

CS 116x Final Exam Review Solutions – Winter 2015

This review will most likely not cover everything that could possibly be on the exam. The following is intended to help you study but remember that you may be tested on anything covered in Modules 1-10 as well as lectures, assignments, and labs.

Module 6 – Procedural Content

- Recursion
- `random()`, `randomSeed()`
- `noise()`
- Combining recursion and randomness

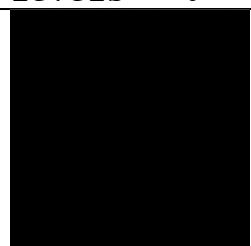
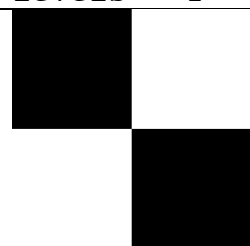
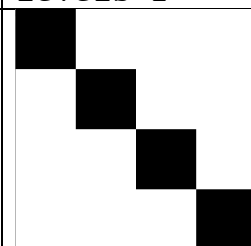
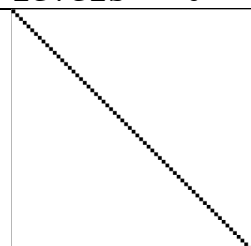
Module 6 Questions

1. In a recursive function, what is the base case?

In a recursive function, “we avoid infinite regress with some sort of stopping condition, called a base case. Every recursive function must have a base case, a way to execute the body of the function without ever making a recursive call.”

<https://www.student.cs.uwaterloo.ca/~cs116/x/lectures/Module06notes.pdf>

2. Consider the following recursive function that produces the following sketches based on the variable `levels`. Fill in the blanks between push and pop matrix using (translate, rotate, and/or scale) to complete this function.

levels = 0	levels = 1	levels 2	...	levels = 6
				

```
int levels = 2;

void setup()
{
  size( 400, 400 );
}

void draw()
{
  background( 255 );
  scale(400);
  noStroke();
  fill( 0 );

  drawSquares( levels );
}

void drawSquares( int lev )
{
  if ( lev == 0 ) {
    rect( 0, 0, 1, 1);
  } else {

    pushMatrix();

    scale(0.5);

    drawSquares( lev - 1 );
    popMatrix();

    pushMatrix();

    translate(0.5, 0.5);
    scale(0.5);

    drawSquares( lev - 1 );
    popMatrix();
  }
}
```

3. Explain what the `randomSeed()` function does and be sure to explain how this affects the `random()` function.

“The built-in function `randomSeed()` takes an integer as input and resets Processing’s random number generator based on that “seed”. For any given seed, any sequence of calls to `random()` will return the same sequence of answers.”

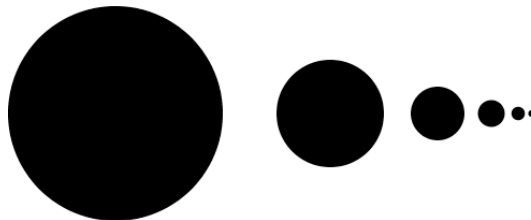
<https://www.student.cs.uwaterloo.ca/~cs116/x/lectures/Module06notes.pdf>

4. Explain what the `noise()` function does and give an example of situation where you want to use it.

“This function can be passed one, two, or three floating-point numbers as parameters. In one dimension, the noise function produces an unpredictable number for every input. That number never changes—its permanently associated with the input number” An example where we used this was the scrolling for the Archipelago assignment.

<https://www.student.cs.uwaterloo.ca/~cs116/x/lectures/Module06notes.pdf>

5. Answer the following questions about the code below:
 - a. What shapes are being drawn? **Circles.**
 - b. How many shapes are drawn? **6.**
 - c. Do the shapes vary in size? If yes, how so? Where is the biggest one located? The smallest? **Yes, each one is half as small as the one to the left of it.**
 - d. Are all of the shapes completely visible in the sketch window? **Yes.**
 - e. Do any of the shapes overlap? If yes, which ones and where? **No.**



```
void setup() {  
  size( 500, 500 );  
  fill( 0 );  
  noStroke();  
}  
  
void makeDrawing( int levs ) {  
  ellipse( 0, 0, 200, 200 );  
  if ( levs > 0 ) {  
    pushMatrix();  
    translate( 200, 0 );  
    scale( 0.5 );  
    makeDrawing( levs - 1 );  
    popMatrix();  
  }  
}  
  
void draw() {  
  background( 255 );  
  translate( 100, 250 );  
  makeDrawing( 5 );  
}
```

Module 7 – Advanced Types and OO

- What is an object?
- Classes and instances
- Fields, methods, constructors
- Writing simple classes
- `this`
- Arrays, dictionaries, trees

Module 7 Questions

1. Explain how a dictionary works and give an example of data that would want to store in a dictionary. Specifically, be sure to mention the roles of keys and values.

“A dictionary is a way of associating a set of indexable keys to values. In the case of an actual dictionary, the keys are words and the values are their definitions. An old-fashioned dictionary is organized as a long list of key/value pairs. The keys are organized in alphabetical order to make the key you’re interested in easier to find.

<https://www.student.cs.uwaterloo.ca/~cs116/x/lectures/Module07notes.pdf>

2. Consider the following complete sketches. Answer the following questions for both sketches.
 - a. What is the name of the class defined in this code?

SKETCH 1: Point

SKETCH 2: NamedNumber

- b. Circle an instance of this class. Place an “I” next to the circle.
- c. Circle a field that belongs to this class. Place an “F” next to the circle.
- d. Circle a method. Place a “M” next to the circle.
- e. Circle the constructor. Place a “C” next to the circle.
- f. What does this sketch do? Specifically, what is drawn and where is it located?

SKETCH 1: Draws an ellipse at point 250, 150, with diameter 50.

SKETCH 2: Prints out

`e = 2.178`

`2.0`

SKETCH 1:

```
class Point
{
  float x; F
  float y; F
  Point(float x_val, float y_val) C
  {
    x = x_val;
    y = y_val;
  }
  void move(float x_change, float y_change) M
  {
    x += x_change;
    y += y_change;
  }
}

Point p;

void setup() {
  size(500, 500);
  p = new Point(100, 100); I
  p.move(150, 50);
  ellipse(p.x, p.y, 50, 50);
}
```

SKETCH 2:

```
class NamedNumber
{
    float val;      F
    String name;

    NamedNumber(float a_val, String a_name)
    {
        val = a_val;      C
        name = a_name;
    }

    void report()
    {
        println(name, "=", val);      M
    }
}

void setup()
{
    NamedNumber n1 = new NamedNumber(PI, "PI");      I
    NamedNumber n2 = new NamedNumber(2.718, "e");
    NamedNumber n3 = new NamedNumber(6, "Six");
    NamedNumber n4 = new NamedNumber(4, "Four");

    n2.report();
    println(n3.val - n4.val);
}
```

Module 8 – Image Processing

- Cropping
- Scaling and rotating
- Working with pixel arrays
- Filtering and blurring
- Working with the camera

Module 8 Questions

1. Fill in the blanks to complete the following code so that it writes the pixels of `img` to the sketch window, with 50 added to the red value of each pixel.

```
void setup() {  
  PImage img = loadImage("barn.jpg");  
  size(img.width, img.height);  
  
  img.loadPixels() ;  
  loadPixels() ;  
  
  for ( int x = 0 ; x < width ; x++ ) {  
    for ( int y = 0 ; y < height ; y++ ) {  
  
      int i = y*width+x;  
      color pix = img.pixels[i];  
  
      float r = red(pix);  
      float g = green(pix);  
      float b = blue(pix);  
  
      pixels[y*width+x] = color( r+50, g, b) ;  
    }  
  }  
  updatePixels() ;  
}
```


Module 9 – Text Processing

- `loadStrings()`, `split()`, `splitTokens()`
- `equals()`, `charAt()`
- Other String and Character functions
- Regular expressions

Module 9 Questions

1. Give an example of time when it would be helpful to use regular expressions.

“ A regular expression is a specification for a pattern that might appear in text.”

<https://www.student.cs.uwaterloo.ca/~cs116/x/lectures/Module09notes.pdf>

2. Consider the following sketches. What is printed in each case?

```
This is a text file.  
CS116X is a course  
for  
GBDA students.
```

“file.txt” contains the text above.

```
void setup() {  
  String[] info = loadStrings("file.txt");  
  println(info[2]);  
}
```

for

```
String[] cat_names = {  
  "Ginkgo", "Ginseng", "Arlo", "Otis", "Titania"  
};  
println(join(cat_names, ", "));
```

Ginkgo, Gineng, Arlo, Otio, Titania

```
void setup() {  
  String[] info = loadStrings("file.txt");  
  String[] words = split(info[0], "is");  
  println(words[0]);  
}
```

Th

```
void setup() {  
  String[] info = loadStrings("file.txt");  
  String[] words = split(info[1], " ");  
  println(words[3]);  
}
```

course

```
String text =  
"CS116X is the second-level introductory" +  
"programming course for students in the GBDA program";  
  
if (match (text, "CS116X") != null) {  
  println("That's in the text!");  
}
```

That's in the text!

Module 10 – Data Processing

- Tabular data and Table
- Loading tables
- Hierarchical data
- JSON
- Web APIs

Module 10 Questions

1. Describe what the following table looks like. How many rows and columns does it have? What information does it contain?

The table has three columns "First Name", "Last Name" and "Age" where age must be an integer. One row is added to the table where the First Name is "Joe", the Last Name is "Shmoe" and his age is 5.

```

void setup()
{
  Table table = new Table();
  table.addColumn("First Name");
  table.addColumn("Last Name");
  table.addColumn("Age", Table.INT);

  TableRow row = table.addRow();
  row.setString("First Name", "Joe");
  row.setString("Last Name", "Shmoe");
  row.setInt("Age", 5);
}

```

2. Consider the following JSON Object, called obj, write code that will put text on the screen that tells you the day, time, and location of our (CS116 Section 2) exam. You just need to create some variables and (a) call(s) to the text function. Assume that everything else works and you have a variable called obj already defined.

```

{
  "meta":{
    "requests":7285,
    "timestamp":1428690829,
    "status":200,
    "message":"Request successful",
    "method_id":1187,
  },
  "data":[
    {
      "course":"CS 116",
      "sections":[
        {
          "section":"001",
          "day":"Friday",
          "date":"2015-04-17",
          "start_time":"12:30 PM",
          "end_time":"3:00 PM",
          "location":"PAC 1,2,3,4,5,6,7,8",
          "notes":""
        },
        {
          "section":"003",
          "day":"Friday",
          "date":"2015-04-17",
          "start_time":"12:30 PM",
          "end_time":"3:00 PM",
          "location":"PAC 1,2,3,4,5,6,7,8",
          "notes":""
        },
      ],
    }
  ]
}

```

```

        "section": "004",
        "day": "Friday",
        "date": "2015-04-17",
        "start_time": "12:30 PM",
        "end_time": "3:00 PM",
        "location": "PAC 1,2,3,4,5,6,7,8",
        "notes": ""
    },
    {
        "section": "005",
        "day": "Friday",
        "date": "2015-04-17",
        "start_time": "12:30 PM",
        "end_time": "3:00 PM",
        "location": "PAC 1,2,3,4,5,6,7,8",
        "notes": ""
    },
    {
        "section": "002",
        "day": "Friday",
        "date": "2015-04-17",
        "start_time": "12:30 PM",
        "end_time": "3:00 PM",
        "location": "PAC 11,12",
        "notes": ""
    }
}
]
}

```

```

JSONArray data = obj.getJSONArray("data");
JSONObject CS = data.getJSONObject(0);
JSONArray sections = CS.getJSONArray("sections");
JSONObject two = sections.getJSONObject(4);
String day = two.getString("day");
String time = two.getString("start_time");
String location = two.getString("location");

text(day + " " + time + " " + location);

```