Santa Clara University
School of Engineering

Honor Code of the School of Engineering

"All students taking courses in the School of Engineering agree, individually and collectively, that they will not give or receive unpermitted aid in examinations or other course work that is to be used by the instructor as the basis of grading."

-From the Graduate/Undergraduate Bulletin

I have read, understood, and agree to abide by the Honor Code of the School of Engineering.

Name: _____

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Date: _____

1. [20 points]
2. [20 points]
3. [60 points]
4. [20 points]
5. [20 points]
6. [20 points]
7. [20 points]
8. [20 points]

Total Score:

Midterm Examination

COEN 233 Computer Networks
Department of Computer Engineering
Santa Clara University

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Winter Quarter 2015
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Saturday 4:30-5:00pm

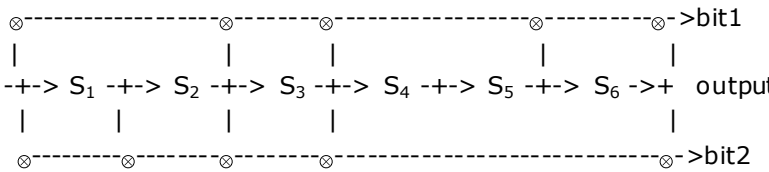
1. [20 points] Please give the whole names for the following acronyms: DMCA, GPRS, 3GPP, CMTS, AMI, HLR, STDM, LDPC, FEC, DIS.

2. [20 points] True or false (yes or no, 1 or 0) problems with wrong-answer penalties:
   a) If two messages (M1 and M2) with the same length L and calculated CRC (C1 and C2) respectively, then the CRC for concatenated message (M1 . M2) is the concatenated CRS (C1 . C2).
   b) Is it possible to use the values 1 0 0 0, 0 1 0 0, 0 0 1 0, 0 0 0 1, and so on as spreading sequences of the nodes of a network supporting CDMA based on DSSS?
   c) FDDI is fault tolerant. Does this mean that under conditions of any single cable breakdown the network can continue normal operation?
   d) Is buffering used in circuit-switched networks?

3. [60 points] Simple question or calculation problems:
   a) Consider an analog repeater system in which the signal has power σ_x^2 and each stage adds noise with power σ_n^2. For simplicity assume that each repeater recovers the original signal without distortion but that the noise accumulates. Find the SNR after n repeater links. Write the expression in decibels.
   b) Suppose we wish to transmit at a rate of 64 kbps over a 3 kHz telephone channel. What is the minimum SNR required to accomplish this?
   c) Show that no polynomial with an odd number of terms is divisible by $x + 1$.
   d) If you received a hamming code 00111010101, it may contain single bit error, then what is the character sent originally.
   e) For the data frame 1101011011 and CRC generator $x^4 + x + 1$, what is the transmission frame?
   f) A station communicates with it partner using CDMA chip sequence 00011011. If the station detect the m-chip vector as (-2, -2, 0, -2, 0, -2, +4, 0), then what is the data bit its partner sent to it?

4. [20 points] Suppose that *x* bits of user data are to be transmitted over a *k*-hop path in a packet switched network as a series of packets, each containing *p* data bits and *h* header bits, with $x >> p + h$. The bit rate of the line is *b* bps and the propagation delay is negligible. What value of *p* minimizes the total delay?

5. [20 points] Using the convolutional coder below, what is the output sequence when the input sequence is 10101010 (left to right) and the internal state is initially all zero?



6. [20 points] The distance from earth to a distant plant is approximately $9x10^{10}$m. What is the cannel utilization if a stop-and-wait protocol is used for frame transmission on a 64 Mbps point-to-point link? Assume that the frame size is 32KB and the speed of light is $3x10^{8}$m/s.

7. [20 points] Two musicians located in different cities wish to have a jam session over a communications network. Find the maximum possible distance between the musicians if they are to interact in real-time, in the sense of experiencing the same delay in hearing each other as if they were 10 meters apart. The speed of sound is approximately 330 meters/second. Assume that the network transmits the sound at the speed of light in cable, 2.3×10^{8} meters/second.

8. [20 points] Please derive the efficiency of slotted ALHOHA:
   a) The efficiency of slotted ALOHA is $Np(1-p)^{N-1}$. Find the value of p that maximizes this expression
   b) Using the value of p found in a), find the efficiency of slotted ALOHA by letting N approach infinity. Hint: $(1-1/N)^{N}$ approaches 1/e as N approaches infinity.