Name: _______________________

CS 145 Images and Imagination

Exam 2

Score:

1. (max 14) ____________
2. (max 18) ____________
3. (max 24) ____________
4. (max 8) ____________
5. (max 10) ____________
6. (max 8) ____________
7. (max 8) ____________
8. (max 10) ____________

Total: (max 100) ____________
1. (14 pts total) For the following function

```java
float calcGray(int r, int g, int b) {
    float gray = 0.3*r + 0.59*g + 0.11*b;
    return gray/255.;
}
```

a. (2 pts) What is the return type? _________________________
b. (2 pts) How many parameters are there? _______________
c. (2 pts) What is the type of each parameter? ______________
d. (2 pts) What are the names of each of the parameters? _______________
e. (6 pts) What needs to go into the two println statements:

```java
void setup() {
    int myRed   = random(255);
    int myBlue  = random(255);
    int myGreen = random(255);

    println(                                                ); // fill in
    println(                                                ); // fill in
}
```

To print the output below (note, the choice of numbers written below may be different since we don’t know ahead of time what random numbers will be chosen).

For red = 241, green = 100, and blue = 16
The gray scale value is .5218

*You should make use of the calcGray() function.*

2. (3 pts each, 18 pts total) Complex Number Representation:
   a. Place the following in standard form a + b i.
      i. \(3 i^3 + 7 i^4\) _______________
      ii. \(-6 i^2 + i \sqrt{16}\) _______________
   b. What is the standard form for the complex numbers whose values in polar coordinates are
      i. \((r, \theta) = (\sqrt{2}, 45^\circ)\) _______________
      ii. \((r, \theta) = (3, 270^\circ)\) _______________
   c. What is the polar coordinate representation \((r, \theta)\) for the following complex numbers
      i. \(-3\) \((r, \theta) = \)_______________
      ii. \(-2 i\) \((r, \theta) = \)_______________
3. (4 pts each, 24 pts total) Complex numbers: Given \( z_1 = -8 + 2i \) and \( z_2 = 1 - 3i \). Calculate the following, placing the result in standard form

a. \( z_1 + z_2 = \) ______________

b. \( z_1 - 2z_2 = \) ______________

c. \( z_1z_2 = \) ______________

d. \( \bar{z}_1 + z_1 = \) ______________

e. \( \bar{z}_1z_1 = \) ______________

f. Length of \( z_1 = |z_1| = \) ______________

4. (8 pts total) Class syntax:

a. (3 pts) How would you create a new Complex object with real component equal to 4.2 and imaginary component equal to 5.8?

b. (5 pts) In Processing, suppose you have created complex numbers \( c_1, c_2, \) and \( c_3 \). How do you compute (i.e. what is the syntax of) for computing

\[
c_3 = c_1/c_2 + c_1\times c_2
\]
5. (10 pts) Functions and Classes: Write a Processing function called `zSquared` that takes a Complex number as a parameter and returns a float which is equal to the square of the Complex number’s real part plus the square of its imaginary part. That is, if \( z = a + b \ i \), then the function will return \( a^2 + b^2 \) (of course, you need to put this all in Processing syntax).

6. (4 pts each, 8 pts total) Rescaling: Given a region of the complex plane where the real and imaginary components range as shown in the figure below:

```
int pixeli = map(                                    );
int pixelj = map(                                    );
```

```
int real = map(                                    );
int imag = map(                                    );
```
7. (8 pts) The following for-loop computes the sum of the numbers from 10 to 100. Write a while-loop that does the same thing.
   ```java
   int sum = 0;
   for (int i = 10; i <= 100; i++) {
     sum = sum + i;
   }
   ```

8. (10 pts) Recursion: Write a recursive function called multNums that will multiply the numbers from 1 to n, for some value of n. It could be called from the setup() function as follows:
   ```java
   void setup() {
     int n = random(20);
     int product = multNums(n);
     println("The product is ", product);
   }
   ```