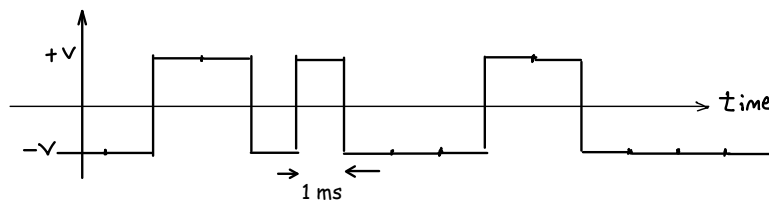


FINAL EXAMINATION
8:00 – 11:00 AM
May 21, 2014

This exam has 7 (seven) questions on 2 (two) pages. The marks for each question are as indicated. There are a total of 24 marks. Answer all questions. Write your answers in the exam book provided. Show your work. Numerical answers must include units. You may answer the questions in any order. Books and notes are allowed. No electronic devices other than calculators are allowed. You may keep this exam paper. Show your work.

Question 1 (4 marks)

A serial port is configured for 8 bits per character, even parity and one stop bit. It receives the following waveform corresponding to one character:



- (a) What was the baud rate?
- (b) What character was received?
- (c) Is the parity bit 0 or 1?
- (d) Does the parity bit indicate an error?

Question 2 (3 marks)

Draw the waveform used to transmit the data bits 00101101 using the MLT-3 line code. Assume the initial value of the waveform is at the waveform's most negative value of -1 V and the bit rate is 1 MHz. Label the time and voltage axes.

Question 3 (4 marks)

A communication system operates over a channel with a bandwidth of 1 MHz at a rate of 4 Mb/s. The noise at the receiver is white with a Gaussian distribution. The noise power is measured to be 0 dBm. What is the minimum received signal power (in dBm) that would allow error-free communication?

Question 4 (3 marks)

What polynomial with coefficients from GF(2) would represent the bit sequence 10001? What is the result (quotient and remainder) of dividing this polynomial by the generator polynomial $x^2 + 1$? Give your result as both bit sequences and a polynomials.

Question 5 (3 marks)

You receive an IP frame whose header begins with the following 20 bytes (in hex):

45 00 00 50
12 34 00 00
3A 73 12 34
0A 00 00 03

Based on the partial header shown above:

- (a) how many bytes are contained in the IP *payload* of this frame?
- (b) what is the source IP address in “dotted quad” notation?
- (c) how many additional routers can this frame can pass through?

Question 6 (4 marks)

The table below shows the codewords of a (7,4) block code.

0 0 0 0 0 0 0
0 0 0 1 0 1 1
0 0 1 0 1 1 0
0 0 1 1 1 0 1
0 1 0 0 1 1 1
0 1 0 1 1 0 0
0 1 1 0 0 0 1
0 1 1 1 0 1 0
1 0 0 0 1 0 1
1 0 0 1 1 1 0
1 0 1 0 0 1 1
1 0 1 1 0 0 0
1 1 0 0 0 1 0
1 1 0 1 0 0 1
1 1 1 0 1 0 0
1 1 1 1 1 1 1

The minimum distance for this code is 3.

- (a) How many errors is this code guaranteed to detect?
- (b) How many errors is it guaranteed to correct?
- (c) If the codeword 1 0 0 0 0 0 0 is received, what codeword was most likely transmitted? Why?

Question 7 (3 marks)

A wireless communication system transmits 8 Mb/s using QPSK modulation.

- (a) What is the symbol rate?
- (b) What is the minimum RF (bandpass) channel bandwidth that would result in no ISI?
- (c) What would be the RF channel bandwidth if the excess bandwidth parameter, α , were 0.25.