Model 1 Primitive Types

Keyword	Size	Min Value	Max Value	Example
`byte`	1 byte	-128	127	`(byte) 123`
`short`	2 bytes	$-32,768$	$32,767$	`(short) 12345`
`int`	4 bytes	-2^{31}	$2^{31}-1$	`1234567890`
`long`	8 bytes	-2^{63}	$2^{63}-1$	`123456789012345L`
`float`	4 bytes	-3.4×10^{38}	3.4×10^{38}	`3.14159F`
`double`	8 bytes	-1.8×10^{308}	1.8×10^{308}	`3.141592653589793`
`boolean`	1 byte	N/A	N/A	`true`
`char`	2 bytes	0	65,535	`'A'`

Note that 1 byte is 8 bits, i.e., eight "ones and zeros" in computer memory. Since there are only two possible values for each bit, you can represent $2^8 = 256$ possible values with 1 byte.

Questions (15 min) Start time:

1. Which of the primitive types are integers? Which are floating-point?

2. Why do primitive types have ranges of values? What determines the range of the data type?

3. Why can't computers represent every possible number in mathematics? Will they ever be able to do so?

4. Since a `byte` can represent 256 different numbers, why is its max value 127 and not 128?

5. What is the data type for each of the following values?

1.14159	7.2E-4	-128
0	0.0	'0'
-1.0F	-13L	false
123	'H'	true

6. Based on the examples below, when does Java allow you to assign one type of primitive variable to another?

```
int int_ = 3;
long long_ = 3L;
float float_ = 3.0F;
double double_ = 3.0;

int_ = int_;
int_ = long_;      // illegal
int_ = float_;     // illegal
int_ = double_;    // illegal

long_ = int_;
long_ = long_;
long_ = float_;    // illegal
long_ = double_;   // illegal
```

```
float_ = int_;
float_ = long_;
float_ = float_;
float_ = double_;  // illegal

double_ = int_;
double_ = long_;
double_ = float_;
double_ = double_;

int_ = '0';
int_ = false;      // illegal
double_ = '0';
double_ = false;   // illegal
```

7. Given the following variable declarations, which of the assignments are not allowed?

```
byte miles;
short minutes;
int checking;
long days;
float total;
double sum;
boolean flag;
char letter;
```

```
checking = 56000;
total = 0;
sum = total;
total = sum;
checking = miles;
sum = checking;
flag = minutes;
days = '0';
```