Name: _____

CS 145 Images and Imagination

Exam 1

Score:

1. (max10) _____
2. (max 4) _____
3. (max 16) _____
4. (max 6) _____
5. (max 9) _____
6. (max 6) _____
7. (max 5) _____
8. (max 15) _____
9. (max 15) _____
10. (max 14) _____

Total: (max 100) _____

1. (10 pts total) Color can be represented as RGB or HSB.
   a. (3 pts) What does RGB stand for?

   b. (3 pts) What does HSB stand for?

   c. (4 pts) Each component of RGB can have 256 values (0 to 255). Where does the number 256 come from?

2. (4 pts) What is an algorithm?

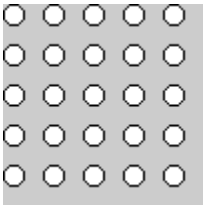
3. (16 pts total, 4 pts each) For the following images, complete the commands so that the code generates the image shown on left.

```
size(100,100);
```


a)
```
line(                  );
```

b)
```
for (         ;              ;          ) {

        line(                          );
}
```

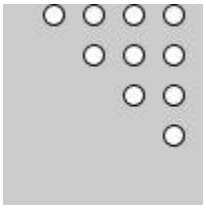


d.
```
strokeWeight(1);
ellipseMode(CORNER);
for (int i = 0;            ;            ) {

  for (int j = 0;           ;            ) {


         ellipse(                );

  }
}
```



e.

Changing *exactly one thing* in the code in d) will produce the image on left. What do you need to change? (re-write the altered line below) :

4. (6 pts) What are the values of x, y and z after executing the following code?

   a.
```
int x = 2;
int y = 7;
int z = 5;
z = 2*y;
x = z;
y = x + y;
```

   x is _____, y is _____, z is _____

5. (9 pts total, 3 pts each) Assume that you have integer variables x and y declared:
```
int x;
int y;
```
   How do you write a Boolean expression that *evaluates to* `true` if

   a. x is not twice y. _____

   b. x is between -10 and 10. _____

   c. x is *outside* the range from -10 to 10. _____

6. (6 pts total, 3 pts each) Recall that the "mod" function (symbol is %) is the remainder function. Suppose we have some integer x:

   a. If `x = 30`, then what is the value of `x % 20` ? _____

   b. What are all the positive values of x that will make the following expression true?

      `(x%2)==1` _____

7. (5 pts) The following code draws a square at the point (x,y). Assume that x and y are integers that are declared and set elsewhere in the code.

```
rect(x,y,20,20);
```

   Write a conditional statement (i.e. an "if-else statement") so that the fill color of the square will be red if x is smaller than 150, blue if x is between 150 and 200, and yellow otherwise.

8. (15 pts total, 3 pts each) Given the code:

```
Line 1    void setup() {
Line 2       size(s,s);
Line 3       background(100);
Line 4       drawShape(15);
Line 5       int b = 25;
Line 6       for (int i = 0; i < 5; i++) {
Line 7           translate(i*b,0);
Line 8           drawShape(150);
Line 9       }
Line 10   }

Line 11   int s = 300;

Line 12   drawShape(int x) {
Line 13     ellipse(x,x,5,5);
Line 14     int w = 20;
Line 15     ellipse(2*x, 2*x,w,w);
Line 16   }
```

What is the scope of each of the variables in the above program?

a) variable s:
Line numbers of scope are: _____

b) variable b:
Line numbers of scope are: _____

c) variable i:
Line numbers of scope are: _____

d) variable x:
Line numbers of scope are: _____

e) variable w:
Line numbers of scope are: _____

9. (15 pts total, 5 pts each) Given the code:

```
Line 1    void setup() {
Line 2      size(300,300);
Line 3      translate(width/2, height/2);
Line 4      for (int i = 0; i < 3; i++) {
Line 5         rotate(5*i);
Line 6         drawShape(i);
Line 7      }
Line 8   }

Line 9    drawShape(int x) {
Line 10      translate(10*x,20);
Line 11      ellipse(0,0,20,20);
Line 12   }
```

   a. What does the matrix stack contain at the end of `setup()` (Line 8)? (Calculate the actual value of the transformations. For example, if i=2 in line 5, then the rotation should be written as rotate(10) rather than rotate(5*i)).

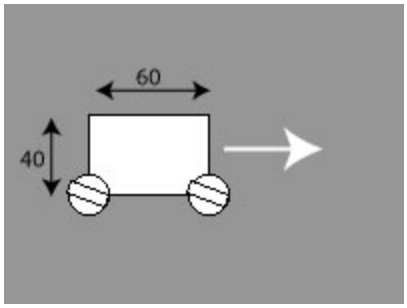
   b. What would the matrix stack contain at the end of `setup()` if `drawShape` was modified as follows:

```
drawShape(int x) {
    pushMatrix();
    translate(10*x,20);
    ellipse(0,0,20,20);
    popMatrix();
}
```

c. What would the matrix stack contain at the end of `setup()` if `drawShape` was modified as follows:

```
drawShape(int x) {
    resetMatrix();
    translate(10*x,20);
    ellipse(0,0,20,20);
}
```

10. (14 pts total, 7 pts each) Suppose you want to animate a cart moving across the window. The variable `x_position` controls the movement of the cart from left to right, and the variable `angle` controls the rotation of the two wheels about their center. (See code on next page.)



Window size is 200x150.

a. Similar to what we did in lab and class, draw the hierarchical graph structure. Include the needed transformations and any push and pops of the matrix stack. You will need to examine the code to determine that exact sizes of the transformations.

b. Based on your graph in part a), add the necessary commands in the code below in order to animate the cart:

```
float x_position = 0;
float angle = 0;

void setup() {
  size(200,150);
  rectMode(CENTER);
  ellipseMode(CENTER);
}

void draw() {
  background(150);
  // add your code here:
```

```
  x_position += 1;
  angle += 5;
}

void cart() {
  rect(0,0,60,40);
}

void wheel() {
  ellipse(0,0,20,20);
  rect(0,0,20,6);
}
```