An array is a way to create multiple variables, all of the same type, with a single line of code. For example

int[] ages = new int[10];

creates 10 int variables all at once (and auto-initializes them all to 0). The 10 variables are named ages[0] through ages[9].

One nice feature of arrays is that the index value can be any Java expression that evaluates to an integer. So if i has the value 4, then ages[i] is the value ages[4] and ages[i+2] is the variable ages[6].

1) When desk-checking code that uses an array, draw a wide, skinny rectangle divided into one box per index in the array. Write each box's index below it and keep track of each index's current value inside. Use desk checking to determine the value of the array after this code is run.

```
int[] numbers = new int[8];
numbers[1] = 4;
numbers[4] = 99;
numbers[7] = 2;

int x = numbers[1];
numbers[x] = 44;
numbers[numbers[7]] = 11;
```

2) Leonardo Fibonacci modeled the growth of rabbit population around the year 1200 as follows: In month 0 there is 1 pair of rabbits. In month 1 there is still only 1 pair of rabbits. But, in each subsequent month the number of pairs of rabbits is the sum of the numbers of pair of rabbit in the two previous months. Symbolically this can be written $f_0 = 1$, $f_1 = 1$, and $f_i = f_{i-1} + f_{i-2}$ for all $i > 1$. Use this formula to write Java code that calculates f_n by creating an array and placing at index i the value of f_i. First write pseudocode for your code and then translate the pseudocode to Java.

Java has lots of built-in functionality to help you deal with arrays. If you have an array variable "ages", you can get the number of elements in the array as "ages.length" (note that this is not a method call, so there are no parentheses). And, the built-in Java class Arrays has methods that do things for you like sort an array into increasing order or duplicate an array into a new array. You can look at the Javadoc if you want to see more.

3) The median of a group of numbers is the number where there are just as many larger than it in the group as there are smaller. For example, the median of {3,2,5,4,1} is 3. You can find the median value of an array by sorting it and then returning the middle element. If the number of elements is even, then the median is defined as the average of the middle two elements.

   Write pseudocode and then Java code that finds the median of an array of integers.

4) It is sometimes important to not disturb the order of an array because the order of the elements is important for some reason. Redo the previous exercise, but this time do it without changing the order of the original array.