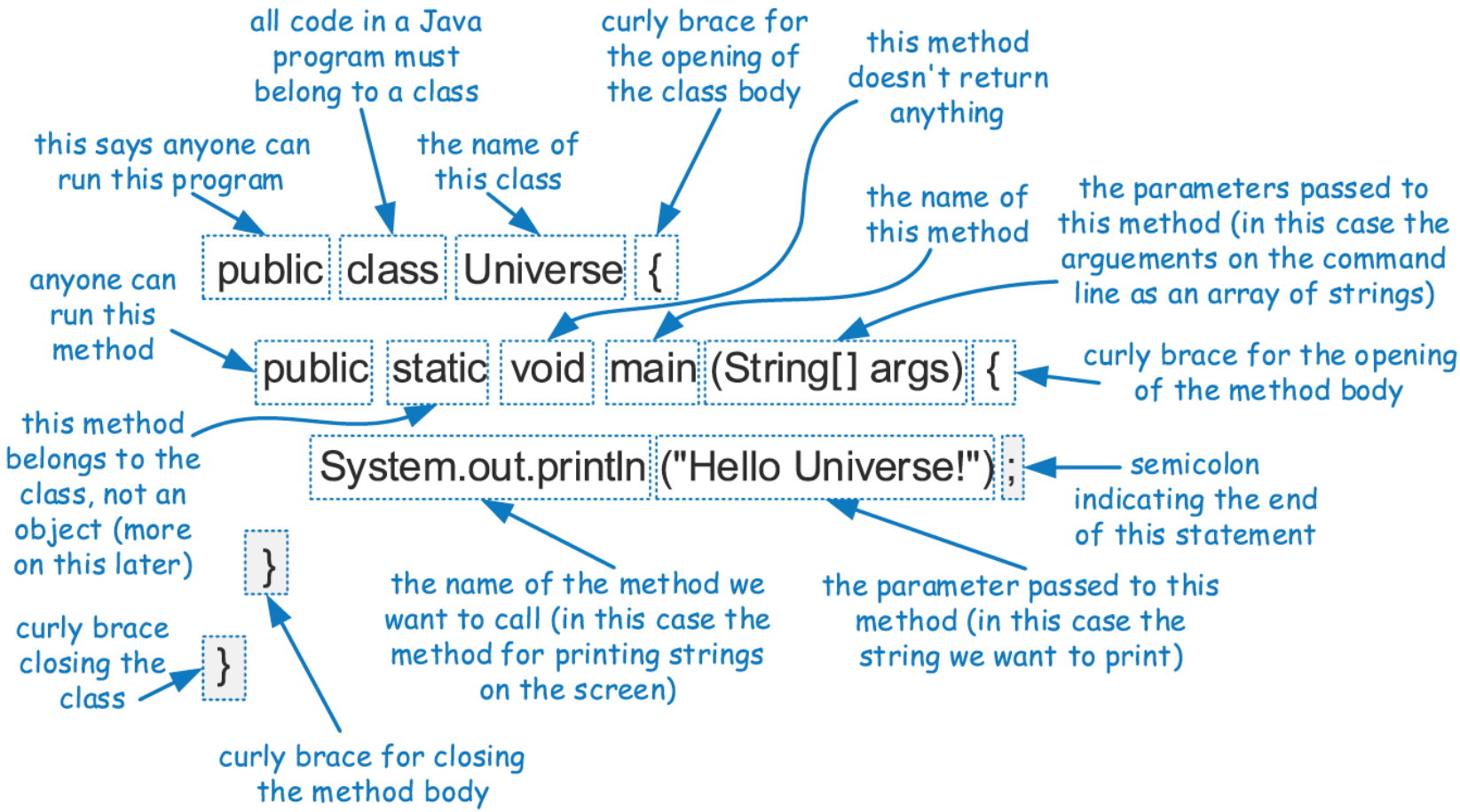
Data Structures and Algorithms

Chapter 1

Java Basics

Sample Program



Java Basics

Components of a Java Program

- In Java, executable statements are placed in functions, known as **methods**, that belong to class definitions.
- The static method named **main** is the first method to be executed when running a Java program.
- Any set of statements between the braces "**{**" and "**}**" define a program block.

- Examples:
  - SampleProgram1.java
  - SampleProgram2.java

Java Basics
Primitive (or Base) Types

- Primitive types:
  - **byte**: 8-bit signed 2's complement integer; from -128 to 127, inclusive
  - **short**: 16-bit signed 2'c complement integer; from -32768 to 32767, inclusive
  - **int**: 32-bit signed 2's complement integer; from -2147483648 to 2147483647, inclusive
  - **long**: 64-bit signed 2's complement integer;
    from -9223372036854775808 to 9223372036854775807, inclusive
  - **char**: 16-bit Unicode character;
    from '\u0000' to '\uffff' inclusive, that is, from 0 to 65535
  - **float**: single-precision, 32-bit floating point number (IEEE 754-1985)
  - **double**: double-precision, 64-bit floating point number (IEEE 754-1985)
  - **boolean**: true of false

Java Basics
Reference Types

- Reference types: class types, interface types, array types.
- Values of a reference type: references to objects
- A reference variable stores the location (i.e., memory address) of an object.

- Example:
  - PrimitiveReference.java

Java Basics

Access Control Modifier

- Also called *access level modifier* or *visibility modifier*.
- Declared for classes, variables, and methods.

Modifier	**Access Level**			
	Class	Package	Subclass	World
public	Y	Y	Y	Y
protected	Y	Y	Y	N
no modifier	Y	Y	N	N
private	Y	N	N	N

Java Basics

When a New Object is Created

- Use the *new* operator and the constructor.
- Memory is dynamically allocated.
- Instance variables are initialized .
- The *new* operator returns the *reference* to the new object.
- The reference is assigned to an instance variable (a reference to the object).

Java Basics

Static Modifier

- Specified for variables or methods of a class.
- They belong to the class not to an instance of the class.
- Example:
  - Car.java
  - TestCar.java

Java Basics
Wrapper Class

Primitive Type	Wrapper Class	Creating object	Accessing object
boolean	Boolean	obj = new Boolean(true)	obj.booleanValue()
char	Character	obj = new Character('A')	obj.charValue()
byte	Byte	obj = new Byte((byte) 16)	obj.byteValue()
short	Short	obj = new Short((short) 128)	obj.shortValue()
int	Integer	obj = new Integer(1024)	obj.intValue()
long	Long	obj = new Long(4096L)	obj.longValue()
float	Float	obj = new Float(3.14F)	obj.floatValue()
double	Double	obj = new Double(3.14)	obj.doubleValue()

Java Basics
Wrapper Class

- Example:

```
public class WrapperTest {
  public static void main(String[ ] args) {
    Character c = new Character('A');
    Integer a = new Integer(1024);
    Double x = new Double(3.14);
    System.out.println("c is " + c.charValue());
    System.out.println("a is " + a.intValue());
    System.out.println("x is " + x.doubleValue());
  }
}
```

Java Basics
Wrapper Class

- Expected output:

  c is A

  a is 1024

  x is 3.14

Java Basics
Wrapper Class

- Autoboxing and autounboxing

```
public class BoxingTest {
    public static void main(String[ ] args) {
        Integer a = 1024; // primitive value 1024 is boxed into an object
        System.out.println("a is " + a.intValue());
        int b = a + 10; // object a is unboxed to primitive type
        System.out.println("b is " + b);
    }
}
```

Java Basics
Casting

- Narrowing vs. widening type conversion

```
double x = 3.14
int a = (int)x; // narrowing conversion from
                // double to int
double y = a;   // widening conversion from int
                //to double
```

Java Basics
Control Flow

- if statements

```
if (booleanExpression)
    trueBody
else
    falseBody
```

Java Basics
Control Flow

- if statements

```
if (firstBooleanExpression)
    firstBody
else if (secondBooleanExpression)
    secondBody
else
    thirdBody
```

Java Basics
Control Flow

- **switch** statements

```
switch (var) {
    case value1:       // var == value1
        do something;
        break;
    case value2:       // var == value2
        do something;
        break;

    . . .

    default            // none of the above
        do something
}
```

Java Basics
Control Flow

- **for** loops

for (initialization; booleanCondition; increment)
loopBody

Meaning:

```
{
    initialization;
    while (booleanCondition) {
        loopBody;
        increment;
    }
}
```

Java Basics
Control Flow

- **while** loops

```
while (booleanExpression)
    loopBody
```

- **do-while** loops

```
do
    loopBody
while (booleanExpression)
```

- Example: ControlFlowExamples.java

Java Basics
Arrays

- Declaration

```
int [ ] intArray; // array of integers
double [ ] doubleArray; // array of doubles
Char [ ] charArray; // array of characters
String [ ] stringArray; // array of strings
```

- Allocate memory, and initialize

```
intArray = new int [5];
IntArray[0] = 10;
IntArray[1] = 20;
IntArray[2] = 30;
IntArray[3] = 40;
IntArray[4] = 50;
```

Java Basics

Arrays

- Declare and allocate memory

  Int [ ] intArray = new int[10];

- Shortcut

  Int [ ] intArray = {10, 20, 30, 40, 50};

- Example: ArrayExample.java

Java Basics
Simple I/O

- Read from standard input and write to standard output example:
  - SimpleIOTest1.java
  - SimpleIOTest2.java

- Read from a text file and write to a text file:
  - SimpleIOTest3.java
  - There are other ways

References

- M.T. Goodrich, R. Tamassia, and M.H. Goldwasser, “Data Structures and Algorithms in Java,” Sixth Edition, Wiley, 2014.