COMP 110/L Lecture 11

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Some slides adapted from Dr. Kyle Dewey

Outline

- `@Test` **vs.** `assertEquals`
- Boolean operations
  - `&&`
  - `||`
  - `!`
- Complex `if` conditions

`@Test` **vs.** `assertEquals`

`@Test` vs. `assertEquals`

- `@Test` defines a test
- `assertEquals` checks a condition
- Can have a `@Test` containing no `assertEquals`
  - Test always passes
- Can have multiple `assertEquals` per `@Test`
  - Test passes if all `assertEquals` are ok

Example:
`MultiAssert.java`
`MultiAssertTest.java`

Boolean Operations

Boolean Operations

You're already familiar with operations returning `boolean`

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```
3 < 6
```

Boolean Operations

You're already familiar with operations returning `boolean`

```
3 < 6
```

```
2 == 7
```

Boolean Operations

You're already familiar with operations returning `boolean`

```
3 < 6
```

```
2 == 7
```

```
8 >= 8
```

Bigger Expressions

Can chain `boolean` expressions with AND (`&&`).

Semantics: only `true` if both sides are `true`.

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```
3 > 1 && 1 < 5
```

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```
3 > 1 && 1 < 5
```

```
true
```

Bigger Expressions

Can chain `boolean` expressions with AND (`&&`).

Semantics: only `true` if both sides are `true`.

```
3 > 1 && 1 < 5
```

```
true
```

```
1 > 3 && 1 < 5
```

Bigger Expressions

Can chain `boolean` expressions with AND (`&&`).

Semantics: only `true` if both sides are `true`.

```
3 > 1 && 1 < 5
```

```
true
```

```
1 > 3 && 1 < 5
```

```
false
```

Bigger Expressions

Can chain `boolean` expressions with AND (`&&`).

Semantics: only `true` if both sides are `true`.

```
3 > 1 && 1 < 5
true
```

```
1 > 3 && 1 < 5
false
```

```
3 > 1 && 5 < 1
```

Bigger Expressions

Can chain `boolean` expressions with AND (`&&`).

Semantics: only `true` if both sides are `true`.

```
3 > 1 && 1 < 5
true
```

```
1 > 3 && 1 < 5
false
```

```
3 > 1 && 5 < 1
false
```

Truth Table

Truth tables show the result of combining any two boolean expressions using the **AND** operator and the **OR** operator (or the **NOT** operator).
You should memorize/learn these values.

condition 1 (e.g., X)	**condition 2 (e.g., Y)**	**X AND Y (X && Y)**
false	false	false
false	true	false
true	false	false
true	true	true

Example:
`And.java`

Boolean Or

`boolean` expressions can also be combined with OR (`||`)

Semantics: `true` if either side is `true`.

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```
3 > 1 || 5 < 1
```

Boolean Or

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Semantics: `true` if either side is `true`.

```
3 > 1 || 5 < 1
true
```

Boolean Or

`boolean` expressions can also be combined with OR (`||`)

Semantics: `true` if either side is `true`.

```
3 > 1 || 5 < 1
     true
```

```
2 < 1 || 8 < 9
```

Boolean Or

`boolean` expressions can also be combined with OR (`||`)

Semantics: `true` if either side is `true`.

```
3 > 1 || 5 < 1
true
```

```
2 < 1 || 8 < 9
true
```

Boolean Or

`boolean` expressions can also be combined with OR (`||`)

Semantics: `true` if either side is `true`.

```
3 > 1 || 5 < 1
true
```

```
2 < 1 || 8 < 9
true
```

```
2 < 1 || 9 < 8
```

Boolean Or

`boolean` **expressions can also be combined with OR (`||`)**

Semantics: `true` **if either side is** `true`**.**

```
3 > 1 || 5 < 1
true
```

```
2 < 1 || 8 < 9
true
```

```
2 < 1 || 9 < 8
false
```

Truth Table

Truth tables show the result of combining any two boolean expressions using the **AND** operator and the **OR** operator (or the **NOT** operator).
You should memorize/learn these values.

condition 1 (e.g., X)	**condition 2 (e.g., Y)**	**X OR Y (X || Y)**
false	false	false
false	true	true
true	false	true
true	true	true

Example:

`Or.java`

Boolean Not

Can negate a `boolean` expression with not (`!`).

Semantics: `!true == false` and `!false == true`.

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```
!(1 < 2)
```

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Semantics: `!true == false` and `!false == true`.

```
!(1 < 2)
  false
```

Boolean Not

Can negate a `boolean` expression with not (`!`).

Semantics: `!true == false` and `!false == true`.

```
!(1 < 2)
false
```

```
!(1 > 7)
```

Boolean Not

Can negate a `boolean` expression with not (`!`).

Semantics: `!true == false` and `!false == true`.

```
!(1 < 2)
false
```

```
!(1 > 7)
true
```

Boolean Not

Can negate a `boolean` expression with not (`!`).

Semantics: `!true == false` and `!false == true`.

```
!(1 < 2)
false
```

```
!(1 > 7)
true
```

```
!(1 < 2 && 1 > 3)
```

Boolean Not

Can negate a `boolean` expression with not (`!`).

Semantics: `!true == false` and `!false == true`.

```
!(1 < 2)
false
```

```
!(1 > 7)
true
```

```
!(1 < 2 && 1 > 3)
true
```

Truth Table

Truth tables show the result of combining any two boolean expressions using the **AND** operator and the **OR** operator (or the **NOT** operator).
You should memorize/learn these values.

condition 1 (e.g., X)	**NOT X (!X)**
false	true
true	false

Example:
`Not.java`

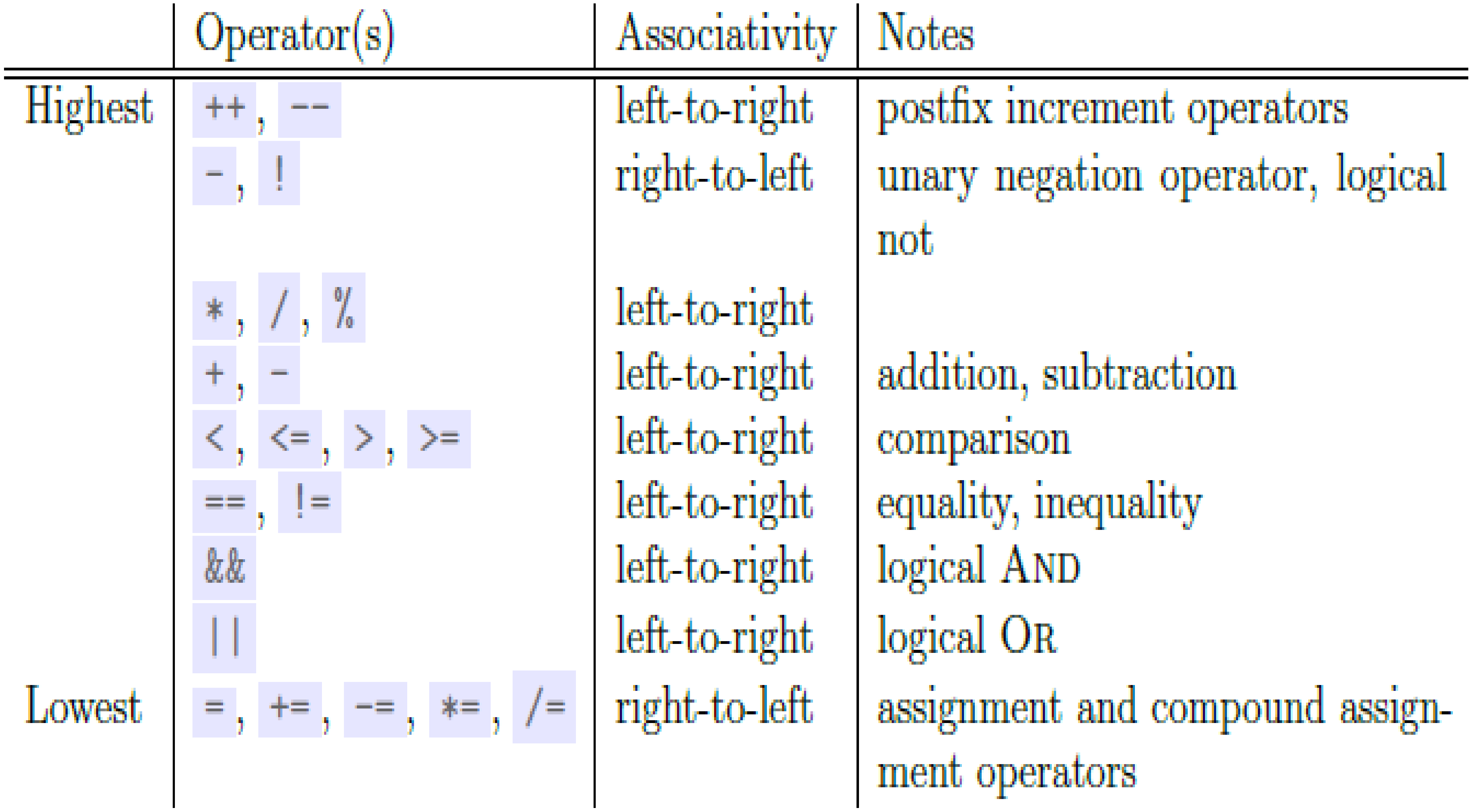
Truth Table

Truth tables show the result of combining any two boolean expressions using the **AND** operator and the **OR** operator (or the **NOT** operator).
You should memorize/learn these values.

condition 1 (e.g., X)	**condition 2 (e.g., Y)**	**NOT X (!X)**	**X AND Y (X && Y)**	**X OR Y (X || Y)**
false	false	true	false	false
false	true	true	false	true
true	false	false	false	true
true	true	false	true	true

Putting it Together: `ComplexConditional.java`

Operator Order of Precedence in Java



	Operator(s)	Associativity	Notes
Highest	`++`, `--`	left-to-right	postfix increment operators
	`-`, `!`	right-to-left	unary negation operator, logical not
	`*`, `/`, `%`	left-to-right	
	`+`, `-`	left-to-right	addition, subtraction
	`<`, `<=`, `>`, `>=`	left-to-right	comparison
	`==`, `!=`	left-to-right	equality, inequality
	`&&`	left-to-right	logical AND
	`||`	left-to-right	logical OR
Lowest	`=`, `+=`, `-=`, `*=`, `/=`	right-to-left	assignment and compound assignment operators

Associativity tells the direction of execution of operators

Testing with Boolean Operations

Uses of `&&` and `||` usually mean more tests are appropriate

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Uses of `&&` and `||` usually mean more tests are appropriate

```
if (x == 1 || x == 5) {
  return 7;
} else if (x > 7 && x <= 20) {
  return 8;
} else {
  return 55;
}
```

Testing with Boolean Operations

Uses of `&&` and `||` usually mean more tests are appropriate

Test: `x = 1`

```
if (x == 1 || x == 5) {
  return 7;
} else if (x > 7 && x <= 20) {
  return 8;
} else {
  return 55;
}
```

Testing with Boolean Operations

Uses of `&&` and `||` usually mean more tests are appropriate

Test: `x = 1`   Test: `x = 5`

```
if (x == 1 || x == 5) {
  return 7;
} else if (x > 7 && x <= 20) {
  return 8;
} else {
  return 55;
}
```

Testing with Boolean Operations

Uses of `&&` and `||` usually mean more tests are appropriate

Test: `x = 1` Test: `x = 5`

Test: `x = 8`

```
if (x == 1 || x == 5) {
   return 7;
} else if (x > 7 && x <= 20) {
   return 8;
} else {
   return 55;
}
```

Testing with Boolean Operations

Uses of `&&` and `||` usually mean more tests are appropriate

Test: `x = 1` Test: `x = 5`

```
if (x == 1 || x == 5) {
  return 7;
} else if (x > 7 && x <= 20) {
  return 8;
} else {
  return 55;
}
```

Test: `x = 8`

Test: `x = 21`

Putting it Together: `ComplexConditionalTest.java`