CS 145 Images and Imagination

Practice Problems for Exam 2

1. String concatenation: Complete the `println` instruction so that the output of

```
for (int i =0; i < 10; i++) {
    int num = (int) random(100);
    println(                                          ); //finish this
}
```

will be formatted as follows (obviously, the value of the random numbers will be random).

```
i = 0:  The random number is 10
i = 1:  The random number is 51
i = 2:  The random number is 77
...
i = 9:  The random number is 81
```

2. For the function below:

```
float convertRed(int red) {
       return red/255.0;
}
```

   a. What is the return type?

   b. What is the *name* of the parameter?

   c. What is the *type* of the parameter?

   d. Which of the following are legal ways (or reasonable) <u>*to call*</u> the function?

```
i.   float r = convertRed();
ii.  int r = convertRed(2.5);
iii. float r = convertRed(155);
iv.  convertRed(100);
v.   stroke(convertRed(100), 1.0, 1.0));
```

3. To set a color in Processing, you use the command stroke(r,g,b). To set a grayscale value, you just use a single number stroke(g) where g can be computed from the RGB value by adding together 30% of the red value, 59% of the green value, and 11% of the blue value. For example, if r=10 (out of 255), g =100, and b = 255, then the grayscale value will be g = (0.3*10)+(0.59*100)+((0.11*255) = 90.2. *Write a function that takes the three rgb integer values as parameters, and returns the grayscale value as a float.*

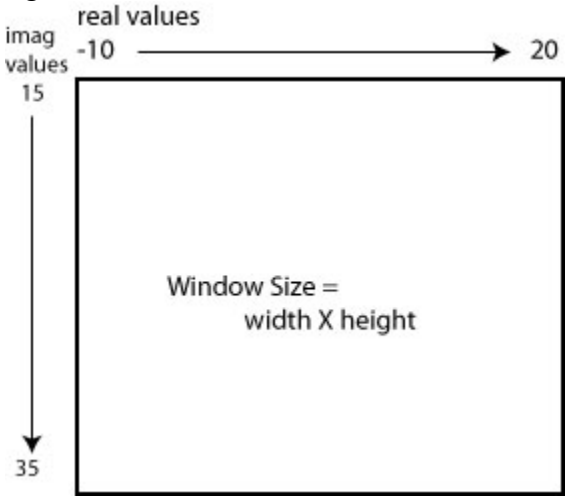
4. Complex numbers: Place the following in standard form a + b i.
   a. i^3 _____
   b. $\sqrt{-36} + 3\ i^2$ _____
5. Complex numbers: Given $z_1 = -1 + 7\ i$ and $z_2 = (2 + i)$. Calculate the following, placing the result in standard form
   a. z1 + z2 = _____
   b. z1 - z2 = _____
   c. 2 z1 = _____
   d. z1 z1 = $z1^2$ = _____
   e. z1 z2 = _____
   f. $\bar{z}_1 + z_1$ = _____
   g. $\bar{z}_1 z_1$ = _____
   h. Length of z1 = | z1| = _____
6. Class syntax: In class, we made use of a Complex class in Processing to compute the Mandelbrot set.
   a. How would you create a new Complex object with real component equal to 1.5 and imaginary component equal to -6 ?

   b. In Processing, suppose you have created complex numbers c1, c2, and c3. How do you multiply c1 and c2 together, placing the result in c3?

   c. In Processing, suppose you have created complex numbers c1, c2, and c3. How do you compute (i.e. what is the syntax of) for computing

      c3 = c1*c2 + c1

7. What is the standard form for the complex numbers whose values in polar coordinates are
   a. $r = 2, \theta = 90°$ _____
   b. $r = 1, \theta = 180°$ _____
8. What is the polar coordinate representation (r, θ) for the following complex numbers
   a. $-3i$ _____
   b. $1 + i$ _____
9. Rescaling: Given a region of the complex plane where the real component ranges between -10 and 20, and the imaginary part ranges between 15 and 35 as shown in the figure:



   a. How does one use the map function to determine the pixel location of the complex number
   $z = 5 + 21i$.

```
int pixeli = map(                                    );

int pixelj = map(                                    );
```

   b. How does one use the map function to determine the complex number corresponding to the pixel (i,j)

```
int real = map(                                   );

int imag = map(                                   );
```

10. Convert the following `for-loop` to a `while` loop:

```
for (int i =0; i < 100; i++) {
    println(i);
}
```

11. Mandelbrot Set: Write a do-while loop that iterates on the complex function $z = z^2 + c$. It stops when either the loop has iterated 100 times or the length of z exceeds 2. Initialize z and c to be z=0 and c = 0.5 + i.

12. Recursion: Write a recursive function to output the numbers from 0 to 100 *in reverse order*.

```
void setup() {
  printNums(100);
}

void printNums(int n) {









}
```

13. Recursion: Write a recursive function to add the numbers from 1 to n, for some value of n.

```
void setup() {
  int n = 100;
  println ("The sum from 1 to "+ n + " is " + addNums(n));
}

int addNums(int n) {









}
```