Decisions

CSE 142, Summer 2002

Computer Programming 1

http://www.cs.washington.edu/education/courses/142/02su/

Readings and References

- Reading
  - » Chapter 6, *An Introduction to Programming and Object Oriented Design using Java*, by Niño and Hosch
  - » Chapter 11, *Introduction to Programming in Java*, Dugan

Implementing Interesting Behavior

- We need to be able to make decisions in order to have objects behave in interesting ways
  - » Has the Shape moved to the edge of the window?
  - » Did the user supply any arguments to the program?
  - » Is the display window visible?
  - » How many shapes are moving around on the screen?
- The **`if`** statement is our primary tool for changing the flow of control in the program

Sequences and Blocks

```
/* Simple sequence */

statement1;
statement2;

/* Block - can replace a single statement anywhere */

{
   statement1;
   statement2;
}
```

The **`if`** statement

```
if (condition) {
    this block is executed if the condition is true
} else {
    this block is executed if the condition is false
}
```

- The condition is a logical expression that is evaluated to be **`true`** or **`false`**, depending on the values in the expression and the operators

operators that produce boolean results

- All of the normal arithmetic comparison operators are available

`>`	:	greater than
`<`	:	less than
`>=`	:	greater than or equal
`<=`	:	less than or equal
`==`	:	equal
`!=`	:	not equal

`BooleanDemo.java`

examples

- numeric comparisons are extremely common

```
if (count == limit) {
   messageDialog.warn(“count has reached limit”);
}
```

- methods can return boolean values too

```
if (arg.equals(“green”)) {
  myColor = Color.green;
} else {
  myColor = defaultColor;
}
```

Compound expressions

- We can combine various logical expressions together to make one larger expression

```
if (arg != null && args.equals(“begin”)) {
   process the beginning of something …
}
```

- There are operators for “and”, “or” and “not”

```
&&     :   and
||     :   or
!      :   not
```

examples

- the “not” operator can be handy for clarity in some cases, but it can also be confusing, so use carefully

```
if (!ready) {
    messageDialog.warn(“system not ready”);
}
```

- the **&&** and | | operators are “shortcut” operators
  - » they stop evaluation as soon as the logical condition is satisfied

```
if (arg != null && arg.equals(“green”)) {
   myColor = Color.green;
}
```

Use braces and parentheses liberally

- Better safe than sorry
  - » Braces surround a block of code, even one line
  - » Parentheses surround parts of an expression

```
if ((a==b) && ((c+d) == e)) {
  state.advance(a);
} else {
  state.retreat(e);
}
```

multiple cases

- You can chain **`if`** statements together to select one of several possibilities

```
if (arg.equals(“green”)) {
  myColor = Color.green;
} else if (arg.equals(“blue”)) {
  myColor = Color.blue;
} else {
  myColor = defaultColor;
}
```

boolean expressions and variables

- If you find yourself doing something like this

```
if (pageNumber == lastPage) {
  allDone = true;
} else {
  allDone = false;
}
```

- there is an easier way

```
allDone = (pageNumber == lastPage);
```

boolean variable

boolean expression

conditional operator (3 operands)

- If you find yourself doing something like this

```
if (score < 0) {
  color = Color.red;
} else {
  color = Color.black;
}
```

- there is an easier way

use this value if expression is true

```
color = (score < 0) ? Color.red : Color.black;
```

variable

boolean expression

use this value if expression is false

returning a boolean value

- It is often convenient to return a boolean expression from a method

```
public boolean isEmpty() {
  return (this.itemCount == 0);
}
```

itemCount is an instance variable in this example

comparing floating point numbers

- Never, never test for exact equality of two floating point numbers using ==
  - » double and float values are approximate values which may vary slightly way out to the right of the decimal point
  - » 1.000000000000000000000000001
  - » 1.000000000000000000000000002
  - » Are they equal?

    NO. But probably close enough for our purposes ...

floating point compare

- check for exceeding a limit

```
if (xVal >= maxX) { …
if (yVal < 0.0) { …
```

- check for difference less than some small amount

```
double epsilon = 0.00001;
if (Math.abs(xVal-xGoal) < epsilon) {...
```

switch statement

```
switch (integral type) {

   case value1 : {
      statement1;
      break; //Break out of switch
   }
   case value2 : {
      statement2;
      break;
   }
   default : {
      statement3;
   }

}
```

there are lots of limitations and potential bugs in using this, so be careful!

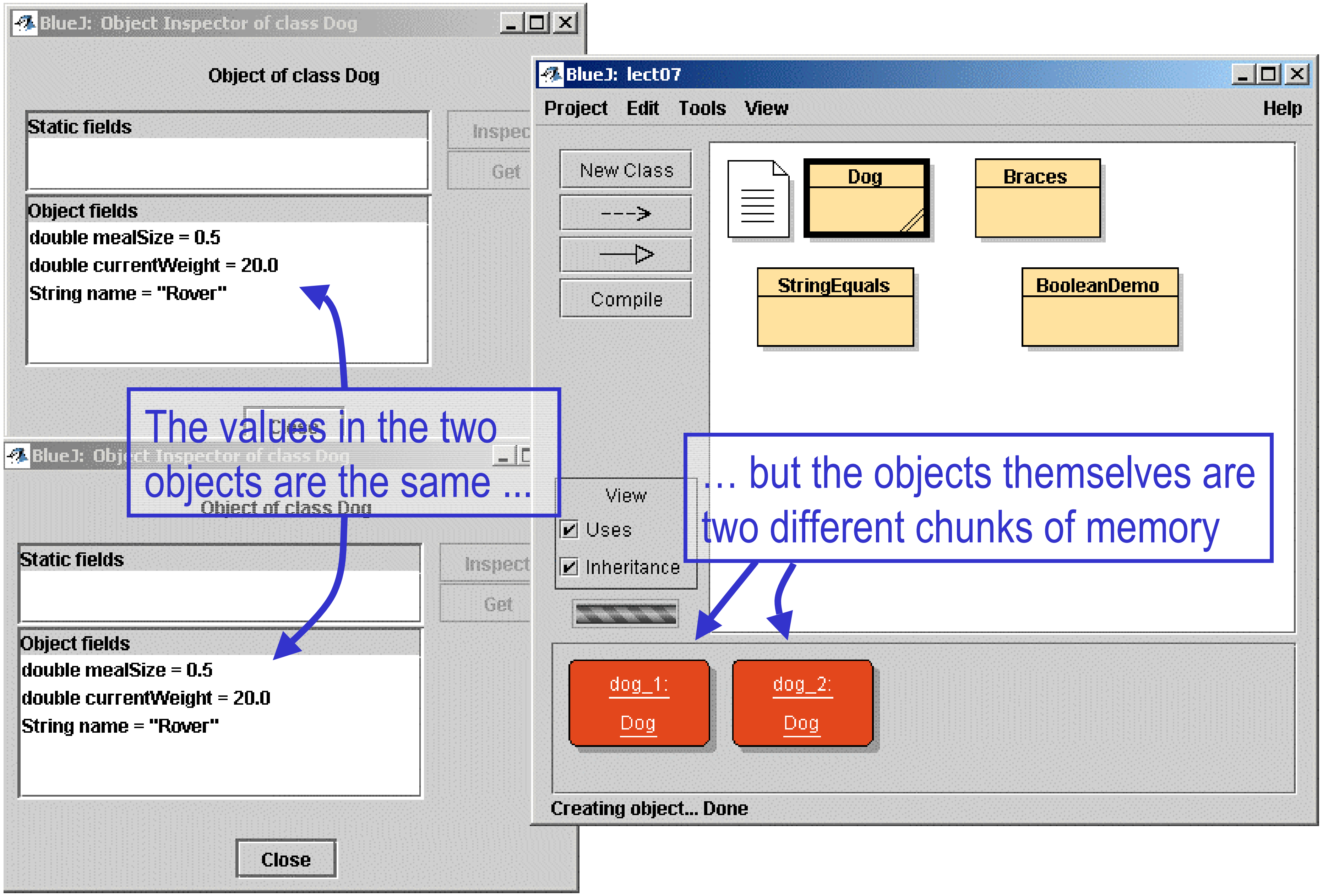
comparing objects for "equality"

- so far we've been comparing mostly simple values

```
if (count == limit) {
   messageDialog.warn("count has reached limit");
}
```

- but the situation is more complex with objects
  - » when are two String objects equal?
  - » when are two Dog objects equal?

`StringEquals.java, Dog.java`



```
double mealSize = 0.5
double currentWeight = 20.0
String name = "Rover"
```

```
double mealSize = 0.5
double currentWeight = 20.0
String name = "Rover"
```

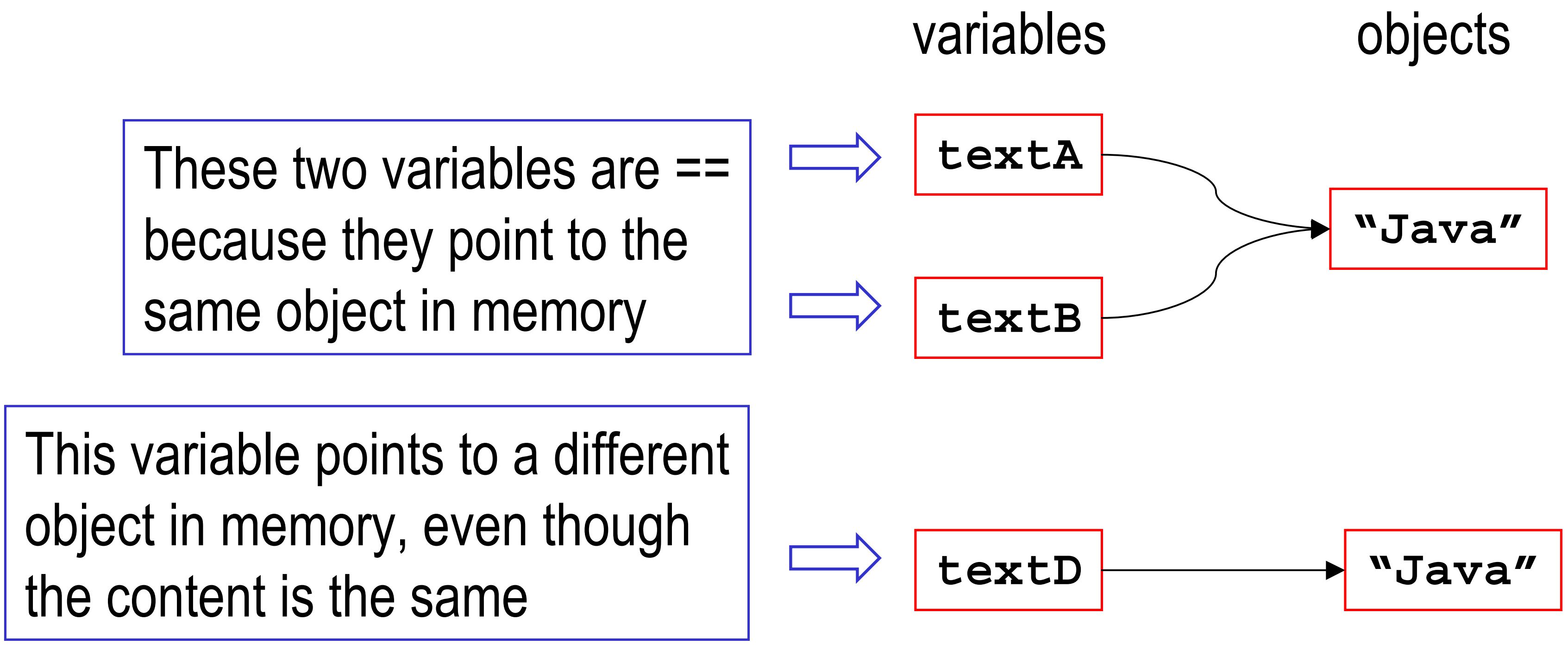
Creating object... Done

The values in the two objects are the same ...

... but the objects themselves are two different chunks of memory

== operator tests for literal equality

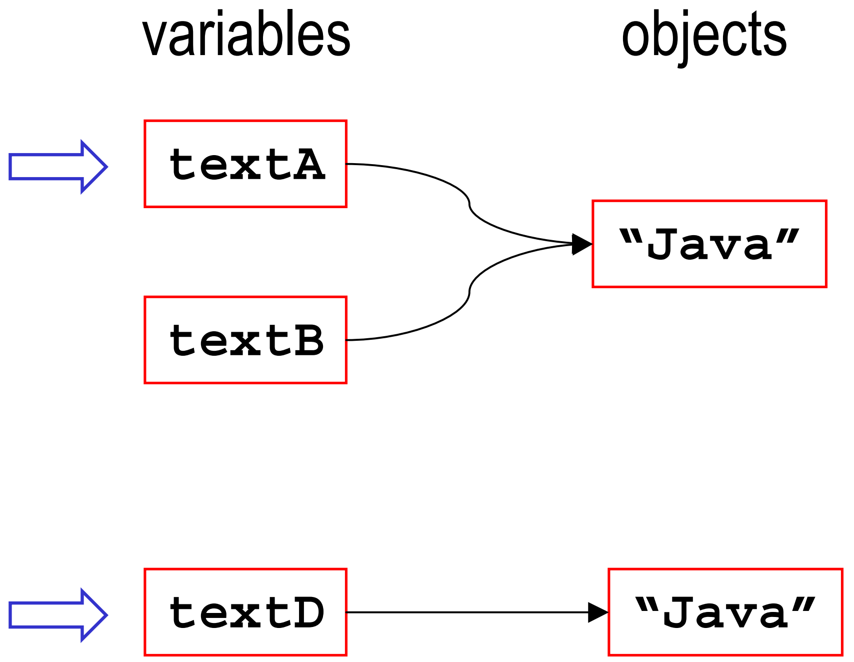
- Two object references are == if they point to exactly the same object


variables
objects
These two variables are == because they point to the same object in memory
This variable points to a different object in memory, even though the content is the same
textA
textB
textD
"Java"
"Java"

equals() method tests for content equality

- Two object references are equal if the content is deemed to be the same

These two variables are considered equal because the strings that they point to contain the same characters


variables
objects
textA
textB
"Java"
textD
"Java"