Section 4: Variables

Introduction: A variable is a storage location that is referenced by name and contains a value of a particular data type. In lecture, we likened this to containers that come in different molds: the name lets you know which container to use and each container can only hold contents/values that fit in that particular mold.

Variables are most often used for (1) storing and manipulating a value that will change over the course of your program and/or (2) giving a meaningful name to a particular value used in your program.

Data Types: The following is a list of the most commonly used data types in CSE 120.

- `int` – Stores an integer: a positive or negative number with no fractional part (e.g. -7, 0, 120).
- `float` – Stores a positive or negative number that can have a fractional part (e.g. 3.14, -1.0).
- `color` – Stores a color triplet, which can be defined using the command `color(red, green, blue)`.
- `char` – Stores a character: a single symbol that you can find in text files (e.g. 'a', 'C', '5', '$', '_').
- `boolean` – Stores a logical value, which can only be `true` or `false`.

Variable Declaration: Before you can use a variable, you must declare it (i.e. ask Processing to create the container). Because programs are executed in sequence, the variable declaration must occur before you try to use the variable. A variable declaration is of the form: `var_type var_name;`

- `var_type` is one of the data types listed above and indicates the mold of your container (and determines what values it can store).
- `var_name` is the name associated with this variable. You should try to use intuitive names that indicate what the variable is used for. Variable names can include letters, numbers, and non-arithmetic symbols, but cannot start with a number.

When Processing creates a new variable/container, it starts “empty.” Processing will complain if you try to use a variable when it is empty. To fill a variable while you are declaring it, you may initialize it like so: `var_type var_name = initial_value;`

Examples: `int len = 50;`  
           `color purple = color(128, 0, 128);`

Using Variables: You can freely use variable names in your program and they will automatically be substituted with the current values stored in those variables!

Examples: `ellipse(40, len+20, len, len);`  // circle of diameter 50 at (40,70)  
          `background(purple);`  // set background to (128, 0, 128)

To change the value stored in a variable, we use an assignment statement: `var_name = new_value;` Although we use an equals sign, you should think of the effect/behavior as `var_name ← new_value`.

Examples: `len = len + 10;`  // new value of len is 50+10 = 60  
           `purple = color(75, 42, 133);`  // darker shade of purple
Exercises:

1) For the following values, what data type does a variable need to be in order to store them?

- true
- color \((0,0,255)\)
- 42
- 2.71

2) Write out a Processing statement below to declare and initialize a variable that holds our course number (120). Make sure that you give it an intuitive and legal variable name.

3) Describe what will be drawn when the following Processing program is run:

```java
int i = 10;
int j = i * 3/2;
color c = color(255,0,0);
i = i + j;
fill(c);
noStroke();
rect(i, j, 30, 30);
```

4) Complete the program below that draws an isosceles triangle with the top point at \((\text{topX}, \text{topY})\) no matter what we initialize the following variables to (note that declaring multiple variables on one line, as shown here, does work as long as they are the same data type):

- \(\text{int h} = 60, \text{b} = 60;\)
- \(\text{int topX} = 100, \text{topY} = 100;\)

```java
triangle(__________,__________,__________,__________,__________,__________);```

5) Complete the commands described below for \(\text{float x}\) and \(\text{float y}\) using the \text{min()} and \text{max()} functions.

```java
// increases x in increments of 2, but stops at 120
x = ______________________________;

// decreases y in increments of 3.5, but stops at -1
y = ______________________________;
```

6) Go to the course website and get started on the homework titled “Lego Family.” [individual]