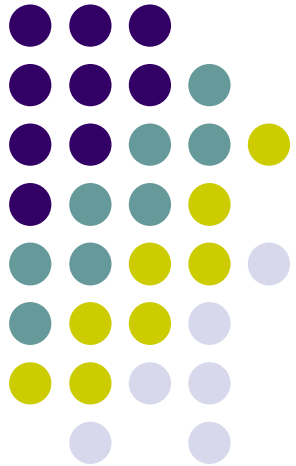
WIX1002
Fundamentals of Programming

Chapter 2

Java Fundamental



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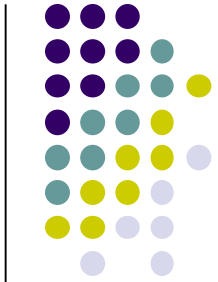
Variable



- A variable is a storage location in the memory that has a **type, name and contents**.
- A variable must be **declared**, specifying the variable's **name** and the **type** of information that will be held in it.
- **Identifier** is the name of the variable. In Java, identifier may contains letters, digits (0 – 9), and the underscore (_) character.
- **However, identifier cannot begin with a digit, cannot contain spaces and cannot be reserved words.**
- A meaningful identifier will made the program easy to understand.
- By convention, variable names should start with a lowercase letter

Variable

- Java has basic types for characters, integers and floating points number. These basic types are known as **primitive types**.
- Java Unicode character chart
  - http://www.ssec.wisc.edu/~tomw/java/unicode.html

Java Primitive Data Types				
Type	Values	Default	Size	Range
byte	signed integers	0	8 bits	-128 to 127
short	signed integers	0	16 bits	-32768 to 32767
int	signed integers	0	32 bits	-2147483648 to 2147483647
long	signed integers	0	64 bits	-9223372036854775808 to 9223372036854775807
float	IEEE 754 floating point	0.0	32 bits	+/-1.4E-45 to +/-3.4028235E+38, +/-infinity, +/-0, NAN
double	IEEE 754 floating point	0.0	64 bits	+/-4.9E-324 to +/-1.7976931348623157E+308, +/-infinity, +/-0, NaN
char	Unicode character	\u0000	16 bits	\u0000 to \uFFFF
boolean	`true, false`	`false`	1 bit used in 32 bit integer	NA

Variable

- **declaration**

  int number;

  double first, second;

  boolean status;

- **initialization**

  double speed = 2.6;

  char letter = 'A'; //use single quote for character

Variable

- A **constant** is an identifier that is similar to a variable except that it holds one value for its entire existence
- The compiler will issue an error if you try to change a constant variable
- Constant is declared using the **final** keyword.
  - final int MIN=0;
  - final int MAX=100;

Operator

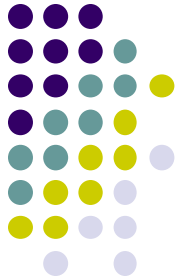
- Operators are special symbols that perform specific operations on one or more **operands**.
- An operand is the part of a computer instruction which specifies what data is to be manipulated or operated on.
- **Assignment Operator (=)**
  - It is used to change the value of variable after the variable has been declared.

    temperature = 36.9;

    grade = 'c';

    status = true;

Operator



- **Arithmetic Operator**
  - It is used to compute numeric results
  - + (addition) - (subtraction) * (multiplication) / (divison) % (modulo or remainder)

    temperature = a + 36.9;

    total = monthlyPayment * 12;

    answer = 20 % 6; // answer is 2

Operator

- Java follows **precedence rules** that determine how the operators are executed in order

Operator Precedence

Operators	Precedence
postfix	*expr++ expr--*
unary	*++expr --expr +expr -expr* ~ !
multiplicative	* / %
additive	+ -
shift	<< >> >>>
relational	< > <= >= instanceof
equality	== !=
bitwise AND	&
bitwise exclusive OR	^
bitwise inclusive OR	|
logical AND	&&
logical OR	||
ternary	? :
assignment	= += -= *= /= %= &= ^= |= <<= >>= >>>=

Operator

- **Parentheses Operator ( )**
  - Controls the order in which the operators execute in the expression. Parentheses override the normal precedence order
- **Postfix Operator**
  - number++;
    - **Use the current value of number**. Then increment by 1 for the next statement.
  - number--;
    - **Use the current value of number**. Then decrement by 1 for the next statement

Operator

- **Unary Operator**
  - ++number;
    - **Increment number by 1** and then use the value
  - --number;
    - **Decrement number by 1** and then use the value.
- Other assignment operator
  - number += 5; // -=, *=, /=, %=
  - number = number + 5;

Type Casting

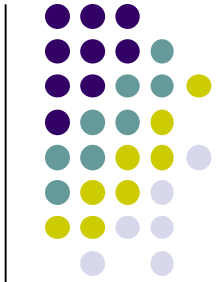
- Sometimes it is convenient to convert data from one type to another. For example, we may want to treat an integer as a double value during a computation
- Type casting takes a value of one type and produces a value of another type.

```
int a=8, b=3;
double answer;
answer = a / b;                    // Output is 2
answer = a / (double) b;           // Output is 2.6666
```

String

- A string is a sequence of characters that is treated as a single value.
- String class is used to store and process **strings of characters**.
- Declaration and initialization
  - String fullname;
  - String topic = "Object-oriented Programming";
- Concatenation
  - + operator is used to connecting two strings.
  - String firstName, lastName, fullname;
  - fullname = firstname + lastname;

Console Input

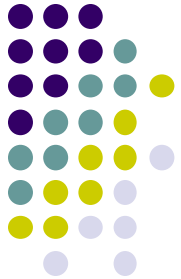


- **Scanner Class**
  - A simple text scanner which can used to **get input for primitive types and strings**.
  - To load Scanner Class into java program

    import java.util.Scanner;

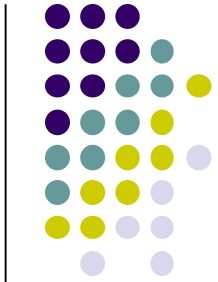
```
Scanner keyboard = new Scanner(System.in);
int num;
System.out.println("Please enter a number");
num = keyboard.nextInt();
 System.out.println(“The number is " + num);
```

Console Input



- .nextInt()
  - Reads one int from the keyboard
- .nextLong()
  - Reads one long int from the keyboard
- .nextDouble()
  - Reads one double from the keyboard
- .next()
  - Reads **one word** into String class from the keyboard
- .nextLine()
  - Reads an entire line into String class from the keyboard

Console Output



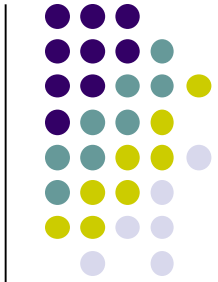
- System.out is known as the standard output object
- **System.out.println** display a line of text in the command window. When it completes its tasks it automatically positions the output cursor to the beginning of the next line.
- **System.out.print** display a line of text in the command window. However, it does not position the output cursor at the beginning of the next line in command window.
- **System.out.printf** display output in a **specific format**

Console Output

Code	Output	Examples
d	decimal integer	%d %6d
f	fixed-point floating point	%f %6.2f
e	E-notation floating point	%e %4.2e
g	general floating point	%g %4.2g
s	string	%s %20s
c	character	%c %5c
-	left alignment	%-5d

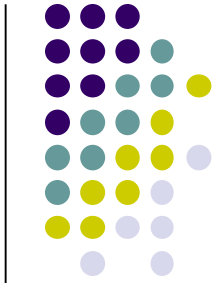
- System.out.printf("%6.2f", 22/7.0)
  - Display 6 spaces with 2 decimal places as in _ _3.14
- System.out.printf("PI%-6.2fValue", 22/7.0)
  - Display PI3.14_ _Value

Console Output



- You can use some of the special characters in the standard output object
- Special Character
  - **\n** is the **newline character**. It cause the screen's output cursor to move to the beginning of the next line
  - **\t** is the **horizontal tab** character
  - **** display a backslash character
  - **\"** display a double quote character

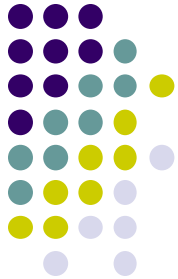
Comment



- Comment is used to help other programmers to understand the program
- Comments **are not executed** when the application start.
- There are three types of comment in Java
- Single line comment
  - ***//*** A Single Line Comment
- Multiple lines comment

```
/*
    A multiple
    line comments
*/
```

Comment



- Documentation comment describe the functionalities of each Java class and methods.

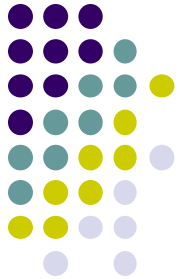
  /**

  This method display a line of text on the screen

  ***/**

- How to write a standard Java Documentation Comment
  - https://www.oracle.com/technical-resources/articles/java/javadoc-tool.html
- To run javadoc on a package
  - **javadoc -d documentationDirectory PackageName**

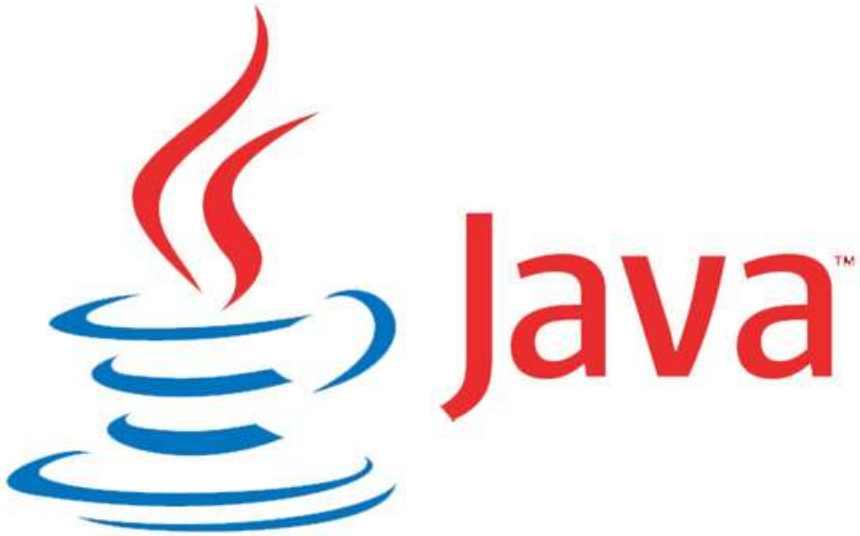
Random Number



- Random number is very useful in game and simulation
- The Random class of Java implements a random number generator
  - **import java.util.Random;**

```
Random g = new Random();
int num;
num = g.nextInt();       //any random value of integer

int MAX = 100;
num = g.nextInt(MAX); // random value from 0 to 99
```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