COMP3721 – Introduction to Data Communications
Assignment One – Fall 2008

General Instructions

- You may work with one partner for this assignment. Your partner may be from your set or another full-time CST set.
- You and your partner may discuss any and all details of each question freely. You may also discuss questions in broad terms with others, particularly in lab, but ultimately your answers should show sufficient individuation from others' answers reflecting your work in answering the questions.
- All work submitted is subject to the standards of conduct as specified in BCIT Policy 5002.

Submissions

- This assignment is due October 6, 2008 by 1630 hrs at the latest. Late assignments will not be accepted.
- Submit you assignment to your **lab instructor's** assignment box in the SW2 connector.
- Your submissions must include a cover page clearly specifying your name, student number and set. If working with a partner, this information should be provided for each partner.

Marking

The assignment consists of 7 questions totaling 39 marks.

Questions

1. Two blue armies are strategically camped on opposite hills preparing to attack a single red army in the valley. The red army can defeat either of the blue armies separately but will fail to defeat both blue armies if they attack simultaneously. The blue armies communicate using an "unreliable" communication system (a foot soldier).

   The commander with one of the blue armies would like to attack at noon. His problem is this: if he sends a message to the other blue army, ordering the attack, he cannot be sure it will get through. He could ask for an acknowledgement, but that might not get through either. Is there a protocol that the two blue armies can use to synchronize their attacks and avoid defeat? [2 marks]

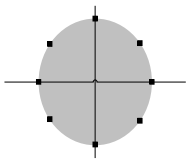
2. Decompose the signal $(1 + 0.1\cos 5t)\cos 100t$ into a linear combination of three sinusoidal functions. Find the amplitude, frequency and phase of each component. Plot each component, then sum the components over time to produce the composite signal. Hint: use the identity for cos(a) cos(b). [5 marks]

3. What is the minimum signal-to-noise ratio, in decibels, required to place a T1 signal (1.544 Mbps) on a 1 MHz line? *[5 marks]*

4. A 10 kHz baseband channel is used by a digital transmission system. Ideal pulses are sent at the Nyquist rate, and the pulses can take 16 levels. What is the bit rate of this system? *[5 marks]*

5. A digital transmission system has a bit rate of 45 Megabits/second. How many PCM voice calls can be carried by the system? *[5 marks]*

6. Does the following constellation diagram represent ASK, PSK, FSK or QAM modulation? How many levels does this system have? Given bandwidth *H*, what is the maximum data transfer rate possible using this modulation scheme? *[5 marks]*



7. Suppose a storage device has a capacity of 1 gigabyte. How many one-minute songs can the device hold using conventional CD format? *[5 marks]*

8. Suppose that a digitized TV picture is to be transmitted from a source that uses a matrix of 480 by 500 picture elements (pixels), where each pixel can take on one of 32 intensity values. Assume that 30 pictures are sent per second.

   (a). Find the source data rate, R. [2 marks]
   (b). Assume that the TV picture is to be transmitted over a channel with a 4.5-MHz bandwidth and a 35-dB signal-to-noise ratio. Find the capacity of the channel (in bps). [3 marks]
   (c). Discuss how the parameters given above could be modified to allow transmission of color TV signals without increasing the value of R. [2 marks]