CSE 121 Lesson 2: Expressions and Datatypes

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Today's playlist:
121 24au lecture tunes

Announcements & Reminders

- Creative Project 0 due tonight by 11:59 PM
- Programming Assignment 0 releases later today
  - due Tuesday, October 8th
- IPL is open! Schedule & instructions on website
- “Extra resources” tab – practice! (with a caveat)

PCM Recap: Data Types & Expressions

- Types: `int, double, String, boolean`
  - note: only `String` is capitalized!
- Operators
  - mathematical operators, like + or –
  - relational operators, like < or !=
  - logical operators, like && or ||
- Two tricky concepts:
  - “precedence” (order of operations)
  - type conversions

(PCM) Data Types in Java

In programming, you're dealing with data…

- `ints` (whole numbers)
- `doubles` (real numbers)
- `Strings`
- `booleans` (true or false)

(among other ones – which we'll introduce later)

(PCM) Operators (for numerical & `String` values)

Numerical:

- + Addition
- - Subtraction
- * Multiplication
- / Division
- % Modulo or “Mod”
- <, >, <=, >=, ==, != Relational

Strings:

- + Concatenation

Booleans:

- ! Logical Not
- && Logical And
- || Logical Or
- == and != Relational

(PCM) Precedence

Parentheses

Multiplication, **M**odulo, **D**ivision

Addition (and Concatenation), **S**ubtraction

If multiple operators at the same level?

Evaluate subexpressions from left to right!

Example

$$\underbrace{1 + \underbrace{2 * 3}_{6}}_{7}$$

$$\underbrace{\underbrace{(1 + 2)}_{3} * 3}_{9}$$

Work on Expressions/Types Practice Problems

Part 1

- Ed lesson linked from the course calendar
- Work with the folks around you!
- TAs and I will be walking around to help

```
5 + 2 * 4

1 + 2 / 3

6 * 5 % 7
```

Part 1 Walkthrough

$$\underbrace{5 + \underbrace{2 * 4}_{8}}_{13}$$

$$\underbrace{1 + \underbrace{2 / 3}_{0}}_{1}$$

$$\underbrace{\underbrace{6 * 5}_{30} \% 7}_{2}$$

(PCM) Mixing Types & Conversions

When mixing types in an expression, Java will convert one type to the other and then perform the operation "normally".

Some conversions seem straightforward:

- `int`s can be converted to `double`s (add `.0`)
- `int`s and `double`s can be converted to `String`s (add `""`)

So, Java does these for you (is this good? controversial!)

(PCM) Conversions Gone Wrong!!

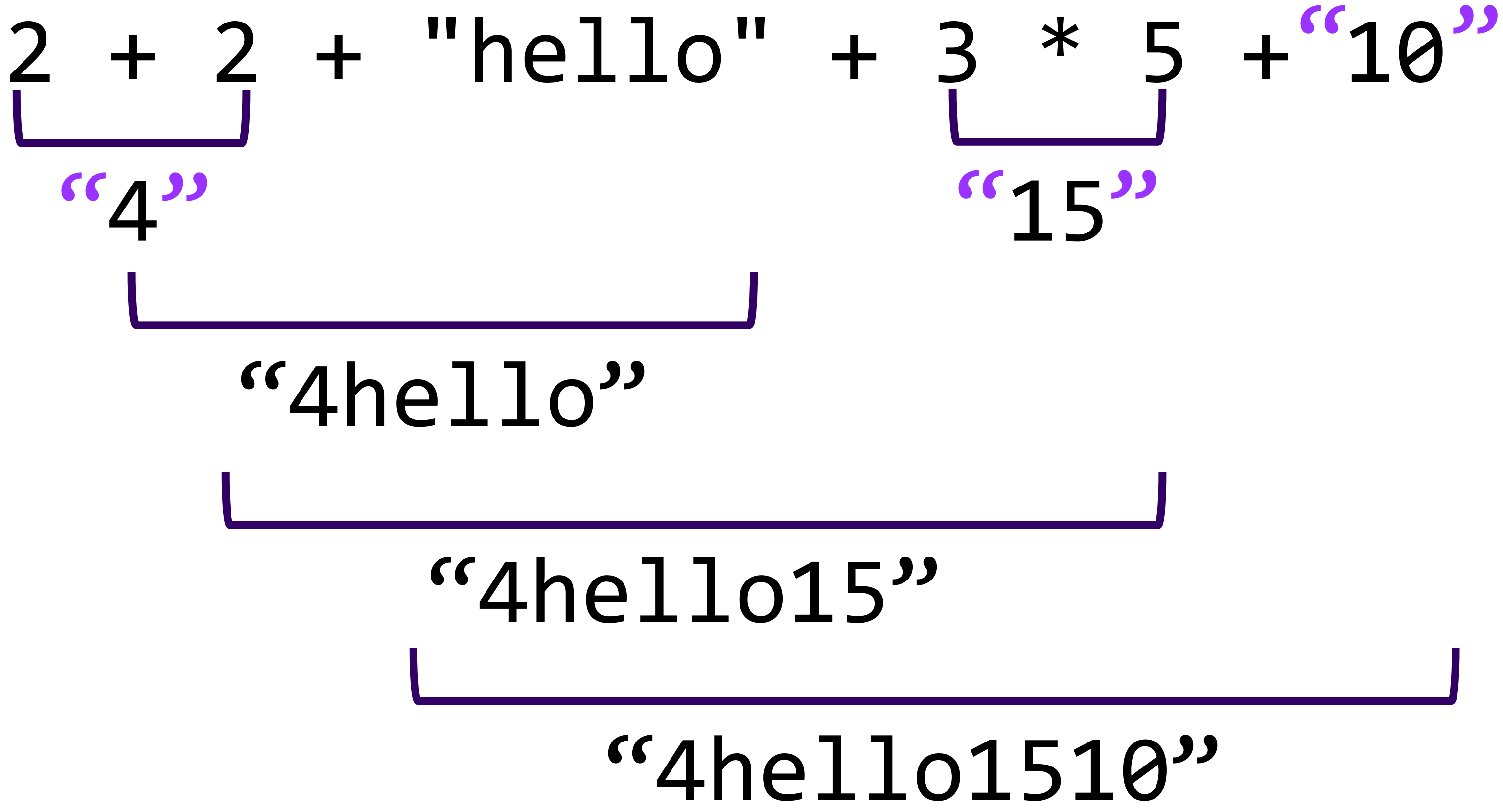
Other conversions are “lossy”, because you'd lose data.

- e.g. to make `3.14` an `int`, you’d probably pick either 3 or 4 – but either one loses data!
- Java won’t do this automatically for you – you need to “ask”.

Some conversions don’t make sense.

- how would you convert "Beyoncé" to an `int`? `double`?
- Java really doesn’t let you do these…

Example 2



```
2 + 2 + "hello" + 3 * 5 +"10"
```

“4”

“15”

“4hello”

“4hello15”

“4hello1510”

Work on Expressions/Types Practice Problems

Part 2

- Ed lesson linked from the course calendar
- Work with the folks around you!
- TAs and I will be walking around to help

```
5 * 3 + 1.0
8 / 3 * 2.0
8.0 / 3 * 2
"Hello" + "world"
1 + "2" + 3
1 + 2 + "3"
1 + "2" + (3 + 4)
```

Part 2 Walkthrough

$$\underbrace{\text{“Hello” + “world”}}_{\text{“Helloworld”}}$$

$$\underbrace{\underbrace{5 * 3}_{15.0} + 1.0}_{16.0}$$

$$\underbrace{\underbrace{8 / 3}_{2.0} * 2.0}_{4.0}$$

$$\underbrace{\underbrace{8.0 / 3}_{2.666\ldots} * 2.0}_{5.333\ldots}$$

$$\underbrace{\underbrace{\text{“1”} + \text{“2”}}_{\text{“12”}} + \text{“3”}}_{\text{“123”}}$$

$$\underbrace{\underbrace{1 + 2}_{\text{“3”}} + \text{“3”}}_{\text{“33”}}$$

$$\underbrace{\underbrace{\text{“1”} + \text{“2”}}_{\text{“12”}} + \underbrace{(3 + 4)}_{\text{“7”}}}_{\text{“127”}}$$

(PCM) Boolean Operators

- ! Logical Not
- < > <= >= Relational Operators
- == != Relational Operators (equality)
- && Logical And
- || Logical Or

(PCM) Precedence (updated)

Parentheses

Logical not

Multiplication**, M**odulo**, D**ivision

Addition (and Concatenation)**, S**ubtraction

Relational operators

Equality operators

Logical and

Logical or

Example 3

$$1 + \underbrace{2 * 3}_{6} \;\texttt{!=}\; \underbrace{(1 + 2)}_{3} * 3$$

$$\underbrace{1 + 6}_{7} \;\texttt{!=}\; \underbrace{3 * 3}_{9}$$

$$7 \;\texttt{!=}\; 9$$

```
true
```

Work on Expressions/Types Practice Problems
Part 3

- Ed lesson linked from the course calendar
- Work with the folks around you!
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```
5 * 3 < 12

10 % 3 == 10 / 3

5 < 9 || (7 != 7)

!(1 + 2 == 3 && 10 % 4 > 2)
```

Part 3 Walkthrough 1

$\underbrace{5 * 3}_{15} < 12$

15 < 12

false

$\underbrace{10 \% 3}_{1} == 10 / 3$

$1 == \underbrace{10 / 3}_{3}$

1 == 3

false

$5 < 9 \, || \, \underbrace{(7 != 7)}_{\text{false}}$

$\underbrace{5 < 9}_{\text{true}} \, || \, \text{false}$

true || false

true

Part 3 Walkthrough 2

```
!(1 + 2 == 3 && 10 % 4 > 2)
!(1 + 2 == 3 &&    2   > 2)
!(  3   == 3 &&    2   > 2)
!(  3   == 3 &&     false )
!(    true   &&     false )
!(         false          )
           true
```

(Friday) Variables

- Java allows you to create variables within a program. A variable has:
  - a type,
  - a name, and
  - (potentially) a value it is storing
- When you use a variable in an expression, you substitute its value

Declaration: `int x;`

Initialization: `x = 30;`

Or all in one line:

```
int x = 30;
```

```
System.out.println(x + 5);
```

Work on Expressions/Types Practice Problems

Part 4

- Ed lesson linked from the course calendar
- Work with the folks around you!
- TAs and I will be walking around to help

See Ed lesson for problems