Final Exam Review

General Remarks

The exam will be cover the entire semester; there may be a slightly greater emphasis on topics not covered on the first two exams.

You may bring one 8\(\frac{1}{2}\) × 11 sheet of paper with notes on it to use during the exam (you may use both sides). Otherwise, the exam is closed book, closed notes.

Older Topics

For review exercises related to material covered on the first two exams, see your class notes, the review sheets for those exams, and the exams themselves. Solutions to both midterms were handed out in class; they are not online, but I'm happy to provide you with copies if you didn't receive them.

Review handouts are located on the course Web page under the “Notes” link. See also the various files of notes (e.g., “Notes on R,” parts 1, 2, and 3) on the same page.

More Recent Topics

- **R.** Be able to write basic R “plot” functions for point and line graphs. In particular, know how to plot one numeric variable (e.g., a labeled column in a table) against another; know how to adjust axis labels, plot color, and axis limits. Know how to use the “points” and “lines” functions to overlay graphs. Be able to *read and discuss* more complex R functions such as “read.table” or “range” or other functions that we have used in labs. Know the meanings of the different portions of a box and whisker plot. Know things such as the “$” notation for specifying columns in a table or “c(....)” notation for specifying vectors of values.

- **More General Data Visualization.** We did not do any labs on this topic; therefore you will not be asked to read or write code for anything here. However, you might be asked questions at a very high level.

- **Iterated Function Systems.** We did not do any labs on this topic; you will not need to write code. However, you should at least know what an IFS is and have some notion of what can be done with it.

- **Face Detection.** We did not go into much depth here; you should not expect to be able to write code for face detection. However, you should have some high-level understanding of the
problems involved in applying “simple” techniques such as the “pattern-matching” technique we used in lab 9.

- **Web Graphics, SVG, D3.** You won’t need to read or write code for this, but you ought to know what HTML, CSS, Javascript, and SVG are, and the purpose of each one.

### A Few Sample Questions
*(ONLY from Recent Topics; Exam Will Be Comprehensive!)*

1. Suppose we have the set of values \{1, 5, 6, 7, 8, 9, 30\}. Here is a box-and-whisker graph of this data:

![Box-and-Whisker Graph](image)

The first question is about this specific box-and-whisker graph; the rest are about box-and-whisker plots *in general*.

(a) Why is the point at the top (labeled “(a)”) not included inside the top “whisker”?

(b) **True or False:** The solid line in the middle of the box in any box-and-whisker plot (for instance, the line labeled “(b)”) always represents the mean of the set of values

(c) In a general box-and-whisker plot, what does the lower portion of the box (for instance, the portion labeled “(c)”) represent?

(d) **True or False:** In any box-and-whisker plot, the values between the bottom of the box and the lower “whisker” (for instance, the area labeled “(d)”) always represent the lower 25% of the values.

2. Which of the graphs in Figure 1 corresponds to the following R code?
\begin{verbatim}
x <- 1:10
y <- x - x^2
plot(y~x,type='l',xlab="This",ylab="That")
\end{verbatim}

\begin{figure}
\centering
\begin{subfigure}{0.4\textwidth}
\includegraphics[width=\textwidth]{fig1a.png}
\end{subfigure} \quad
\begin{subfigure}{0.4\textwidth}
\includegraphics[width=\textwidth]{fig1b.png}
\end{subfigure}
\end{figure}

\begin{figure}
\centering
\begin{subfigure}{0.4\textwidth}
\includegraphics[width=\textwidth]{fig1c.png}
\end{subfigure} \quad
\begin{subfigure}{0.4\textwidth}
\includegraphics[width=\textwidth]{fig1d.png}
\end{subfigure}
\end{figure}

\textbf{Figure 1}: See Problem 2

3. In class, we saw an example of a program that generates the following image, one pixel at a time:
This was drawn using what kind of process?

(a) an SVG  
(b) an IFS  
(c) an HSV  
(d) a CSS

What do the initials in your answer stand for?

4. Given the following definitions in R

```r
x <- seq(-5,5,.1)
y1 <- sin(x)
y2 <- cos(x)
```

Write the commands in R that will produce the graph in Figure 2. Don’t worry about axis labeling—just produce the two overlaid graphs, one in black, the other in red.

5. Mention at least two visualization techniques that we have seen in class that would be appropriate for showing data involving more than three variables.

6. What are “Chernoff faces” and how are they used?

7. In a simple pattern-based face detection algorithm such as the one we looked at in lab 9, why do we often begin by “blurring” the image?

8. What is the difference between HTML and Javascript? What is SVG?

9. In R, suppose we have a file named “mydata.txt” containing the following data:

```
A,B,C  
1,2,3,4  
4,2.432,1.22  
3,1.1,3.14  
8,2.73,8.97
```
The only characters are numbers and commas. Write the statements needed to read in mydata.txt and create a scatterplot of the B and C values, with B along the horizontal axis and C along the vertical axis.

I will try to prepare more review problems for Monday’s class.