

MIDTERM EXAM 2  
10:30 AM – 11:20 AM  
February 22, 2019

This exam has two (2) questions on two (2) pages. The marks for each question are as indicated. There are a total of eight (8) marks. Answer all questions. Write your answers and all rough work in this paper and nowhere else. Show your work. Draw a box around your final answer. Numerical answers must include units. Books and notes are allowed. No electronic devices other than calculators are allowed. **Show your work.**

This exam paper is for:

**Exam 1 A00123456**

Each exam is equally difficult.

Answer your own exam.

Do not start until you are told to do so.

Name: \_\_\_\_\_

BCIT ID: \_\_\_\_\_

Signature: \_\_\_\_\_

Question	Mark	Max.
1		4
2		4
Total		8

**Question 1****4 marks**

A controller generates messages with the following probabilities:

F	0.250
L	0.375
R	0.375

- (a) What is the entropy of this source in bits/message?
- (b) A transmitter encodes these messages using 6 bits per message using the codewords 000000, 010101 and 111111. (i) What is the minimum distance of this code? (ii) How many bit errors is this code guaranteed to correct? (iii) How many errors is it guaranteed to detect?
- (c) If the codeword 000011 is received, which codeword should the receiver decide was transmitted?

**Question 2****4 marks**

The generator matrix for a (4,2) block code is:

$$G = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

- (a) How many information bits ( $k$ ) and how many parity bits are in each codeword?
- (b) List all valid codewords.
- (c) What is the parity check matrix for this code?

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1		4
2		4
Total		8

**Question 1****4 marks**

A controller generates messages with the following probabilities:

F	0.50
L	0.25
R	0.25

- (a) What is the entropy of this source in bits/message?
- (b) A transmitter encodes these messages using 6 bits per message using the codewords 000000, 010101 and 111111. (i) What is the minimum distance of this code? (ii) How many bit errors is this code guaranteed to correct? (iii) How many errors is it guaranteed to detect?
- (c) If the codeword 110000 is received, which codeword should the receiver decide was transmitted?

**Question 2****4 marks**

The generator matrix for a (4,2) block code is:

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}$$

- (a) How many information bits ( $k$ ) and how many parity bits are in each codeword?
- (b) List all valid codewords.
- (c) What is the parity check matrix for this code?