University of British Columbia
CPSC 111, Intro to Computation
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Objects, Methods, Parameters, Input

Lecture 5, Thu Jan 19 2006

based on slides by Kurt Eiselt

http://www.cs.ubc.ca/~tmm/courses/cpsc111-06-spr

Reading This Week

- Rest of Chap 2
  - 2.3-4, 2.6-2.10
- Rest of Chap 4
  - 4.3-4.7

Objectives

- Understand when to use parameters
- Understand how to use return values
- Understand how to handle keyboard input

Recap: Constants

- Things that do not vary
  - unlike variables
  - will never change
- Syntax:
  - final *typeName variableName;*
  - final *typeName variableName = value;*
- Constant names in all upper case
  - Java convention, not compiler/syntax requirement

Recap: Avoiding Magic Numbers

- magic numbers: numeric constants directly in code
  - almost always bad idea!
    - hard to understand code
    - hard to make changes
    - typos possible
  - use constants instead

Recap: Classes, Methods, Objects

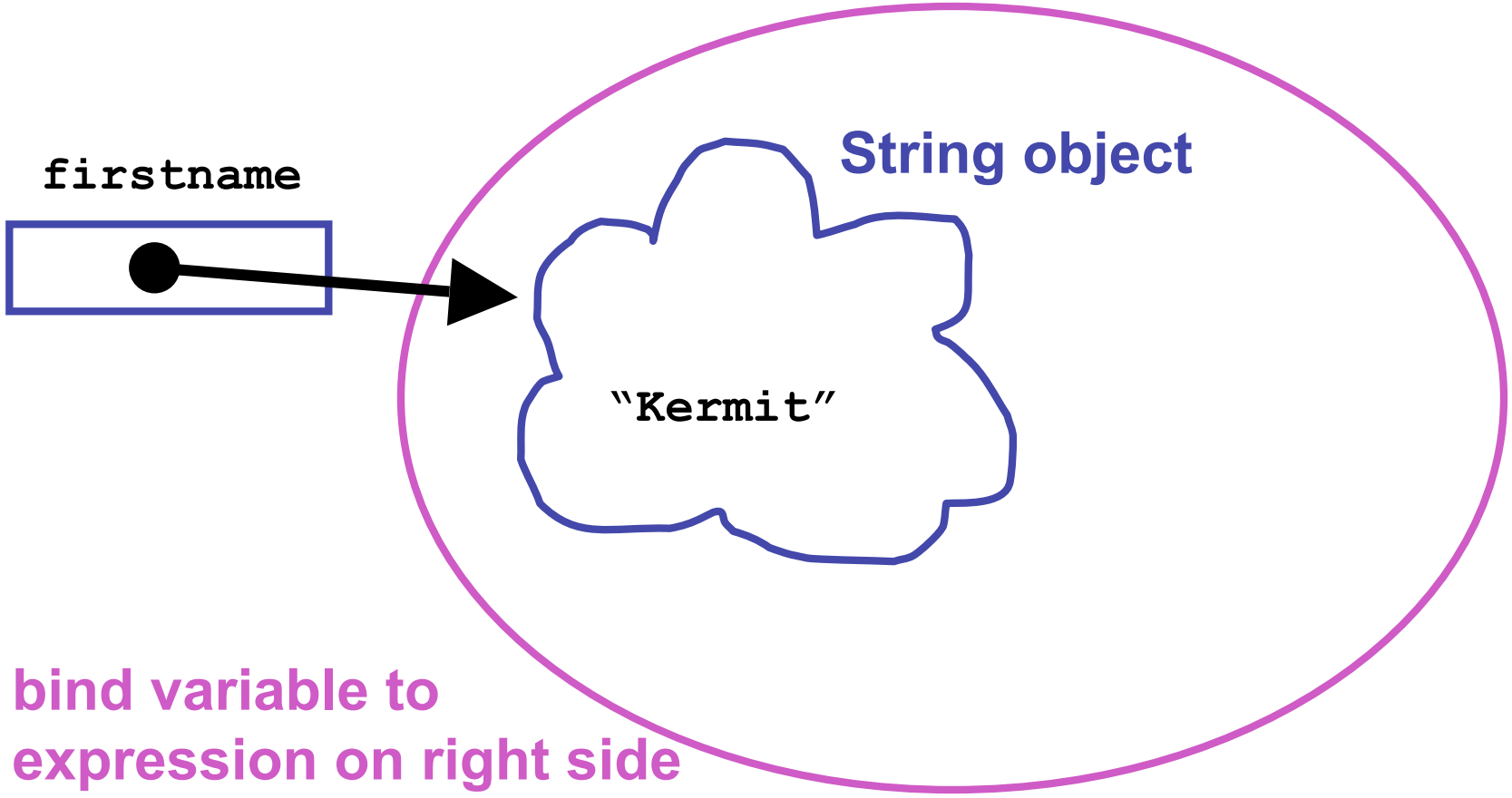
- Class: complex data type
  - includes both data and operations
  - programmers can define new classes
  - many predefined classes in libraries
- Method: operations defined within class
  - internal details hidden, you only know result
- Object: instance of class
  - entity you can manipulate in your program

Recap: Declare vs. Construct Object

```
public static void main (String[] args) {
        String firstname;
        firstname = new String ("Kermit");
}
```

- Variable declaration does not create object
  - creates object reference
- Constructor and new operator creates object somewhere in memory
  - constructors can pass initial data to object
- Assignment binds object reference to created object
  - assigns address of object location to variable

Recap: Declare vs. Construct Object

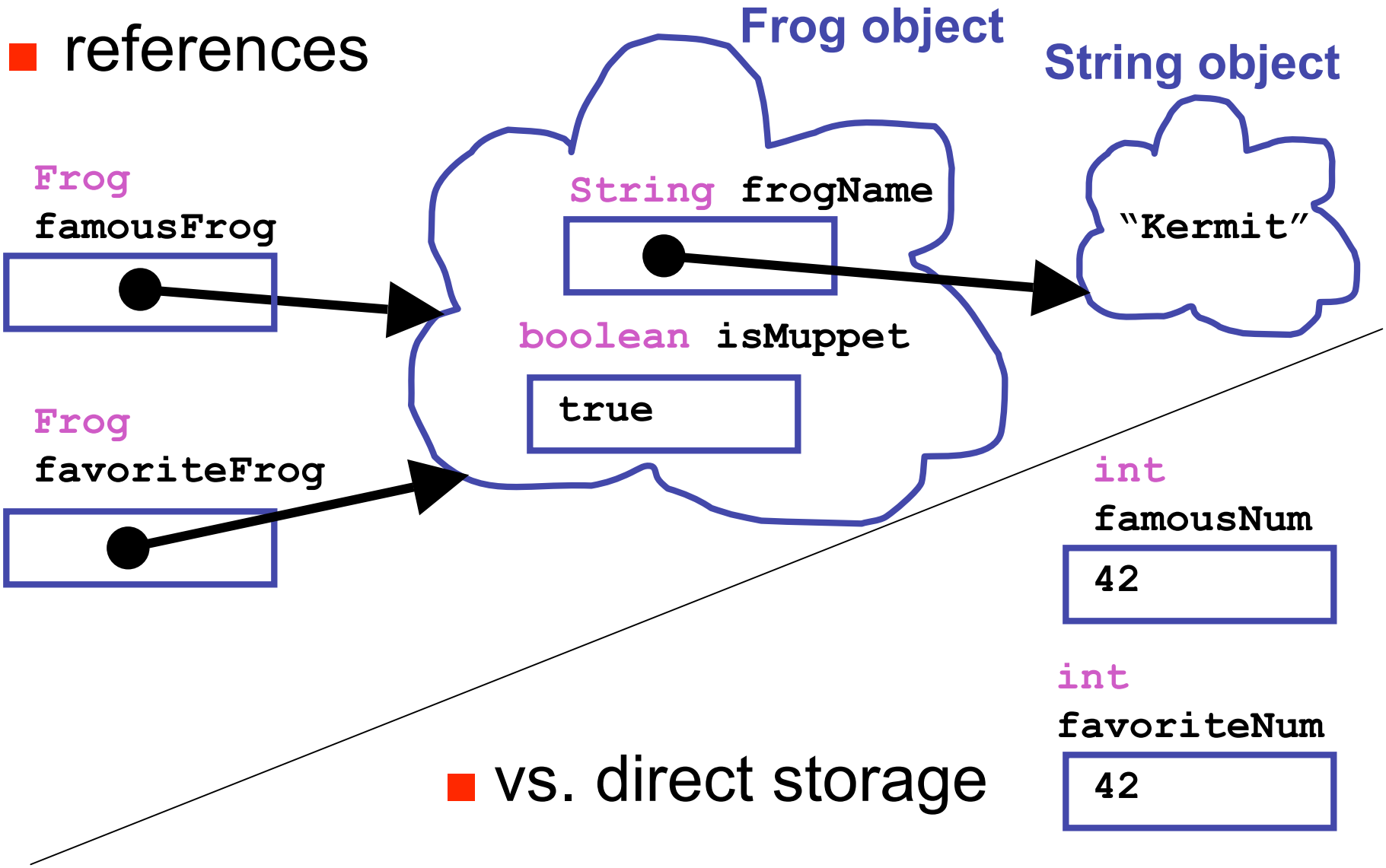


bind variable to
expression on right side
of assignment operator

expression on right side
of assignment operator

Recap: Objects vs. Primitives

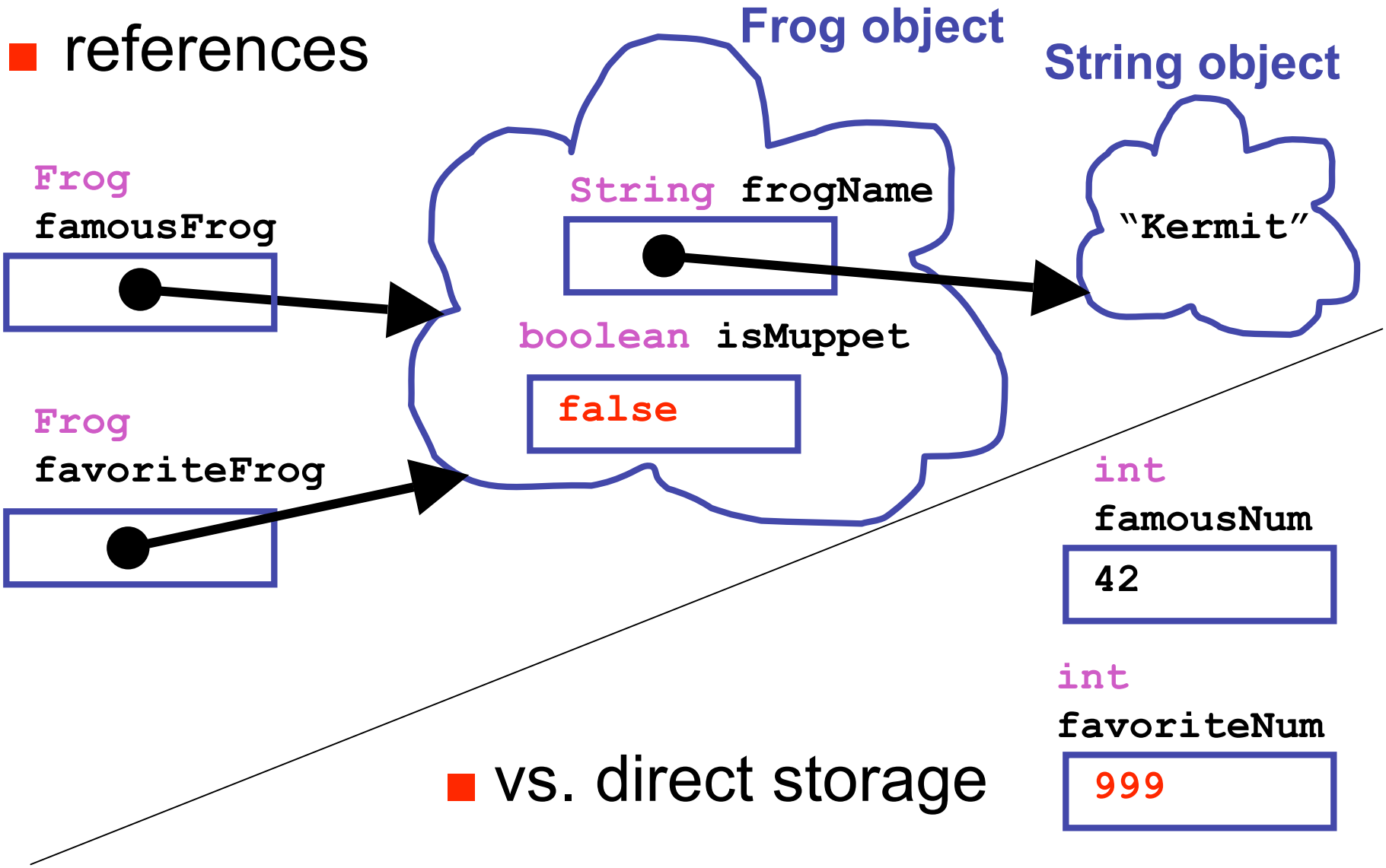
- references



- vs. direct storage

Recap: Objects vs. Primitives

- references



- vs. direct storage

Recap: API Documentation

- Online Java library documentation at http://java.sun.com/j2se/1.5.0/docs/api/
  - textbook alone is only part of the story
  - let's take a look!

- Everything we need to know: critical details
  - and often many things far beyond current need

- Classes in libraries are often referred to as Application Programming Interfaces
  - or just API

Recap: Some Available String Methods

```
public String toUpperCase();
```

Returns a new `String` object identical to this object but with all the characters converted to upper case.

```
public int length();
```

Returns the number of characters in this `String` object.

```
public boolean equals( String otherString );
```

Returns true if this `String` object is the same as `otherString` and false otherwise.

```
public char charAt( int index );
```

Returns the character at the given index. Note that the first character in the string is at index 0.

More String Methods

```
public String replace(char oldChar, char newChar);
```

Returns a new `String` object where all instances of `oldChar` have been changed into `newChar`.

```
public String substring(int beginIndex);
```

Returns new `String` object starting from `beginIndex` position

```
public String substring( int beginIndex, int endIndex );
```

Returns new `String` object starting from `beginIndex` position and ending at `endIndex` position

- up to but not including endIndex char:

```
substring(4, 7)     "o K"
```

H	e	l	l	o		K	e	r	m	i	t	F	r	o	g
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

String Method Example

```
public class StringTest
{
    public static void main (String[] args)
    {
        String firstname = new String ("Kermit");
        String lastname = new String ("theFrog");
        firstname = firstname.toUpperCase();
        System.out.println("I am not " + firstname
                                + " " + lastname);
    }
}
```

- invoking methods
  - objectName.methodName();
  - remember identifiers can't have . in them

Methods and Parameters

- Class definition says what kinds of data and methods make up object
  - object is specific instance of class

```
String firstname = "Alphonse";
char thirdchar = firstname.charAt(2);
```

object

Methods and Parameters

- Class definition says what kinds of data and methods make up object
  - object is specific instance of class
  - methods are how objects are manipulated

```
String firstname = "Alphonse";
char thirdchar = firstname.charAt(2);
```

object method

Methods and Parameters

- Class definition says what kinds of data and methods make up object
  - object is specific instance of class
  - methods are how objects are manipulated
  - pass information to methods with parameters
    - inputs to method call
    - tell `charAt` method which character in the String object we're interested in

```
String firstname = "Alphonse";
char thirdchar = firstname.charAt(2);
```

object method parameter

Parameters

- Methods can have multiple parameters
  - API specifies how many, and what type

```
public String replace(char oldChar, char newChar);
```

```
String animal = "mole";
animal.replace('m', 'v');
```

```
public String substring( int beginIndex, int endIndex );
```

```
animal = "aardwolf";
String newanimal = animal.substring(4,8);
System.out.println(newanimal);                // wolf
```

Explicit vs. Implicit Parameters

- Explicit parameters given between parentheses
- Implicit parameter is object itself
- Example: **`substring`** method needs
  - **`beginIndex, endIndex`**
  - but also the string itself!

```
animal = "aardwolf";
System.out.println(animal);                    // aardwolf
String newanimal = animal.substring(4,8);
System.out.println(newanimal);                 // wolf
```

- All methods have single implicit parameters
  - can have any number of explicit parameters
    - none, one, two, many…

Parameters

- Most of the time we'll just say parameters, meaning the explicit ones

Return Values

- Methods can have return values
- Example: `charAt` method result
  - return value, the character 'n', is stored in `thirdchar`

```
String firstname = "kangaroo";
char thirdchar = firstname.charAt(2);
```

return value object method parameter

Return Values

- Methods can have return values
- Example: `charAt` method result
  - return value, the character 'n', is stored in `thirdchar`

```
String firstname = "kangaroo";
char thirdchar = firstname.charAt(2);
```

return value object method parameter

- Not all methods have return values
- Example: `println` method does not return anything
  - prints character 'n' on the monitor, but does not return that value
  - printing value and returning it are not the same thing!

```
System.out.println(thirdchar);
```

Return Values

- Again, API docs tell you
  - how many explicit parameters
  - whether method has return value
  - what return value is, if so

Method Summary	
char	charAt(int index) Returns the char value at the specified index.

- No return value indicated as `void`

Constructors and Parameters

- Many classes have more than one constructor, taking different parameters
  - use API docs to pick which one to use based on what initial data you have

Constructor Summary
`String()` Initializes a newly created `String` object so that it represents an empty character sequence.
`String(String original)` Initializes a newly created `String` object so that it represents the same sequence of characters as the argument; in other words, the newly created string is a copy of the argument string.

```
animal = new String();
animal = new String("kangaroo");
```

Accessors and Mutators

- Method that only retrieves data is accessor
  - read-only access to the value
  - example: charAt method of String class
- Method that changes data values internally is mutator
  - Stay tuned for examples of mutators, we haven't seen any yet
  - String class has no mutator methods
- Accessor often called getters
- Mutators often called setters
  - names often begin with get and set, as in getWhatever and setWhatever

Keyboard Input

- Want to type on keyboard and have Java program read in what we type
  - store it in variable to use later
- Want class to do this
  - build our own?
  - find existing standard Java class library?
  - find existing library distributed by somebody else?

- Scanner class does the trick
  - `java.util.Scanner`
  - nicer than `System.in`, the analog of `System.out`

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

- Import Scanner class from java.util package

Importing Packages

- Collections of related classes grouped into packages
  - tell Java which packages to keep track of with import statement
  - again, check API to find which package contains desired class
- No need to import String, System.out because core `java.lang` packages automatically imported

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

- Declare string variable to store what user types in

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

- Use Scanner constructor method to create new Scanner object named scan
  - could be named anything, like **`keyboardStuff`** or **`foo`**

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

- Prompt user for input

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

- **`nextLine`** method reads all input until end of line
  - returns it as one long string of characters

Scanner Class Example

```
import java.util.Scanner;

public class Echo
{
    public static void main (String[] args)
    {
        String message;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter a line of text: ");
        message = scan.nextLine();
        System.out.println ("You entered: \""
                                + message + "\"");
    }
}
```

- Print out the message on the display

Scanner Class Example

- Let’s try running it

Questions?