Practice Midterm (slightly less than half the length of the true midterm)

C. Alex Simpkins

November 1, 2006

1 Multiple Choice

Choose one option for each question (a, b, c, d, or e)

1.1 Which kind of standard matrix is this?

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

a) Identity

b) Tridiagonal

c) Supermassive

d) Transpose

e) Inverse

1.2 The number of students in our class is a...

a) Scalar

b) Vector

c) Matrix

d) Quark

e) Neuron

1.3 A low pass filter is used to...

a) Remove high frequency components from a signal

b) Remove low frequency components from a signal

c) Only allow a narrow band of frequencies through

d) Allow every frequency but a narrow band through

e) Add spam to email

1.4 To recover a signal waveform up to a particular frequency component, we have to sample at what sampling rate at least?

a) 1/2 the highest frequency of interest

b) at the highest frequency of interest

c) It doesn't matter at all

d) twice the highest frequency of interest

e) At the Lagrangian interpolation polynomial

1.5 While listening to 2 versions of the same sound recording for an auditory perception experiment, you hear the following: First sound - a spoken word "Modeling" and Second, a muffled sound which sounds like someone speaking through a pillow, and it is not understandable. What filter was likely used on the first sound to produce the second sound (see sound figure)?

Sound frequency amplitudes (raw and filtered)
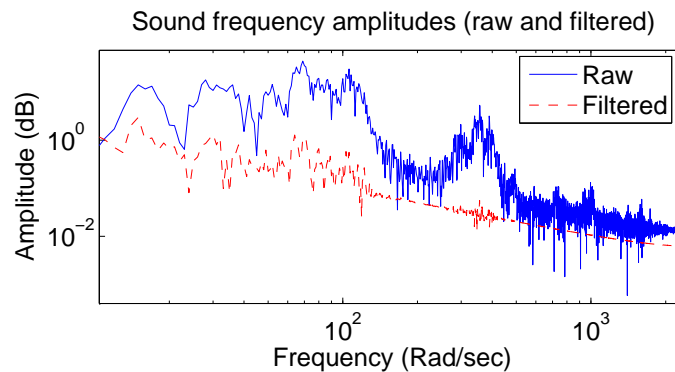
a) A low pass filter

b) A high pass filter

c) A transpose filter

d) A sub-sampler

e) An interpolator

1.6 Which color combination for a powerpoint presentation is easiest for an audience to read given the following options?

a) Black text on dark blue background

b) White text on bright yellow background

c) Highly saturated foregrounds with highly saturated backgrounds (any color)?

d) White text on black background (consider the luminance equation)

e) Neon everything

1.7   What does the luminance equation represent?

a) Perceived intensity due to a color component (see the luminance equation and slides)

b) Contrasting color spaces

c) Evil

d) A polynomial fit method

e) Sound cancellation with low pass filters

1.8   The ASCII format for storing data in files is a type of...

a) Binary file which can only be read by the program which creates it or a programmer who knows the format precisely

b) Linear fit to data

c) Text file format which can be opened in any text editing application program, but is not as efficient as binary (see lecture slides)

d) Program with which to sample data

e) "Awesome Super Cool Imitation of Ink"

1.9   .mat files are easy to open in any text editing program (True or False)?

a) True

b) False (one cannot easily open matlab .mat binary files in any program)

**1.10   For a function $f(x) = x^2$ The domain of the function is
_____ while the range of the function is _____**

*a)** $(-\infty, \infty), [0, \infty)$* (see homework 0.2, math notes on the web site, and your calculus book, or look it up on mathworld.com)

b) $(-1, 1), (-1, 1)$

c) y, x

d) $10, 5$

e) Does not exist, Does not exist

2   Short Answer - briefly answer with only a few sentences the following questions

2.1   Explain in one or two sentences why when I plotted two lines earlier in the quarter with one (a highly saturated) green and the background white, it was difficult to see (assume that the thinness of the line was not an issue, and that it had something to do with the colors)? (Hint: Consider some relationship for perceived intensity - do you know one?)

The two colors have very similar values of luminance. If you consider the luminance equation:

$$L = 0.30 * Red + 0.59 * Green + 0.11 * Blue$$

The slightly off-white of the screen and the highly saturated green have similar perceived intensities. Thus they won't have much contrast visually, especially when physical boundaries are minimal (the green line is thin), thus making it hard to see.

2.2 Please answer the following questions

Below is a plot of the following data:

| 0	-0.0261
0.5	0.7483
1.0	0.9239
1.5	0.9942
2.0	0.9173
2.5	0.3751
3.0	0.8956
3.5	-0.4388
4.0	-1.3226
4.5	-1.0987
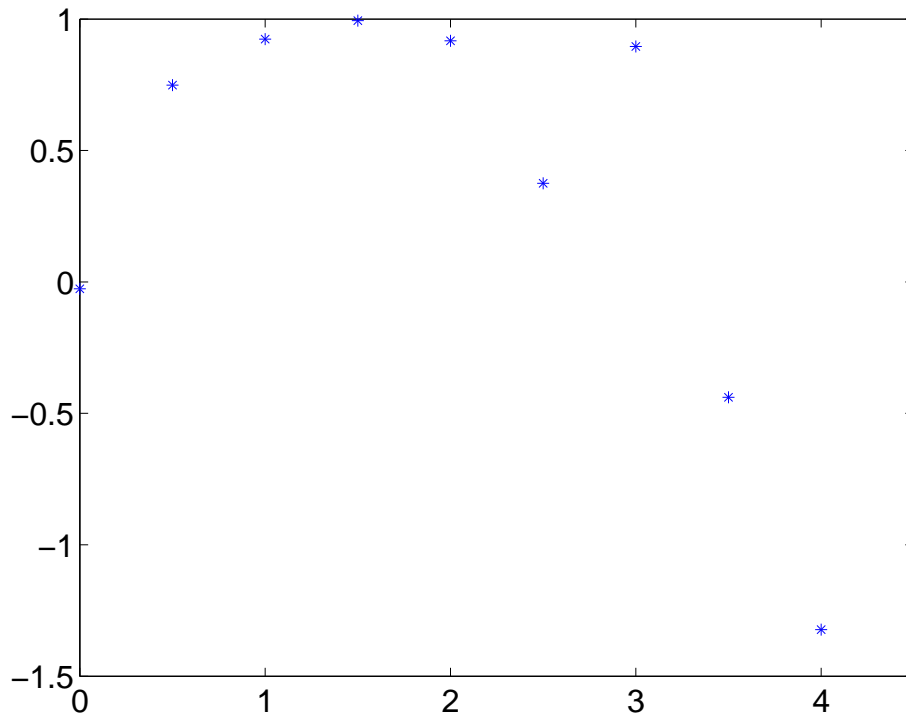
A) Using solid lines, plot the linear interpolation between each pair of points to approximate the values of the curve between the data points.

B) Using a dashed line, draw the *approximate* linear (first order) least squares fit to the data.

C) Using a dotted line, draw the *approximate* quadratic (second order) least squares fit to the data.

D) Extrapolate to x=-.5 and x=5.0 for (A), (B), and (C). For (A), keep along the line that you used to extrapolate between the first two and last two points. For (B) and (C) extrapolate along the curves you fit in B and C. Mark the extrapolated point for (A) with a square, for (B) with a circle, and for (C) with a triangle.
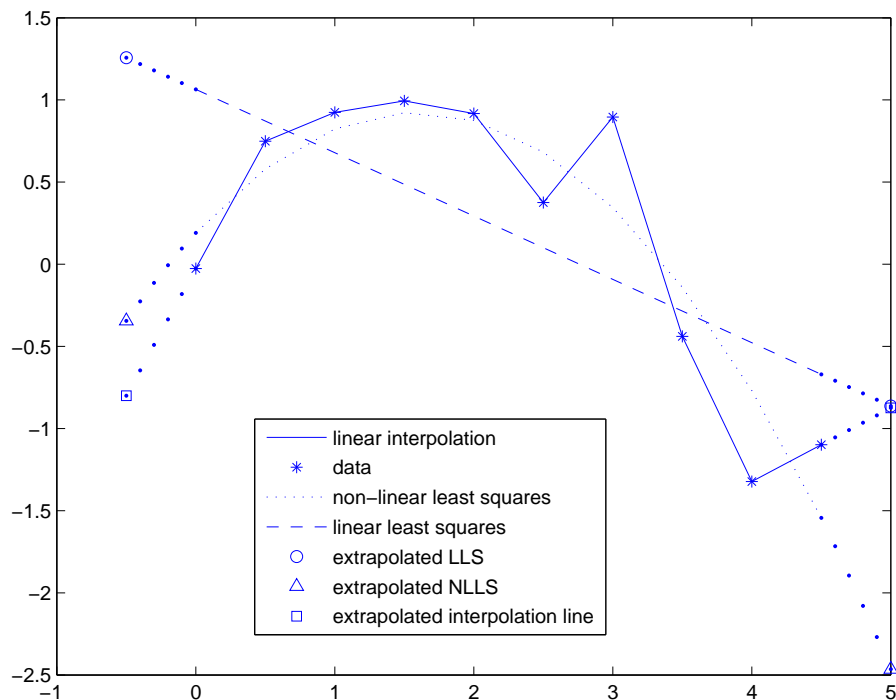
E) Which method for data fitting has the least model error (i.e. which curve passes most closely through the observed points)? Which method has the worst?

Best - A, worst - B

F) Which method for data fitting seems to provide the best guess for extrapolated values? Which method has the worst?

Best - C, worst - B

2.3 Please answer the following questions.

A) What is the difference between additive and subtractive color spaces?

Additive colorspaces have the components add together to create white, subtractive colorspaces each color component subtracts color to move toward black.

B) List which is additive and which is subtractive (of RGB and CMY), and what does the following equation mean (briefly)?

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 1 - C \\ 1 - M \\ 1 - Y \end{bmatrix}$$

RGB - Additive, CMY - Subtractive. They are complimentary, meaning they are opposites.

2.4 There will also be statistics questions, so know the meaning of each statistic and be able to think with it. You should also write the equations down on your sheet