237;
number = 35;
```

A. The variable is allocated in memory.

B. The value 237 is assigned to number.

C. The value 35 overwrites the previous value 237.

Code **State of Memory**

Example: Sum of two integer

```
public class Sum {

 // main method
    public static void main( String args[] ){
         int a, b, sum;
         a = 20;
         b = 10;
         sum = a + b;
         System.out.println(a + ” + ” + b + “  = “ + sum);

    } // end main

} // end class Sum
```

Arithmetic/Assignment Operators

Java allows combining arithmetic and assignment operators into a single operator:

Addition/assignment	+=
Subtraction/assignment	–=
Multiplication/assignment	*=
Division/assignment	/=
Remainder/assignment	%=

Arithmetic/Assignment Operators

- The syntax is

```
leftSide  Op= rightSide ;
```

It is either a *literal* | a *variable identifier* | an *expression.*

Allways it is a *variable identifier.*

It is an *arithmetic operator.*

- This is equivalent to:

```
leftSide = leftSide Op rightSide ;
```

- x%=5; ⇔ x = x % 5;
- x*=y+w*z; ⇔ x = x*(y+w*z);

Increment/Decrement Operators

Only use ++ or – – when a variable is being incremented/decremented as a statement by itself.

`x++;` is equivalent to `x = x+1;`

`x--;` is equivalent to `x = x-1;`

Relational Operators

- Relational operators compare two values
- They Produce a *boolean* value (**true** or **false)** depending on the relationship

Operation	**Is true when**
a >b	**a** is greater than **b**
a >=b	**a** is greater than or equal to **b**
a ==b	a is equal to **b**
a !=b	**a** is not equal to **b**
a <=b	**a** is less than or equal to **b**
a <b	**a** is less than **b**

Example

- int x = 3;
- int y = 5;
- boolean result;

  result = (x > y);
- now result is assigned the value false because 3 is not greater than 5

Logical Operators

Symbol	Name
&&	AND
||	OR
!	NOT

&&	T	F
T	T	F
F	F	F

||	T	F
T	T	T
F	T	F

Example

```
boolean x = true;
boolean y = false;
boolean result;

result = (x && y);
```

result is assigned the value false

```
result = ((x || y) && x);
```

(x || y) evaluates to true

(true && x) evaluates to true

result is then assigned the value true

Operators Precedence

Parentheses	(), inside-out
Increment/decrement	++, --, from left to right
Multiplicative	*, /, %, from left to right
Additive	+, -, from left to right
Relational	<, >, <=, >=, from left to right
Equality	==, !=, from left to right
Logical AND	&&
Logical OR	||
Assignment	=, +=, -=, *=, /=, %=