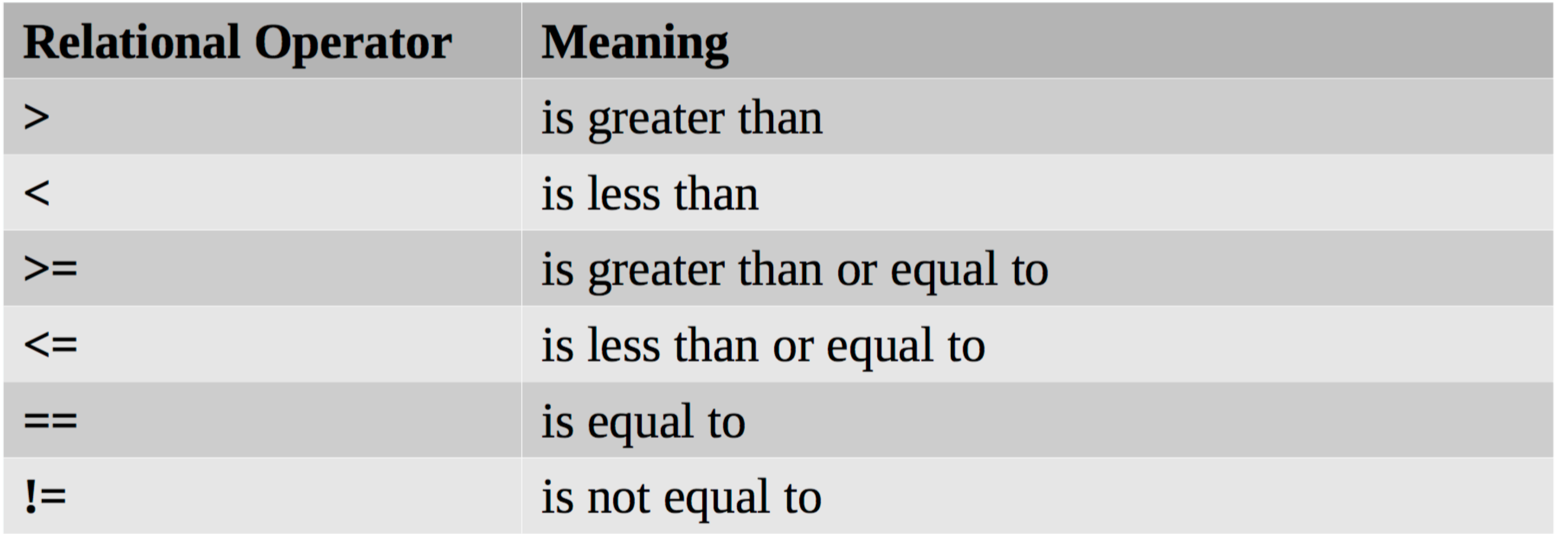
CS 149

Professor: Alvin Chao

Relational Operators

Relational operator – compare two values, evaluate to true or false



Relational Operator	Meaning
>	is greater than
<	is less than
>=	is greater than or equal to
<=	is less than or equal to
==	is equal to
!=	is not equal to

Boolean Expressions

- An expression that evaluates to true or false Examples:
  - X < 7
  - A == B
  - 3!=4

Relational Operators and Types

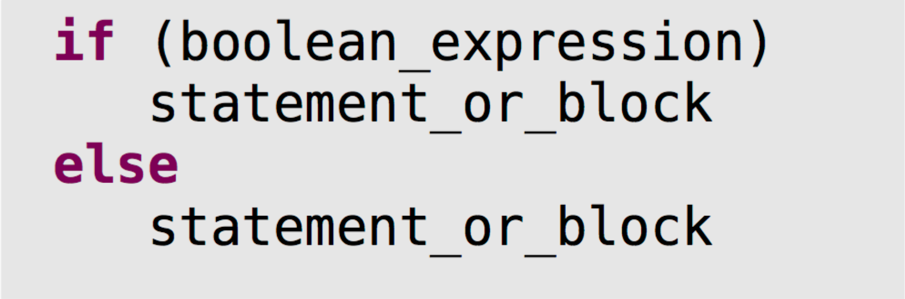
- Relational operators work as expected when comparing integers
- Also possible to compare integers with floating point values
  2 < 3.0 // **true**
- Be careful with floats and doubles!
  (.1 + .1 + .1) == .3 // *false!!!!!*
- Chars:
  'a' < 'b' // true
  '0' < '1' // true
  'Z' < 'a' // true, upper-case less than lower-case
  '9' < 'A' // true, numbers less than letters

String Comparison

- They don't work *at all* with strings:
  “HELLO” < “THERE” // Syntax error!!!
  “HELLO” == otherString // Won't work as expected!!!
- To compare string you will use the method .equals(). If we have two strings a = “Hello” and b = “hello” the expression
- a.equals(b) would yield false.

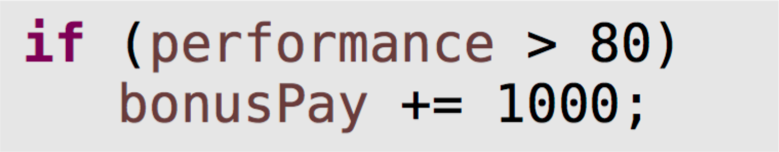
If Statements

- Syntax:

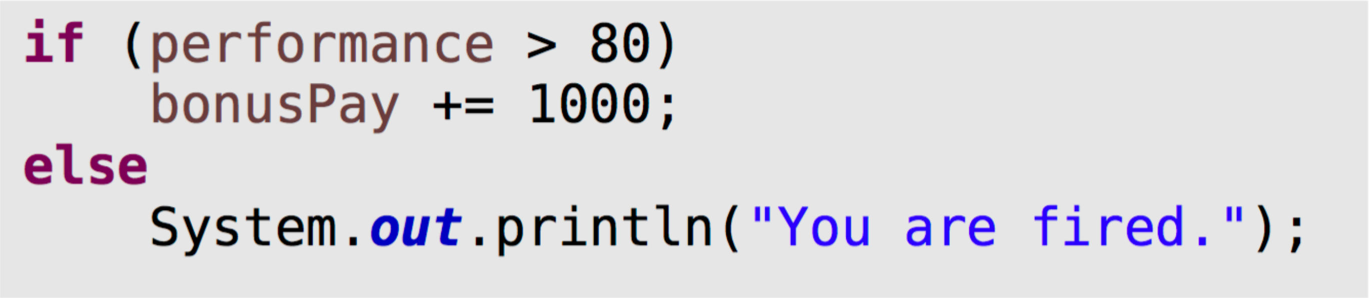


```
if (boolean_expression)
   statement_or_block
else
   statement_or_block
```

- Examples:



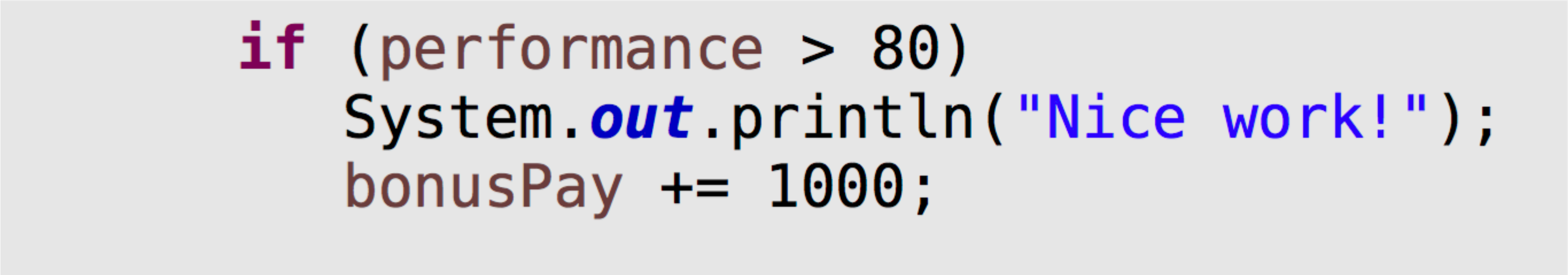
```
if (performance > 80)
   bonusPay += 1000;
```



```
if (performance > 80)
    bonusPay += 1000;
else
    System.out.println("You are fired.");
```

Danger...

- What’s wrong with this code?

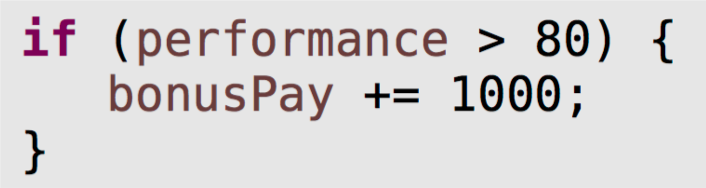


```
if (performance > 80)
    System.out.println("Nice work!");
    bonusPay += 1000;
```

Prevention

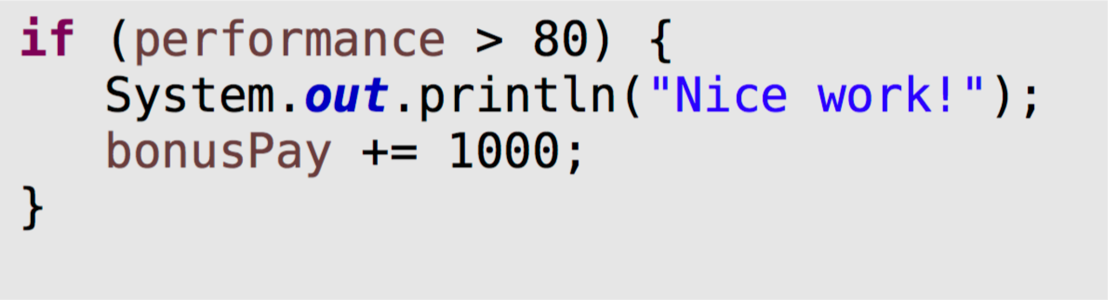
- Style guide / Checkstyle says use braces and proper indentation.

We use braces here:



```
if (performance > 80) {
    bonusPay += 1000;
}
```

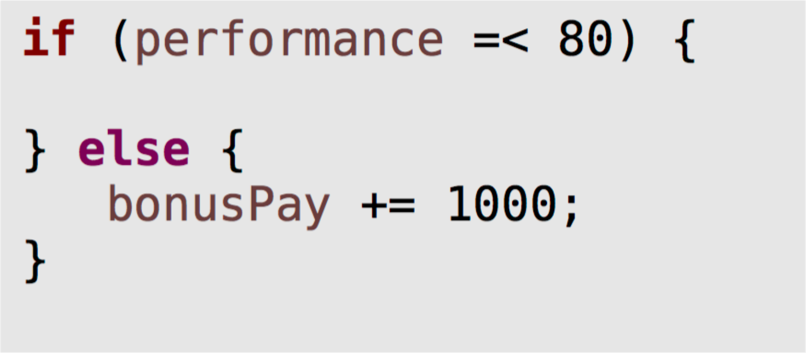
To prevent the mistake from the previous slide.



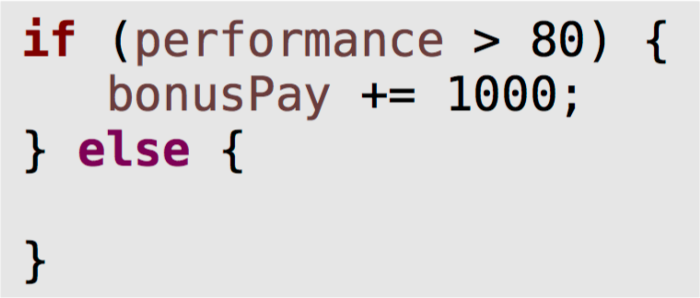
```
if (performance > 80) {
    System.out.println("Nice work!");
    bonusPay += 1000;
}
```

Empty Blocks = bad style

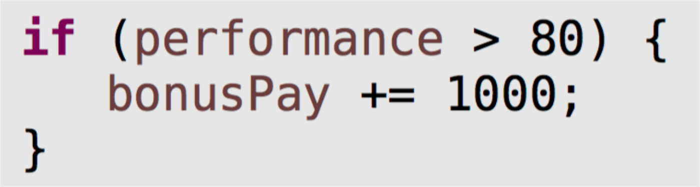
- These are all functionally equivalent, which is better?



```
if (performance =< 80) {

} else {
    bonusPay += 1000;
}
```



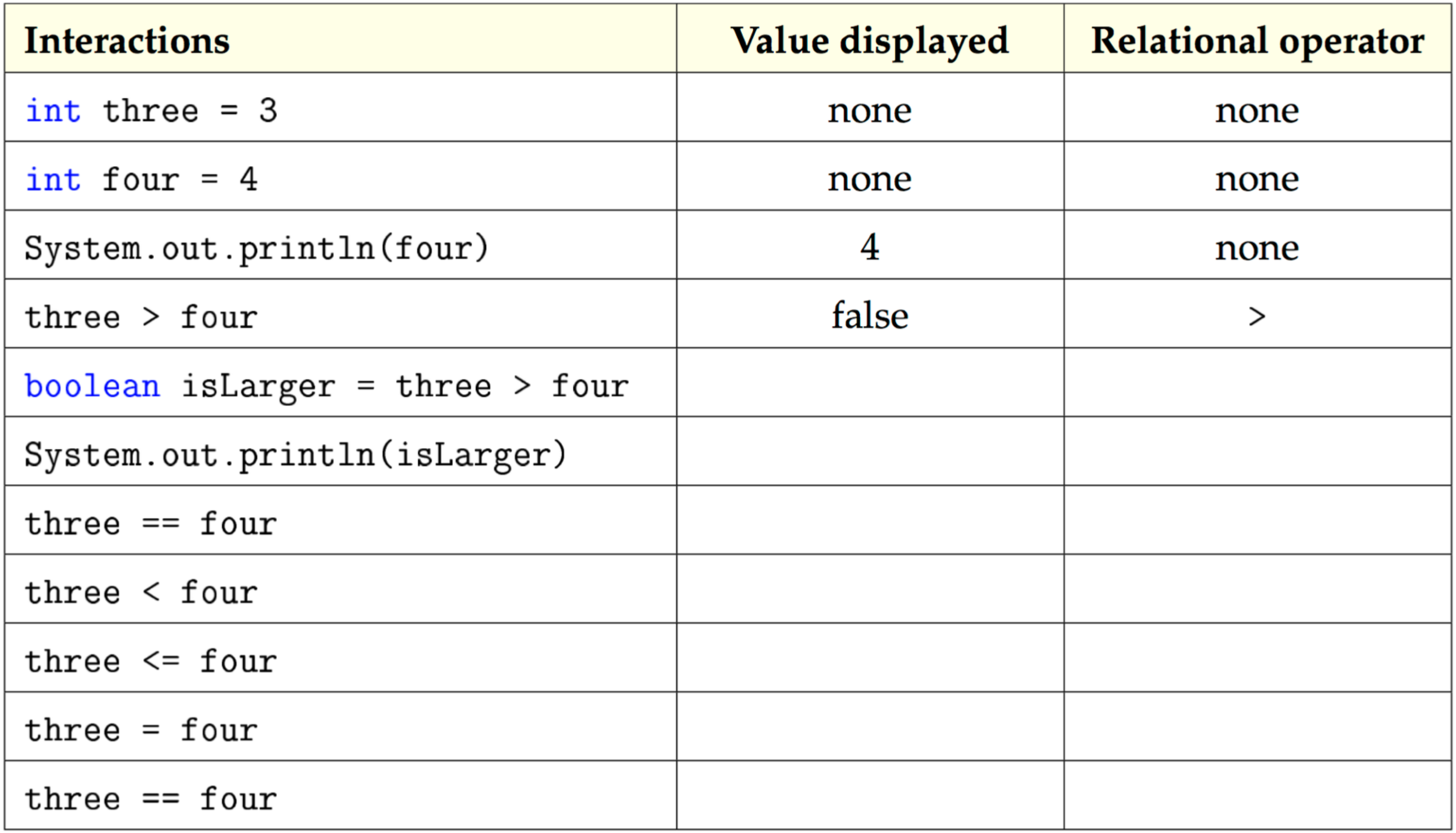
```
if (performance > 80) {
    bonusPay += 1000;
} else {

}
```



```
if (performance > 80) {
    bonusPay += 1000;
}
```

Decisions Model 1

Fill in the rest of the table, the first four lines are completed.



Interactions	Value displayed	Relational operator
`int three = 3`	none	none
`int four = 4`	none	none
`System.out.println(four)`	4	none
`three > four`	false	>
`boolean isLarger = three > four`		
`System.out.println(isLarger)`		
`three == four`		
`three < four`		
`three <= four`		
`three = four`		
`three == four`		

Decisions Model 1

1. On line 5 for the first model: boolean isLarger = three > four
   - a) What three actions are performed in this single line of code?
   - b) Write two lines of code, ending with semicolons, that would perform these same actions (but in two lines instead of a single line).
2. List the four unique boolean expressions used in the model.
3. The!= operator means “not equals”. Give an example of a boolean expression that uses != and evaluates to false.
4. Explain why the same boolean expression three == four resulted with two different boolean values in this Model.
5. What is the difference between = and == in Java?
6. Here are the six relational operators that can be used in a boolean expression.   ==, >, <, >=, <=, !=

Conditionals Model 2

Boolean expressions may also use conditional operators to implement basic logic. Relational operators are always executed first, so there is generally no need for parentheses.

Operator	Meaning
!	Not
&&	And
||	Or

If all three operators appear in the same expression, Java will evaluate the ! first, then &&, and finally ||. If there are multiples of the same operator, they are evaluated from left to right.

Example Variables:

```
    int a = 3;
    int b = 4;
    int c = 5;
boolean funny = true;
boolean weird = false;
```

Example Expressions:

```
a < b && funny
a < b && b < c
c < a || b < a
funny && a < c
!funny || weird
```

Conditionals Model 2

Example Variables:

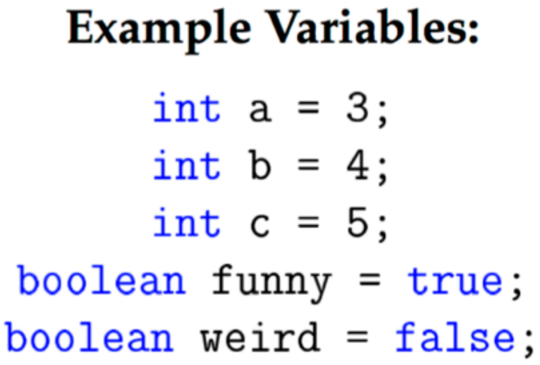
```
     int a = 3;
     int b = 4;
     int c = 5;
 boolean funny = true;
boolean weird = false;
```

Example Expressions:

```
a < b && funny
a < b && b < c
c < a || b < a
funny && a < c
!funny || weird
```

1. What do these example expressions evaluate to (true or false)?

Conditional Operators



Example Variables:

```
    int a = 3;
    int b = 4;
    int c = 5;
boolean funny = true;
boolean weird = false;
```

Give different examples of boolean expressions that:

a) uses a, b, and !, and evaluates to false

b) uses b, c, and !, and evaluates to true

c) uses any variables, but evaluates to false

d) uses any variables, but evaluates to true

Using your answers from the previous question, write the boolean expression p && q where p is your first answer and q is your second answer.

a) Your expression:

b) Result of p && q:

- **Acknowledgements**

Parts of this activity are based on materials developed by Chris Mayfield and Nathan Sprague.

</end>