COP-2210
Computer Programming I

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Text: Big Java: Early Objects, Interactive Edition, 6th Edition

The Java Language

7. Data Types

Data Types

Data Type: A type of "container" that can hold a specific kind of program data

Basic or Primitive Data Types

byte	*short*	*int*	*long*
float	*double*		
char			
boolean			

Primitive Data Types

Data Type	Bytes	Data it contains
byte	1	integer
short	2	integer
int	4	integer
long	8	integer
float	4	real
double	8	real
boolean	1	*true*, *false*
char	2	character

Primitive Data Types

```
type:byte   size:8  min:-128                  max:127
type:short  size:16 min:-32768                 max:32767
type:int    size:32 min:-2147483648            max:2147483647
type:long   size:64 min:-9223372036854775808 max:9223372036854775807
type:float  size:32 min:1.4E-45                max:3.4028235E38
type:double size:64 min:4.9E-324               max:1.79769313486231 57E308
type:char   size:16 min:0                      max:65535
```

The Java Language

8. Variables

Variables

Variable: The actual location in memory

set aside for use by the program

- Variables contain values that may be modified during the execution of a program.

(variables could be think of as the math variables)

Variables: declaration

Variables must be declared:

<variable type> <*name of the variable*> = <value>

Ex.

```
float balance;
double deposit = 1000.0;
int transaction_count;
int check_number = 421;
```

Variables: assigning value

The assignment operator:

<variable name> = **<expression>**

The ***equals sign***, called the assignment operator, takes the value on the right side and places it in the variable on the left side.

Ex.

```
x = 12.345;
```

Variables: *Try it Yourself*

```
// Prog08_01: Declaring variables in Java

public class Prog08_01
{
   public static void main ( String args[] )
   {
          double d;
          d = -2.56;
          System.out.print ( “This is d: ” );
          System.out.println ( d );
   }
}
```

Variables: *Try it Yourself*

```
// Prog08_02 Declaring variables in Java

public class Prog08_02
{
  public static void main ( String args[ ] )
  {
        double d;
        d = -2.56;
        System.out.println ( “This is d: ” + d );
  }
}
```

PRACTICE

- Edit and compile the *Program 08_02*

- In *Program 08_02*:

  - Comment the line ***double d;***
    What did it happen?

  - Uncomment the line. Replace ***double d;*** with ***char d;***
    What did it happen?

Variables: Declaration

```
// Prog08_01: Declaring variables in Java


public class Prog08_01
{
   public static void main ( String args[] )
   {
          double d;          <-------------------   CORRECT
          d = -2.56;
          System.out.print("This is d: ");
          System.out.println(d);
          double d;          <-------------------   INCORRECT
   }
```

Java requires that a variable be declared **before** its is used.

Variables: Naming Rules

1. Names may contain letters, numbers, underscores (_) or a dollar sign ($)
2. The first character must be a letter, an underscore or a dollar sign
3. Names cannot contain any symbols, such as

   ~!@#%^&*()-+=\|/

   nor can they have spaces.
4. Keywords cannot be used as variable names.
5. Variables names may be any length

These rules must be followed when forming any identifier (user-defined classes, methods, packages)

Variables: Naming Rules

Variable Name	
i	Valid
new_VAR	Valid
int	Invalid
3d	Invalid
price#	Invalid
$price	Valid

PRACTICE

- Correct the errors:

```
\\ Prog08_03 Declaring variables in Java
public class Prog08_03
{
    public void static main ( String args[] )
    {
        i& = 3;
        int i&;
        system.out.print (i&, " is the value assigned to i&/n/n");
    }
```


PRACTICE

- Correct the errors:

```
// Prog08_03 Declaring variables in Java
public class Prog08_03
{
    public static void main ( String args[] )
    {
        int i;
        i = 3;
        System.out.print (i + " is the value assigned to i\n\n");
    }
}
```


Modifiers: *final*

Final variable: Used to fix a variable's value forever.

(It is an error to change its value)

final <type> <variable name> = <initial value>;

Example

```
final int x = - 5;
```

String Variables and Expressions

STRING class and concatenation

```
public class Prog08_04
{
   public static void main( String args[ ])
   {
         String firstName = “Joan”;
         String lastName = “Smith”;
         String output = “Name: “ + firstName + “ “ + lastName;

         System.out.println(output);
   }
}
```

String Variables and Expressions

STRING class and concatenation

```
public class Prog08_05
{
   public static void main( String args[ ])
   {
          String s;
          double Pi = 3.14;
          int dec = 92;
          s="PI= " + Pi + 15 + dec + "...";
          System.out.println(s);
   }
}
```

The Java Language

9. Input From the Keyboard

Input from the keyboard: using the Scanner class

```
import java.util.*;

public class Prog09_01
{
   public static void main ( String args[ ] )
   {
            Scanner in  =  new Scanner ( System.in );

            System.out.print ( "Enter INT: " );
            int x  =  in.nextInt ( );
            System.out.println ( "You entered: " + x );

            System.out.print ( "Enter DOUBLE: " );
            double y  =  in.nextDouble ( );
            System.out.println ( "You entered: " + y );
   }
}
```

PRACTICE

Program 09_02

Write a *Java* program that:

a) asks the user to enter his/her *height* (a decimal number).
b) after reading the height, the program will display it.

PRACTICE - ANSWER

```
import java.util.*;

public class Prog09_02
{
   public static void main(String args[])
   {
      Scanner in = new Scanner(System.in);

      System.out.print("Enter HEIGHT: ");
      double height = in.nextDouble();

      System.out.println("Your height is: " + height);
   }
}
```


Input from the keyboard: using the Scanner class

```
import java.util.*;

public class Prog09_03 {
    public static void main ( String args[ ] ) {
            Scanner in  =  new Scanner ( System.in );

            System.out.print ( "Enter STRING: " );
            String s  =  in.nextLine ( );
            System.out.println ( "You entered: " + s);

            System.out.print ( "Enter FLOAT: " );
            double f  =  in.nextFloat( );
            System.out.println ( "You entered: " + f );
```

```
            System.out.print ( "Enter LONG: " );
            Long t  =  in.nextLong ( );
            System.out.println ( "You entered: " + t);
    }
}
```

PRACTICE

Program 09_04 Write a program that:

a) asks the user to enter the first name and the last name,
b) stores the first name in *firstName*, a String variable, and the last name in *lastName*, a String variable,
c) concatenates the values of *firstName* and *lastName* and assigns the result to *output*, a String variable,
d) prints the value of *output*.

PRACTICE - ANSWER

```
import java.util.*;

public class Prog09_04 {
   public static void main(String args[]) {
      Scanner in = new Scanner(System.in);

      System.out.print("Enter FIRST NAME: ");
      String firstName = in.nextLine();

      System.out.print("Enter LAST NAME: ");
      String lastName = in.nextLine();

      String output = firstName + " " + lastName;

      System.out.println("Full Name: " + output);
   }
}
```

JOptionPane class

The *JOptionPane* class:

- **Contained in the *javax.swing* package.**
- **Contain methods tailored for input / output**

  - *showInputDialog ( )* : to obtain data from the user

  - *showMessageDialog ( )* : to show data in a dialog box

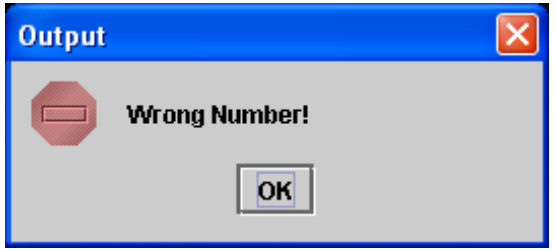
http://java.sun.com/

JOptionPane class: Try it yourself

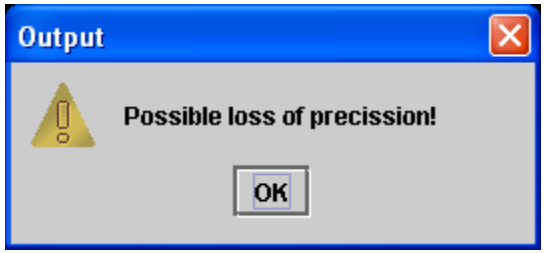
```
// Prog09_05 : The JOptionPane class
import javax.swing.*;
public class Prog09_05
{
    public static void main ( String args[ ] )
    {
            int n;
            String s;
            s = JOptionPane.showInputDialog ( null, "Enter a number",
                                "Input", JOptionPane.QUESTION_MESSAGE);
            n = Integer.parseInt(s);
            s = "This is the number you entered: " + n + "\n\n";

            JOptionPane.showMessageDialog ( null, s, "Output",
                                JOptionPane.INFORMATION_MESSAGE);
    }
}
```

Message Dialog Types

Message	Symbol	Example
JOptionPane.PLAIN_MESSAGE (or -1)	No icon	
JOptionPane.ERROR_MESSAGE (or 0)	Stop sign	
JOptionPane.INFORMATION_MESSAGE (or 1)	"i"	

Message Dialog Types

Message	Symbol	Example
JOptionPane.WARNING_MESSAGE (or 2)	"!"	
JOptionPane.QUESTION_MESSAGE (or 3)	"?"