

CS 4453 Assignment 1

Due on Thursday, Jan. 29, 2015

Each student is required to do this assignment **individually** and to hand in the following:

- Provide a hard copy of your complete solutions of Problems, showing all your work and including computer outputs, if any (but do not include the source codes).
- Send your source code files (if there are) to `cs4453@peace.lakeheadu.ca`.

Name, Student Number, Course Number (CS 4453) and your email address should be included.

Assignments which are not met the above requirements will not be marked. The score of the assignment will depend on:

Specification and documentation: 20 %

Correctness: 80 %

Late assignments will be penalized and will not be accepted after 3 days.

Problem 1.

Suppose the following matrix is given:

$$A = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 \\ 1 & 1 & -1 & -1 & 1 & 1 & -1 & -1 \\ 1 & 1 & -1 & -1 & -1 & -1 & 1 & 1 \\ 1 & -1 & 1 & -1 & 1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 \\ 1 & -1 & -1 & 1 & 1 & -1 & -1 & 1 \\ 1 & -1 & -1 & 1 & -1 & 1 & 1 & -1 \end{pmatrix}$$

1. Prove that any two rows of the matrix are mutually orthogonal. (hint: This is equivalent to prove that $AA^T = nI_n, n = 8$, where I_n is the identity matrix).
2. The above codes are used as CDMA for 8 channels to communicate. Write a computer program to simulate the encoding and decoding as follows.
 - At the sender side, the simulator can input 8 bits (use integer 0, 1 or 9, 9 means no input) for 8 channels respectively. The program will output the encoded vector which includes all the code information of the 8 channels.

- At the receiver side, input a channel number and the received vector (encoded vector) the program outputs the bit sent by that channel.

Problem 2.

In the data link layer, suppose that bit the string 01111110 is used as frame Flag. What is the real data if the receiver received the following frame with bit stuffing?

01111110011100111110110001111100001111101111101100101111110

Write a simulation algorithm for decoding (i.e., use integers 0 and 1 to denote bit 0 or 1, input the transmitted message, output the original data without stuffing and Flags).

Problem 3.

- Download and install Wireshark in your computer from the web.
(<https://www.wireshark.org/download.html>)
- Learn how to run the Wireshark to capture and analysis packets on your computer (you can find the information from the web). The Wireshark will make copies of the frames go through your computer's data link layer.
- Open the web: <http://peace.lakeheadu.ca>, then use Wireshark to capture the packets related to the "http" protocol. Record several rows of that information. You can use the display filter to display only the packet using HTTP protocol.

Problem 4.

Use `tracert` (for UNIX) or `tracert` (for Windows) to trace the following address, record the route:

- `uwaterloo.ca`
- `cs.uwaterloo.ca`