Midterm Exam II

Data Communications and Computer Networks

Wednesday, December 13, 2017, 6-9pm

There are 19 questions, which constitutes of 170 points on this exam.

Here are the exam rules:

A) Please write your answers to the questions on the answer sheets. Please staple your answer sheets along with this exam, and turnin to the TA before you leave.

B) Please write your name on each answer sheet.

C) Please first go through all the pages and make sure that there is no missing page.

D) I would suggest that you go through all the midterm problems first, answer the simple ones first, and go back to the harder ones. This is the strategy to get as much point as possible!

E) Please show all the steps so we know how you derive/solve the problems.

F) Please don't cheat. If TA or I find out that you cheat during the exam, or if you take out your phone out during the exam, you will be considered as cheating and end up of having "0 point" for this exam!!! No Exception!!!

G) You need to turn off your cell phone for the entire exam period. You will get 10% of your grades deducted if your cell phone ring during the exam!

H) You have up to 180 minutes to answer the problems. The TA will collect your exam at 9pm. If you want to turnin your exam early, that's ok. Just be sure that you shouldn't disturb others when you turnin your exam.

I) Please be aware that you need to express your answers in English for ***some questions as indicated***. You may express your answers in English/Chinese for the rest of the questions.

J) Good luck ;)

Name: _____

Student ID: _____

Total Points: _____

1) Please explain:
   a. Each layer in OSI model for each layer, from the bottom to the top layer **in English**. Please be aware that if you name them in the different order, your point will be deducted as well (7 pts)
   b. Then please explain important functions of these layers in detail (7 pts).

2) What are the advantages and disadvantages of having layering models? (6 pts)

3) What are the differences between layers and protocol? Please explain your answer in detail. (6 pts.)

4) What are the differences between computer networks and distributed systems? (6 pts.)

5) Maximum Data Rate Calculation
   a. Given that the bandwidth of a noisy channel is 8kHz and that the signal to noise ratio of the channel is 40 dB, which theorem should you choose to calculate the maximum data rate of a channel? (1 pt) what is the maximum data rate of the channel? (3 pt.)
   b. Given that the bandwidth of a noiseless channel is 1000 Hz, which theorem should you choose to calculate the maximum data rate of a channel? (1 pt) what is the maximum data rate if 128-level digital signals are used? (3 pt.)

6) Code Division Multiple Access

A = (-1, -1, -1, +1, +1, -1, +1, +1)
B = (-1, -1, +1, -1, +1, +1, +1, -1)
C = (-1, +1, -1, +1, +1, +1, -1, -1)
D = (-1, +1, -1, -1, -1, -1, +1, -1)

Assuming we have the following chip: (+1, +3, -1, +1, -1, +1, -3, -1). And assume that the chip sequences are defined above, which station transmitted, and which bits did each one send? Please show all of your steps (8 pts.)

7) What's the differences between unacknowledgment (Unacked) connectionless, acknowledgment (Acked) connectionless, and connection-oriented services? (9 pts)

8) Framing. Assume that Data Link Layer protocol uses the following character encoding: FLAG: 01111110; ESC: 10100101; C: 01000011; E: 01000101; S: 01010011

Show the bit sequence transmitted in binary for the following frame:

C FLAG FLAG ESC

a. Character Count (3 pt.)
b. Flag byte with byte stuffing (3 pt.)
c. Flag bits with bit stuffing (Please clearly indicate where you put your 0 bit for TA to easily grade this problem) (3 pt.)
d. What can you conclude based on your result from b) and c)? (3 pt.)

9) A network has a protocol stack with L layers. A message that is transmitted on the network comprises the application data (payload) and a header for each of the L layers. The length of the application payload (data) is A bytes, and the length of each header is H bytes. ***Please assume that the top layer does not append a header.***

a. Please draw how each layer should look like in terms of A, and H, and L. (3 pt.)
b. Please find the proportion (fraction) of a message that constitute the application payload as a function of A, H, and L. (3 pt.)
c. What can you conclude from part b)? (3 pts)

10) In the class we discussed about how to construct chip sequences for CDMA. Now assume we have the following chip sequences:

A = (-1, -1, -1, +1, +1, -1, +1, +1)
B = (-1, -1, +1, -1, +1, +1, +1, -1)
C = (-1, +1, -1, +1, +1, +1, -1, +1)
D = (-1, +1, -1, -1, -1, -1, +1, -1)

Are these chip sequences valid? Please justify your answer. (9 pts)

11) Hamming Code

a. Assume that the sender has a 16-bit message with its hexadecimal value of 0xCDE. What's the final messages that the sender would send to its channel? (3 pts)
b. Assume that the sender sends out the message as what you derived from part a), but the left-most bit got reversed during the transmission. Could the receiver correct such error? If so, please shows how you could correct this error. If not, then please explain your reason. (3 pts)
c. Assume that the sender sends out the message as what you derived from part a), but this time there are two bits got reversed during the transmission. Could the receiver correct such error? If so, please shows how you could correct this error. If not, then please explain your reason. (3 pts)
d. Assume that we have a 60000-bit byte with binary value, then how many check bits will be needed? Please show your answer. (3 pts)

12) For Cyclic Redundancy Code (CRC), assuming that sender wishes to transmit frame 100010101001, and the generator is 101101, what's the final transmitted frame? (8 pts)

13) If following block of 16 bits is sent using a checksum of 8 bits.

10001101 00011011

a) What's the pattern that is sending out? (3 pts)

b) Assuming the receiver receive the pattern from a) but with the left-most bit got reversed, show that there the error is detected at the receiver's side (3 pts)

14) Sliding Window Protocol

a. Please compare "Go Back N protocol" and "Selective Repeat protocol". (6 pts)

b. Given that the range of sequence number is 0 ... 63, determine the maximum window size for **both receiver and sender** for:

i. Go Back N (4 pts)

ii. Selective Repeat (4 pts)

15) Static & Dynamic Allocation

a. Please describe the differences between static and dynamic allocation. (3 pts)

b. What's the major problem for static channel allocation? (3 pts)

c. Please provide an example for static channel allocation (3 pts)

d. Please provide an example of dynamic channel allocation (3 pts)

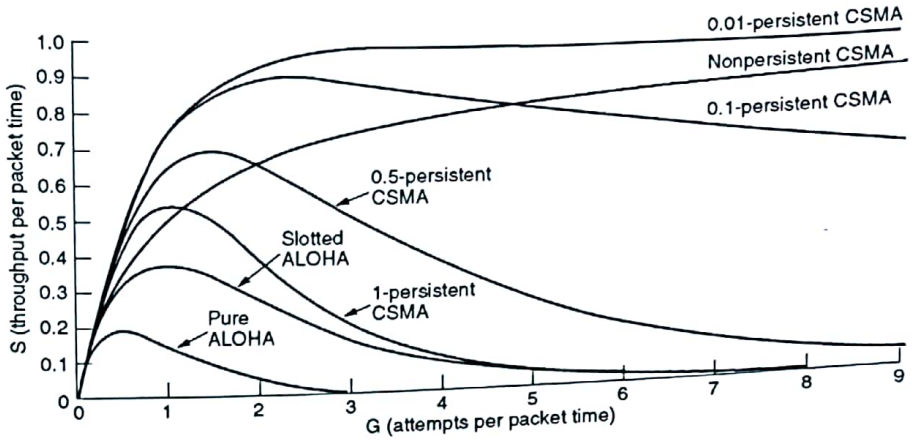
16) What's the differences between p-persistent CSMA and non-persistent CSMA? (6 pts)

17) Consider the following graph for the throughput versus offered load for Pure ALOHA, Slotted ALOHA, 1-persistent CSMA, 0.5-persistent CSMA, 0.1-persistent CSMA, non-persistent CSMA, and 0.01- persistent CSMA.

a) What can this graph tell about 0.5-persisnt CSMA vs. 1-persistent CSMA? (3 pts)

b) What can this graph tell about the Slotted ALOHA vs. Pure ALOHA? (3 pts)

c) What can this graph tell about the CSMA vs. ALOHA? (3 pts)



18) Bit-map vs. Binary countdown

a. Assume station x wants to transmit its frame using bit-map protocol. What's the best case for station x to transmit? (2 pts) What's the worst case for station x to transmit? (2 pts)

b. Assume station x wants to transmit using binary countdown protocol. What's the best case for station x to transmit? (2 pts) What's the worst case for station x to transmit? (2 pts)

19) Consider sixteen stations, numbered 1 through 16, competing for use of a shared channel by **using adaptive tree walk protocol that we discussed in the class**. At a certain instant, stations with prime numbers are ready to send at once. How many bit slots are required to resolve the contention? Show which station(s) is (are) contending in each slot. (8 pts)

國立中正大學＿＿＿＿學年度第＿＿學期＿＿＿＿＿＿考試答案卷

系所別：　　科目：　　姓名：　　學號：

10. $S \cdot T = \frac{1}{m}\sum_{i=1}^{m} S_i T_i = 0$; $S \cdot S = \frac{1}{m}\sum_{i=1}^{m} S_i S_i = 1$

A.B =0
A.C =0
A.D =0
B.C =0
B.D =0
C.D =0

11)

a) 1011 1000 1101 11100

b) 0011 1000 1101 11100

c) 不可，多3位一個不同位錯

d) r=16

14) a. Go Back N pro：錯後面要全重送
Selective Repeat protocol：只要送之後錯的

b. Go Back N：63 = S ; R = 1
Selective Repeat：32 = S = R

16) P-persistent：持續傳，比較貪心
non-persistent：比較放鬆，等比較久

17) a) Delay 比較久，Utilization 較好

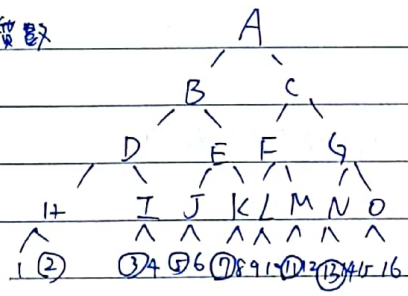
b) slotted ALOHA：較多人使用比較好　Pure ALOHA：較少人比較好

c)

18) a) 第一個最早，最後一個較慢

b) 第一個 address 好　位置不對

19. 答案



1/A = 2 3 7 11 13　　11/J = 5 (求)

2/B = 2 3 5 7　　8/L = 7 (求)

3/D = 2 3　　9/C = 11.13

4/H = 2 (求)　　10/F = 11 (求)

5/I = 3 (求)　　11/G = 13 (求)

6/E = 5, 7

Ans 11 个