# COMP 110/L Lecture 4

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Slides adapted from Dr. Kyle Dewey

# Outline

- New types: `long` and `double`
  - Reading in with `Scanner`
  - Performing operations on them
  - How they interact with each other and other types
- Exponentiation with `Math.pow()`

# New Type: `long`

# Revisit:
# `AddTwo.java`

Try with:

1- 9876543210

2- 1234567890 and 1234567890

# Fundamental Problem

- `int` stores integers in the following range: $-2^{31}$ to $(2^{31} - 1)$
- Numbers out of this range won't work right

# `long` for Bigger Integers

- `long` works like `int`, but its range is exponentially larger
  - $-2^{63}$ to $(2^{63} - 1)$

# Working with `long`

## Declaring a `long` variable

```
long myLong;
```

# Working with `long`

## Declaring a `long` variable

```
long myLong;
```

## Reading in a `long` with `Scanner`

```
Scanner in = new Scanner(System.in);
long myLong = in.nextLong();
```

# Example:
# `LongAddTwo.java`

# Specifying `long`

- By default, if you write a number, Java assumes it's an `int`
- If you follow it with an `l` (the letter ell), Java will treat it as a long

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---

```
14   // int
```

# Specifying `long`

- By default, if you write a number, Java assumes it's an `int`
- If you follow it with an `l` (the letter ell), Java will treat it as a long

```
14  // int
```

```
14l  // long (that's an ell)
```

# Interactions with `long`

String concatenation works like it does with `int`

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---

```
"my string" + 141
```

# Interactions with `long`

String concatenation works like it does with `int`

---

```
"my string" + 141

"my string14"
```

# Interactions with `long`

String concatenation works like it does with `int`

---

```
"my string" + 14l
```

"my string14"

---

```
13l + "other string"
```

# Interactions with `long`

String concatenation works like it does with `int`

---

```
"my string" + 14l
```

```
"my string14"
```

---

```
13l + "other string"
```

```
"13other string"
```

# Interactions with `long`

Addition works like it does with `int`

# Interactions with `long`

Addition works like it does with `int`

---

```
5l + 4l
```

# Interactions with `long`

Addition works like it does with `int`

```
5l + 4l
```

```
9l
```

# Interactions Between `long` and `int`

Values *coerce* into `long`

# Interactions Between `long` and `int`

Values *coerce* into `long`

---

```
41 + 2
```

# Interactions Between `long` and `int`

Values *coerce* into `long`

```
41 + 2
61
```

# Interactions Between `long` and `int`

Values *coerce* into `long`

```
41 + 2
```

```
61
```

```
3 + 61
```

# Interactions Between `long` and `int`

Values *coerce* into `long`

```
41 + 2
61
```

```
3 + 61
91
```

# New Type: `double`

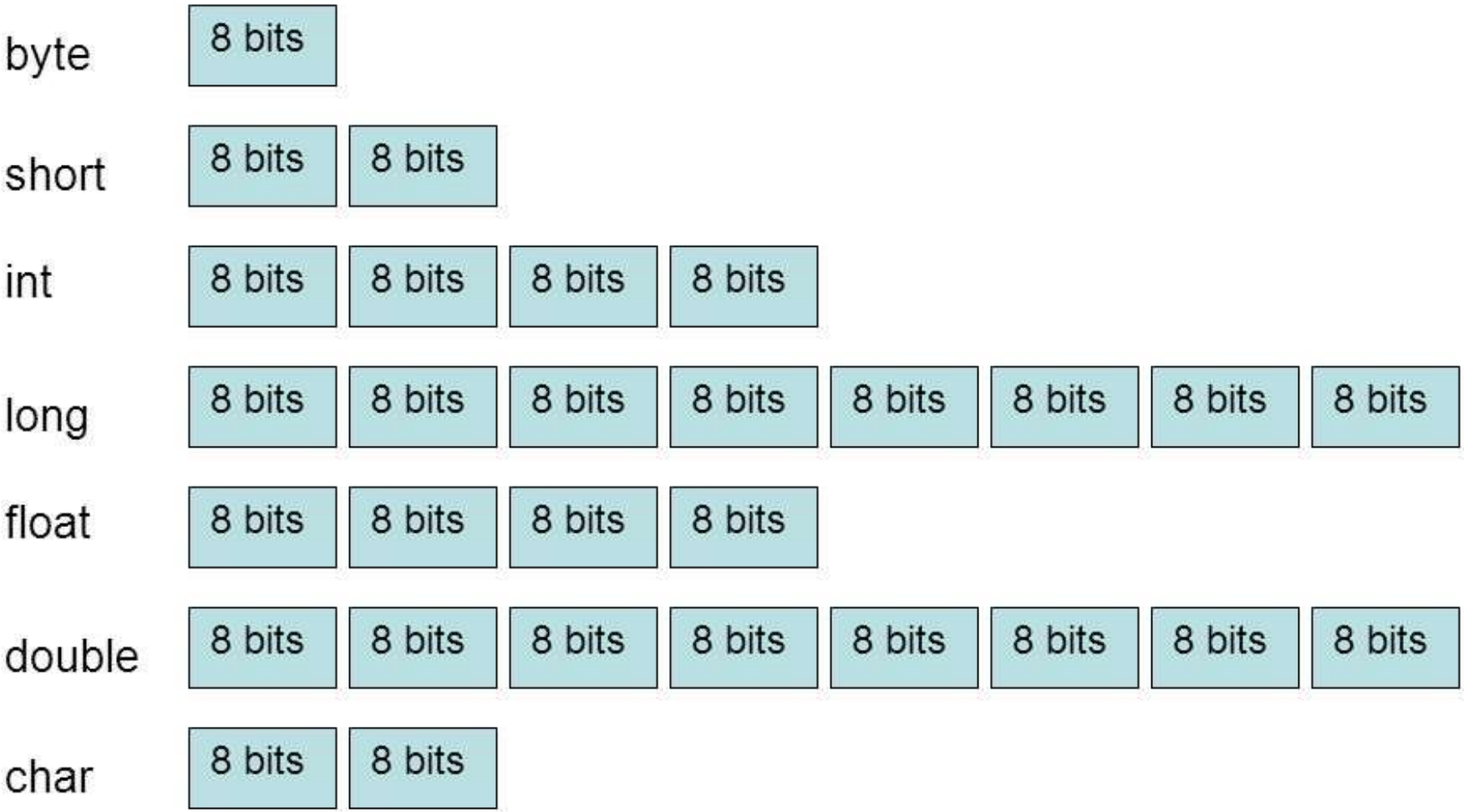
# Revisit:

`AddTwo.java`

# `double` for Floating-Point

- `double` stores floating-point values
- `float` also stores floating-point values, but it's half the size of `double`
  - Narrower range, less precise

# Sizes of Primitive Types



# Working with `double`

## Declaring a `double` variable

```
double myDouble;
```

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## Declaring a `double` variable

```
double myDouble;
```

## Reading in a `double` with `Scanner`

```
Scanner in = new Scanner(System.in);
double myDouble = in.nextDouble();
```

# Example:
# `DoubleAddTwo.java`

# Specifying `double`

If the number contains a decimal point,
Java treats it as a `double`

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Java treats it as a `double`

```
4.5  // double
```

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If the number contains a decimal point,
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```
4.5  // double
1.0  // double
```

# Specifying `double`

If the number contains a decimal point,
Java treats it as a `double`

```
4.5  // double
1.0  // double
0.2  // double
```

# Interactions with `double`

String concatenation works like it does with `int`

# Interactions with `double`

String concatenation works like it does with `int`

---

```
"my string" + 0.5
```

# Interactions with `double`

String concatenation works like it does with `int`

---

```
"my string" + 0.5
```

```
"my string0.5"
```

# Interactions with `double`

String concatenation works like it does with `int`

---

```
"my string" + 0.5
```

```
"my string0.5"
```

---

```
0.2 + "other string"
```

# Interactions with `double`

String concatenation works like it does with `int`

---

```
"my string" + 0.5
```

```
"my string0.5"
```

---

```
0.2 + "other string"
```

```
"0.2other string"
```

# Interactions with `double`

Addition works like it does with `int`

# Interactions with `double`

Addition works like it does with `int`

---

```
5.0 + 4.2
```

# Interactions with `double`

Addition works like it does with `int`

---

```
5.0 + 4.2
```

```
9.2
```

# Interactions Between `double` and `int`

Values *coerce* into `double`

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Values *coerce* into `double`

---

```
0.5 + 2
```

# Interactions Between `double` and `int`

Values *coerce* into `double`

```
0.5 + 2
  2.5
```

# Interactions Between `double` and `int`

Values *coerce* into `double`

```
0.5 + 2
```

```
2.5
```

```
3 + 0.75
```

# Interactions Between `double` and `int`

Values *coerce* into `double`

```
0.5 + 2
  2.5
```

```
3 + 0.75
  3.75
```

# Interactions Between `double` and `long`

Values *coerce* into `double`

# Interactions Between `double` and `long`

Values *coerce* into `double`

```
0.5 + 41
```

# Interactions Between `double` and `long`

Values *coerce* into `double`

```
0.5 + 4l
```

```
4.5
```

# Interactions Between `double` and `long`

Values *coerce* into `double`

```
0.5 + 4l
```

```
4.5
```

```
3l + 0.75
```

# Interactions Between `double` and `long`

Values *coerce* into `double`

```
0.5 + 4l
```

```
4.5
```

```
3l + 0.75
```

```
3.75
```

# Exponentiation with `Math.pow()`

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Use `Math.pow()` for exponentiation
(something to the power of something else)

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Wanted: $2^7$

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```
Math.pow(2, 7)
```

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Wanted: $3.4^{5.6}$

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Use `Math.pow()` for exponentiation
(something to the power of something else)

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Wanted: $2^7$

```
Math.pow(2, 7)
```

---

Wanted: $3.4^{5.6}$

```
Math.pow(3.4, 5.6)
```

# Example:
# `Exponentiation.java`