CS 422 (Park) **Assignment I** **Due: Jan. 26 (Fri.), 2007**

Submission instructions: Please type your answers and submit electronic copies using `turnin` *by 5pm on the due date. You may use any number of word processing software (e.g., Framemaker, Word, LaTeX), but the final output must be in pdf or ps format that uses standard fonts (a practical test is to check if the pdf/ps file prints on a CS Department printer without problem). For experiments and programming assignments that involve output to terminal, please use* `script` *to record the output and submit the output file. Use* `gnuplot` *to plot graphs. Use* `ps2gif` *to convert a eps/ps plot to gif format (e.g., for inclusion in Word) if there is a need.*

PROBLEM 1

Read Chapters 1, 2 and 4 from Comer.

PROBLEM 2 (75 pts)

Carry out the experiments specified in `http://www.cs.purdue.edu/~park/cs422-hw1-07s.html`. Consult the TA notes (`http://www.cs.purdue.edu/homes/wspeirs/422`) for any additional information.

PROBLEM 3 (40 pts)

(a) Find an orthonormal basis set for the 3-D Euclidean space that is different from $\{(1,0,0),(0,1,0),(0,0,1)\}$ considered in class. Show that your set is indeed orthonormal. Express the 3-D vector $(7,2,4)$ as a linear combination of your orthonormal basis set. What is the spectrum of $(7,2,4)$ (i.e., coefficients or weights in the linear combination)? Which basis element is most relevant for forming $(7,2,4)$? Which basis element is least relevant?

(b) Using your orthonormal basis set, construct a 3-D vector $\mathbf{z} = (\mathbf{z_1}, \mathbf{z_2}, \mathbf{z_3})$ that hides (i.e., encodes) the three bit values 1, 0, 1. Show, how, after receiving $\mathbf{z}$, the receiver can decode the three bits transmitted by the sender. Given that the basis set $\{(1,0,0),(0,1,0),(0,0,1)\}$ is simple and pretty easy to work with, why would there be a reason in computer networks to use a different orthonormal basis set (such as yours)? Why would there be a reason to change the basis set from time to time (perhaps even frequently)?