

Computer Networks

Second Partial Exam

April 17, 2020

Department of Computer Science and Engineering - CIIC4070
Department of Electrical and Computer Engineering - ICOM5026
University of Puerto Rico at Mayagüez

Name	
Student ID	

Instructions:

- Write your name (or initial) on top of each page.
- Write your answers in English.

Problem	Page	Points	Score
(I)	2	5	
(II)	2	15	
(III)	3	15	
(IV)	4	15	
(V)	4	10	
(VI)	5	15	
(VII)	5	15	
(VIII)	6	10	
TOTAL		100	

- (I). The following data fragment occurs in the middle of a data stream, for which the character-stuffing algorithm described in the textbook is used:

A B FLAG ESC C ESC D ESC FLAG E

What is the output after stuffing?

- (II). Suppose a complete code consists of four codes:

- Code 1: 00000000
- Code 2: 00001111
- Code 3: 11110000
- Code 4: 11111111

- (1) Using the following table, determine the Hamming distance of each pair of codes:

-	Code 1	Code 2	Code 3	Code 4
Code 1	-			
Code 2		-		
Code 3			-	
Code 4				-

- (2) What is the Hamming distance of this complete code?

- (3) How many bit errors can be detected?

- (4) How many bit errors can be corrected?

(III). Using Hamming coding to encode bit stream: 10101011110.

(IV). Using CRC with general polynomial $x^3 + x + 1$ to encode 11001010.

(V). Medium Access Control (MAC) Sublayer.

- (1) What is the main purpose of the medium access control (MAC) sublayer?
- (2) In Dr. Kejie Lu's videos, find three IEEE standards that include the MAC sublayer. For each standard, write the code of the standard and the title of video below.

(VI). A large number of stations in a slotted ALOHA network generate 50 requests per second on average, where the requests include originals and retransmissions. Suppose the duration of a time slot is 20 ms.

- (1) What is the arrival rate G when the unit is the number of arrival per time slot?
- (2) What is the probability that a message is successfully transmitted on an attempt?
- (3) What is the expected number of transmission attempts needed for a successful delivery?

(VII). Answering the following questions about Ethernet.

- (1) Why the Manchester encoding is used in Ethernet?
- (2) Sketch the Manchester encoding for the bit stream 1010111001.
- (3) Suppose a CSMA/CD network is operating at 100Mbps, and suppose there are no repeaters and the length of the cable is 1.0km. Determine the minimum frame size. (Hint: The signal propagation speed is 200km/ms in cable).

- (VIII). List **four** main collision avoidance schemes used in IEEE 802.11 DCF (CSMA/CA). Then briefly explain how each scheme can help to avoid collision.