

CS 259 Computer Programming Fundamentals

Chapter 2: *Elementary Programming*

Instructor:

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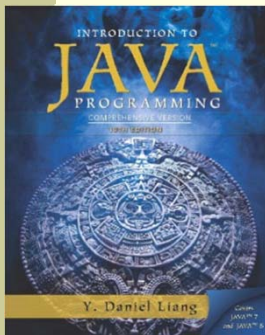
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```
int n = 3;  
float x = 3.14;  
char = '3';
```

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Textbook & Reading Assignment



Read by Friday: Aug 26

Chapter 2: Elementary Programming

Read by Wednesday: Aug 31

Chapter 3: Selections

**Use of multi-way if-else statements

Read by Friday: Sept 2

Chapter 4: Mathematical Functions,
Characters, and Strings

Read by Monday: Sept 5

Chapter 5: Loops

Quiz: byte, short, int, long, float, ...

In Java, the keywords **byte**, **short**, **int**, **long**, **float**, **double**, **boolean** and **char** are:

- a) primitive types
- b) object types
- c) variable types
- d) math operators
- e) relational operators

3

Java's Primitive Types

byte: 8-bit, [-128, 127].

short: 16-bit, [-32,768, 32,767].

int: 32-bit, [-2,147,483,648, 2,147,483,647].

long: 64-bit, [-9,223,372,036,854,775,808, 9,223,372,036,854,775,807].

float: 32-bit, [1.4×10^{-45} , 3.4028235×10^{38}]

double: 64-bit, [4.9×10^{-324} , $1.7976931348623157 \times 10^{308}$]

boolean: Only two possible values: **true** and **false**.

char: 16-bit, [`'\u0000'` (0), `'\uffff'` (65,535)].

4

Quiz:

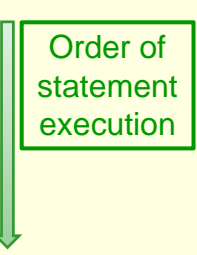
Which is the best variable declaration for the number of people in your family?:

- a) `boolean foo;`
- b) `boolean familyMemberCount = 1;`
- c) `int familyMemberCount = 1;`
- d) `float familyMemberCount = 1;`
- e) `double familyMemberCount = 1;`

5

A Variable of type `int`

```
1. public class Hello
2. { public static void main(String[] args)
3.   {
4.     int x = 0; //Allocates memory
5.     System.out.println(x);
6.     x = x + 2;
7.     System.out.println(x);
8.     x = (x + 1) * 3;
9.     System.out.println(x);
10.  }
11. }
```



x is a **variable**.

Output:

0
2
9

3 is a **literal**.

6

A Variable's Value is a *Function of Time*

```
1. public class Hello
2. { public static void main(String[] args)
3.   {
4.     int a = 2; //At this statement, b is undefined.
5.     int b = 3;
6.     a = a + b; //read a: 2, read b: 3, write a: 5
7.     b = a + b; //read a: 5, read b: 3, write b: 8
8.     System.out.println(a);
9.     System.out.println(b);
10.  }
11. }
```

Output:

```
5
8
```

7

Different Ways To Add

```
1) public class Hello
2) { public static void main(String[] args)
3)   { int a = 7;
4)     System.out.println(a); //7
5)
6)     a = a + 1;
7)     System.out.println(a); //8
8)
9)     a += 1;
10)    System.out.println(a); //9
11)
12)    a++;
13)    System.out.println(a); //10
14)
15)  }
16) }
```

8

Quiz: A Variable of type int

```
1. public class Hello
2. { public static void main(String[] args)
3.   {
4.     int z = 2;
5.     z = z + 2;
6.     z = (z + 3) * 2;
7.     System.out.println(z);
8.   }
9. }
```

When run, what characters are displayed in the console?

- a) z
- b) 2
- c) 4
- d) 10
- e) 14

9

Find the Syntax Error

```
1. public class Hello
2. { public static void main(String[] args)
3.   {
4.     int z = 2;
5.     int z = z + 2;
6.     System.out.println(z);
7.   }
8. }
```

Duplicate local variable z

```
int z = 2;
z = z + 2;
```

or

```
int z = 2;
int w = z + 2;
System.out.println(w);
```

10

Warning: Local Variable Never Read

```
1. public class Hello
2. { public static void main(String[] args)
3.   {
4.     int a = 2;
5.     int b = 3;
6.     a = a * 2;
7.     System.out.println(a);
8.   }
9. }
```

Output:

4



5

`int b = 3;`

The local variable b is never read

11

Printing the Results of Expressions

```
1. public class Hello
2. {
3.   public static void main(String[] args)
4.   {
5.     System.out.println("5 + 6 + 3 * 2");
6.     System.out.println(5 + 6 + 3 * 2);
7.     System.out.println((5 + 6 + 3) * 2);
8.   }
9. }
```

Order of some operators:

First: () parenthesis

Second: *, / multiplication, division

Third: +, - addition and subtraction

Output: `5 + 6 + 3 * 2`

17

28

12

Quiz: Order of Operations

```
1. public class Hello
2. { public static void main(String[] args)
3.   {
4.     int x = 5;
5.     int y = 10;
6.     y = y - x / 2;
7.     System.out.println(y);
8.   }
9. }
```

When run, what characters are displayed in the console?

- a) 8 b) 7.5
c) 3 d) 2.5 e) 2

13

Integer and Floating Point Division

```
1. public class Hello
2. {
3.   public static void main(String[] args)
4.   {
5.     System.out.println(5 / 2);
6.     System.out.println(5.0 / 2.0);
7.     System.out.println(5.0 / 2);
8.     System.out.println(5 / 2.0);
9.   }
10. }
```

Output:

2

2.5

2.5 ← Java **casts** int 2 into double 2.0 then divides.

2.5 ← Java **casts** int 5 into double 5.0 then divides.

14

Double, float and int

```
1. public static void main(String[] args)
2. { System.out.println(1.0 / 3.0);
3.   System.out.println(1.0f / 3.0f);
4.   System.out.println(1000.0f / 3.0f);
5.   System.out.println(3.0*(1.0f / 3.0f));
6.   System.out.println(3.0*(1 / 3));
7. }
```

Type	Size	Range	Significant Figures
int	4 bytes	±2 billion	exact integers
float	4 bytes	±3.4 x 10 ³⁸	about 7
double	8 bytes	±1.8 x 10 ³⁰⁸	about 15

Output:

```
0.3333333333333333
0.33333334
333.33334
1.0000000298023224
0.0
```

15

Quiz: Evaluating Expressions

```
1. public class Hello
2. {
3.   public static void main(String[] args)
4.   {
5.     System.out.println(8 + 11 / 2);
6.   }
7. }
```

When run, what characters are displayed in the console?

- a) 10
- b) 9
- c) 9.5
- d) 13
- e) 13.5

16

Math Expressions to Java

The mathematics expression: $\frac{3}{5} + \frac{2}{3}$

An equivalent expression in Java is:

`3.0 / 5.0 + 2.0 / 3.0`

A Java **expression** is only part of a Java **statement**.

← An expression does not end with a semicolon.

This Java expression can be used in a Java program:

```
1. public class Hello
2. {
3.     public static void main(String[] args)
4.     {
5.         System.out.println(
6.             3.0 / 5.0 + 2.0 / 3.0);
7.     }
8. }
```

17

Math Expressions to Java

The mathematics expression: $\frac{3+4+3}{6-1} + \frac{8}{1+3}$

An equivalent expression in Java is:

`(3.0+4.0+3.0) / (6.0-1.0) + 8.0/(1.0+3.0)`

```
1. public class Hello
2. {
3.     public static void main(String[] args)
4.     {
5.         System.out.println(
6.             (3.0+4.0+3.0) / (6.0-1.0) +
7.             8.0/(1.0+3.0));
8.     }
9. }
```

} The semicolon goes at the end of the **Java statement**, not at the end of each **line of code**.

Output: `4.0`

18

Modulus Operator: %

The *modulus*, $n \% m$, is the integer remainder when integer n is divided by integer m .

```
System.out.println("1 % 3 = " + 1 % 3);
System.out.println("2 % 3 = " + 2 % 3);
System.out.println("3 % 3 = " + 3 % 3);
System.out.println("4 % 3 = " + 4 % 3);
System.out.println("5 % 3 = " + 5 % 3);
System.out.println("6 % 3 = " + 6 % 3);
System.out.println("7 % 3 = " + 7 % 3);
```

1
2
0
1
2
0
1

19

Quiz: What 3 Numbers are Output?

```
public static void main(String[] args)
{
    int n = 92;
    int a = n / 25;
    n = n % 25;
    int b=n/ 10;
    n = n % 10;

    System.out.println(a);
    System.out.println(b);
    System.out.println(n);
}
```

- a) 3.68, 9.2, 0
- b) 3.68, 9.2, 92
- c) 3.68, 9.2, 15
- d) 3, 9, 0
- e) 3, 1, 7

20