Activity 3: Data Types

Java supports two main types of data: *primitive types* like `int` and `double` that represent a single value, and *reference types* like `String` and `Scanner` that represent more complex information.

Model 1 Primitive Types

Keyword	Size	Min Value	Max Value
`byte`	1 byte	-128	127
`short`	2 bytes	$-32,768$	$32,767$
`int`	4 bytes	-2^{31}	$2^{31}-1$
`long`	8 bytes	-2^{63}	$2^{63}-1$
`float`	4 bytes	$\pm 3.4 \times 10^{-38}$	$\pm 3.4 \times 10^{38}$
`double`	8 bytes	$\pm 1.7 \times 10^{-308}$	$\pm 1.7 \times 10^{308}$
`boolean`	N/A	`false`	`true`
`char`	2 bytes	`'\u0000'`	`'\uffff'`

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

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?

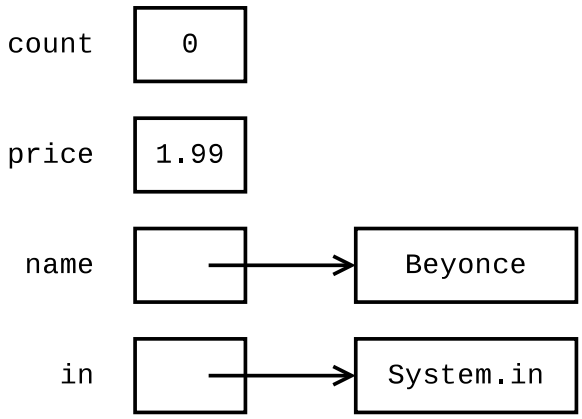
```
byte miles;
short minutes;
int checking;
long days;
float total;
double sum;
boolean flag;
char letter;
```

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

Model 2 Reference Types

```
int count;
double price;
String name;
Scanner in;

count = 0;
price = 1.99;
name = "Beyonce";
in = new Scanner(System.in);
```



Java has eight primitive types (see Model 1). All other types of data are called *reference* types, because **their value is a memory address**. When drawing memory diagrams, use an arrow to *reference* other memory locations (rather than make up integer values for the actual addresses).

Questions (15 min) Start time: _____

8. What are the reference types in the example above?

9. By convention, what is the difference between primitive and reference type names?

10. Variables in Java can use at most eight bytes of memory. Explain why the values `"Beyonce"` and `System.in` cannot be stored directly in the memory locations for `name` and `in`.

11. What is the value of the variable `count`? What is the value of the variable `price`?

12. What is the value of the variable `name`? What is the value of the variable `in`?

13. Carefully explain what it means to assign one variable to another. For example, what does the statement `price = count;` do in terms of memory?

14. Draw a memory diagram for the following code. Make sure your answer is consistent with what you wrote for #13.

```
int width;
double score;
Scanner input;
String first;
String other;

width = 20;
score = 0.94;
input = new Scanner(System.in);
first = "Taylor";
score = width;
other = first;
```

15. What is the output of the following statements after running the code above? Explain your answer using the diagram.

```
first = "Swift";
System.out.println(other);
```

Model 3 Professional Skills

"What do employers look for when they are seeking new college graduates to take on jobs? According to NACE's *Job Outlook 2016* survey, they are looking for leaders who can work as part of a team." http://www.naceweb.org/s11182015/employers-look-for-in-new-hires.aspx

Attributes employers seek on a candidate's resume

	Attribute	% of respondents
1.	Leadership	80.1%
2.	Ability to work in a team	78.9%
3.	Communication skills (written)	70.2%
4.	Problem-solving skills	70.2%
5.	Communication skills (verbal)	68.9%
6.	Strong work ethic	68.9%
7.	Initiative	65.8%
8.	Analytical/quantitative skills	62.7%
9.	Flexibility/adaptability	60.9%
10.	Technical skills	59.6%

Questions (10 min) Start time: _____

16. What is the relationship between the top two attributes employers seek?

17. How is communication (written and verbal) related to problem-solving?

18. As a team, come up with a short description/example of each attribute.

    1. 6.
    2. 7.
    3. 8.
    4. 9.
    5. 10.

19. Which of these skills do you expect to develop in this course? Why?