Section 1: String Manipulation (10 points total)
Circle or write the correct answer to each question.

Given the commands:

```
String aPalindrome = "a man, a plan, a canal Panama";

String[] strs = splitTokens(aPalindrome, ",");
```

Answer the following questions:

1.1 (3 pts) What will be the length of `strs`?

a) 1

b) 2

c) 3

d) 4

1.2 (3 pts) What will be the value of `strs[1]`?

a) "a man"

b) "a plan"

c) "a canal Panama"

d) 3

1.3. (4 pts) Write the expression used to obtain the number of elements in `strs`.

Section 2: Conditionals (15 points total)

2.1 (7 pts) Write a conditional expression that would print to the screen "weekday" whenever the integer variable `day` is not equal to 0 or 6.

2.2 (8 pts) Consider a function which toggles (i.e., switches) the value for a global boolean variable that tracks whether a light is on or off. Two people, creatively named A and B, who are claiming to be expert light switchers have written two different implementations of this function, shown below:

```
// the global variable
boolean lightOn = false;
...
void toggleLightA() {
  if (lightOn) {
    lightOn = false;
  } else {
    lightOn = true;
  }
}
```

```
// the global variable
boolean lightOn = false;
...
void toggleLightB() {
  if (lightOn) {
    lightOn = false;
  }
  if (!lightOn){
    lightOn = true;
  }
}
```

Are these two implementations equivalent? Are both of the people expert light switchers, or is one or are both of them frauds? **Why? Explain your answer! (The explanation is worth 6 pts.)**

Section 3: Multidimensional Arrays (10 points total)

3. Add the necessary lines of code within `setup()` that fills the `vals` array with random numbers of your choosing. Your implementation must use `for` loops.

```
float[][] vals;

void setup() {
    vals = new float[20][300];

    // Add your code here
```

```
} // Closing brace for setup()
```

Section 4: Transformations (10 points total)

4. Add the necessary transformations to `draw()` to render the rectangle at the center of the sketch, twice its size, and rotated by 45 degrees (PI/4 radians).

```
void setup() {
    size(400, 400);
    rectMode(CENTER);
}

void draw() {

    // Add transformations here




    rect(0, 0, 25, 25);
}
```

Section 5: Sorting and Searching (15 points total)

Consider the following array:

```
float[] vals = new float[]{ 1, 3, 6, 8, 9, 13, 19, 23, 32, 40 };
```

We could use the following code to determine whether the value x is in the array:

```
float x = 10;
boolean containsValue = false;
for (int i=0; i < vals.length; i++) {
    if (vals[i] == x) {  // comparison
        containsValue = true;
    }
}
```

However, in the worst case, this method requires `vals.length` (10) comparisons.

5.1 (10 pts) Describe *in detail* how the binary search algorithm would work to find whether x is in the array. Make certain to describe how the algorithm works.

5.2 (5 pts) How many comparisons would binary search take to solve the same problem? Justify your answer if you're not certain.

Section 6: Image Processing (10 points total)

6. Add the necessary code within the nested for-loops to color all pixels white, except for pixels on the diagonal (when r == c).

```
void setup() {
  size(100,100);

  loadPixels();

  for (int r=0; r<width; r++) {
      for (int c=0; c<height; c++) {

          // Add code here




      }  // Closing brace for the c-loop
  } // Closing brace for the r-loop

  updatePixels();
}
```

Section 7: Recursion (15 points total)

7.1. (10 pts) What does the following program print? Justify your answer if you're not certain.

```
void setup() {
   int n = op(5,3);
   println( n );
}

int op (int val, int divisor) {
   if (val < divisor) {
     return val;
   } else {
     return op(val - divisor, divisor);
   }
}
```

7.2. (5 pts) Which built-in mathematical operator does the `op()` function simulate?

Section 8: Algorithms and Debugging (20 points total)

8. The following program was designed to count and print the number of duplicates in the myArray String array. Unfortunately, it doesn't work properly. When I test it with the given data, it tells me that I have 11 duplicates, but I know that there are only two. Fix the program so that it works correctly.

```
// Count and print the number of duplicate strings in myArray

String [] myArray = {"A", "B", "C", "D", "A", "F", "C"};

void setup() {

  int count = 0;

  for (int i=0; i<myArray.length; i++) {

    for (int j=0; j<myArray.length; j++) {

      if (myArray[i].equals(myArray[j])) {

        count++;

      }

    }

  }

  println("There are " + count + " duplicates.");
}
```