



Final Exam paper

Semester 2/2008

Date: February 26, 2009

Time: 13.30 – 16.30

Subject Code: 241-360

Room: R300

Subject: INTRODUCTION TO COMMUNICATION SYSTEMS AND NETWORKS

Instruction:

- Try your best to all questions.
 - Total marks: 230
 - There are 2 sections: Section I and Section II. The answers given in Section I should be in Thai (or English). The answers given in Section II shall be in English only.
 - Calculator is not allowed
- คำตอบสำหรับ Section I ให้เป็นภาษาไทย
คำตอบสำหรับ Section II ฝ่ายเป็นภาษาอังกฤษ

ทุจริตในการสอบ ไทยขึ้นต่ำคือปรับตกในรายวิชานี้
และพักการเรียนหนึ่งภาคการศึกษา

สูตรที่อาจจะมีประโยชน์

Fiber optic

$$v = f\lambda$$

$$B = f_2 - f_1 = c (1/\lambda_1 - 1/\lambda_2)$$

$$B = (c \times \Delta \lambda) / (\lambda_1)^2$$

Encoding

$$\text{Encoding: } x^{n-k}i(x)$$

$$C = mG$$

$$G = [I | P]$$

$$p_i = \text{Remainder of } \left[\frac{x^{n-k+i-1}}{g(x)} \right], \quad i = 1, 2, \dots, k$$

$$x = c \oplus e$$

$$H = [P^T | I_{n-k}]$$

$$S = xH^T$$

Section I

ตอบเป็นภาษาไทย

Transmission Media

(40 marks)

1. Select the best answer of each question.

	a	b	c	d	e
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
1.10					
1.11					
1.12					
1.13					
1.14					
1.15					

- 1.1 Which answer is correct? (2 marks)

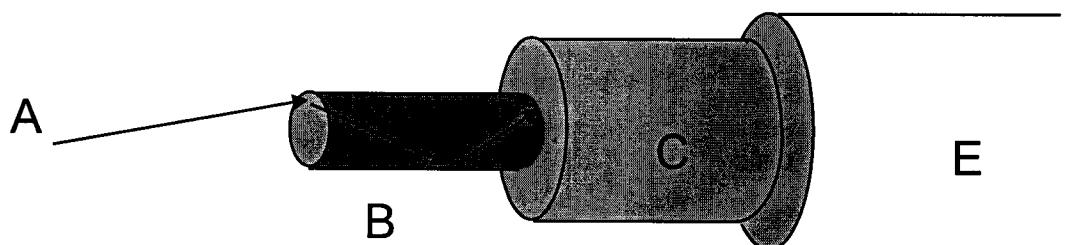


Figure 1 Optical fiber

- a) A = Core, B = Light, C = Jacket, E = Cladding
- b) A = Light, B = Cladding, C = Jacket, E = Core
- c) A = Light, B = Cladding, C = Core, E = Jacket
- d) A = Light, B = Core , C = Cladding, E = Jacket
- e) No correct answer

1.2 which one is giving the bandwidth from low to high? (2 marks)

- a) UTP > Coaxial > Fiber Optic
- b) Coaxial > UTP > Fiber Optic
- c) Fiber Optic > Coaxial > UTP
- d) Fiber Optic > UTP > Coaxial
- e) No correct answer

1.3 Which one is the advantage of WDM (Wave Division MUX) (2 marks)

- a) can be used for twisted-pair
- b) can be used with TDM switch
- c) give more channels than TDM and FM
- d) has a lower attenuation than TDM and FM
- e) all are correct.

1.4 What is the cause of this figure? (3 marks)

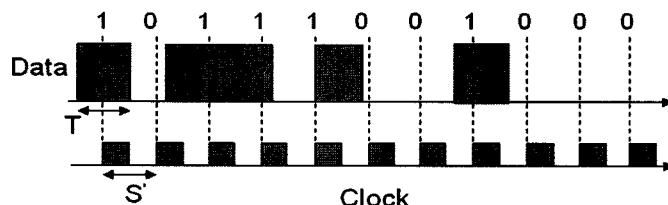


Figure 2 Problem of asynchronous serial communication

- a) synchronization
- b) multiplexing
- c) attenuation
- d) data loss
- e) no correct answer

1.5 Consider asynchronous transmission in the form of 7-bit characters with one start bit and 1.5 stop bits. For a 10 kbps link, let the sampling instants at the receiver be in the middle of each bit. What is the maximum tolerance of the alignment between the transmitter and receiver clocks for correct reception of character on this line? (6 marks)

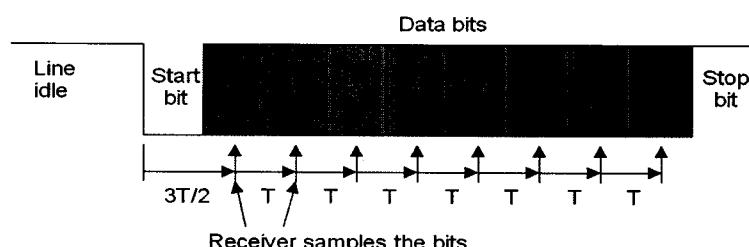
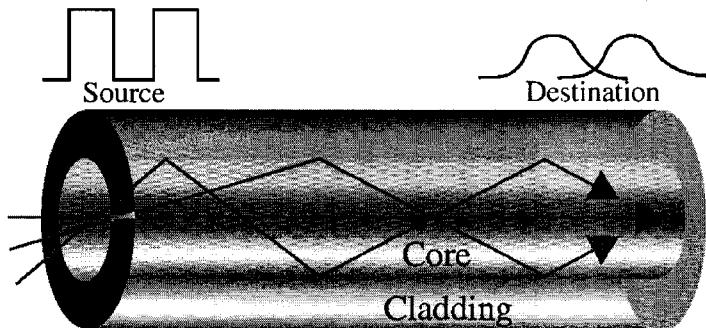


Figure 3 Frame Format of a asynchronous serial communication

- a) 100 usec
- b) 50 usec
- c) 6.67 usec
- d) 6.33 usec
- e) No correct answer

1.6 What does it call? (2 marks)

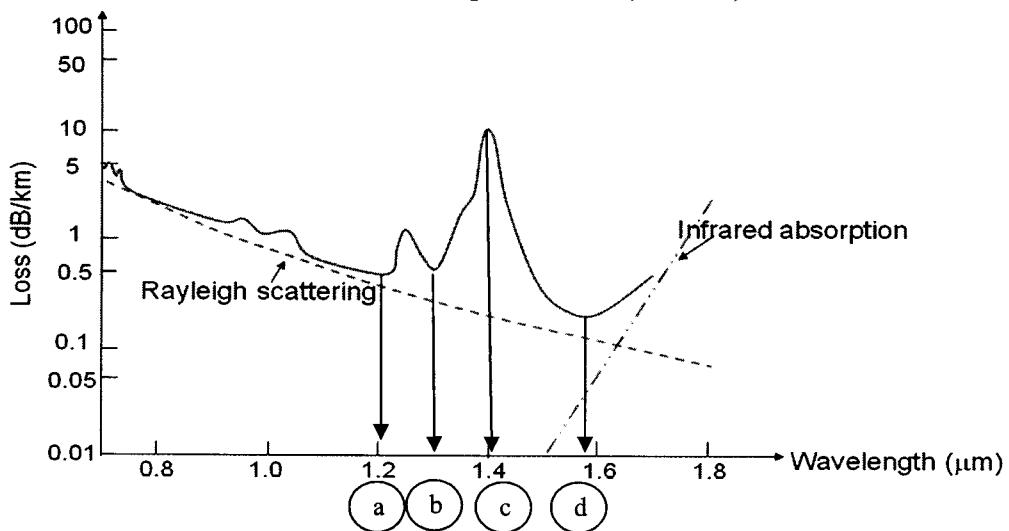


- a) Wavelength dependence
- b) Dense WDM
- c) Multimode Graded – Index
- d) Multimode Step - Index
- e) No correct answer

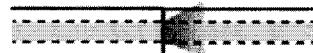
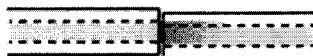
1.7 Which one is true for fiber optic? (2 marks)

- a) Very low attenuation
- b) Noise immunity
- c) Extremely high bandwidth
- d) No corrosion
- e) All are correct.

1.8 Which point is the best for fiber optic to use? (2 marks)

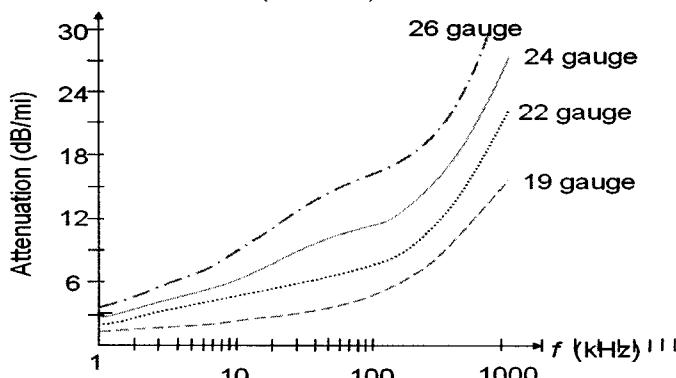


1.9 What is the sequence of the below problems in fiber optic? (3 marks)



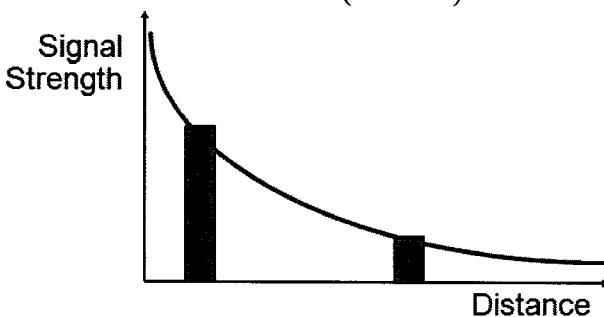
- a) End Gap, Concentricity, Eng Angle, NA Mismatch
- b) End Gap, , Eng Angle Concentricity, NA Mismatch
- c) Concentricity, End Gap, Eng Angle, NA Mismatch
- d) End Gap, Concentricity, NA Mismatch, Eng Angle
- e) Eng Angle, End Gap, Concentricity, NA Mismatch

1.10 Which one is true? (3 marks)



- a) Higher gauge number, higher attenuation
- b) Lower gauge number, higher frequency
- c) 19 gauge cable gives a longer distance than others
- d) At 100 kHz frequency, 22 gauge cable has a lower attenuation than 26 gauge cable
- e) All are correct.

1.11 What is the effect called? (2 marks)



- a) Out of phase
- b) Phase shift
- c) Attenuation
- d) Distortion
- e) No correct answer.

1.12 Which one does describe ‘baseband’? (3 marks)

- a) Divides the total bandwidth into many channels
- b) Each channel can carry a different signal
- c) carry many simultaneous transmissions
- d) voice and data share the same cable
- e) No correct answer

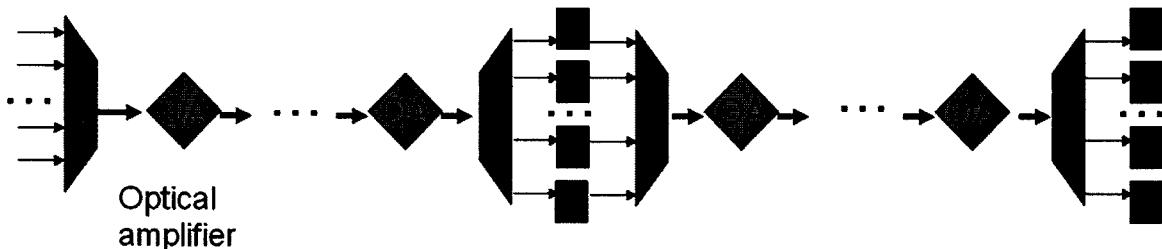
1.13 Which one does describe ‘Full Duplex’? (3 marks)

- a) allow data to be sent in both directions simultaneously.
- b) A channel can be formed from two simplex channels carrying data in opposite directions. There is no waiting for turns or for the devices swap roles
- c) Both end can communicate simultaneously
- d) All are correct.

1.14 Which one can give the highest bandwidth? (2 marks)

- a) Twisted pair (UTP)
- b) Shielded twisted pair (STP)
- c) Fiber optic
- d) Infrared
- e) Microwave

1.15 Which one is the best to describe the below picture? (3 marks)



- a) Erbium Doped Fiber Amplifiers
- b) DWDM system
- c) Impairments in optical amplification
- d) Injection Laser diode (ILD)
- e) Dispersion in optical amplification

ARQ Protocols

(75 marks)

2. Answer the following questions for Go-Back-N ARQ

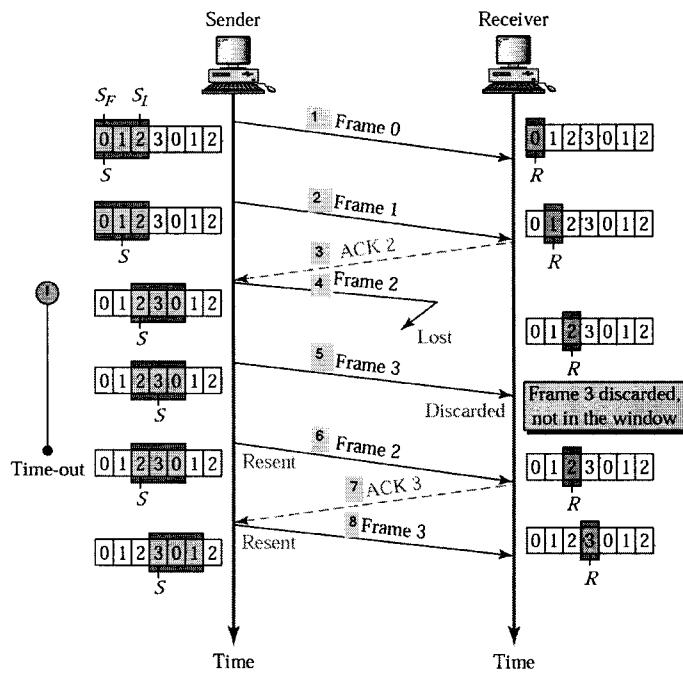


Figure 4 Go-Back-N ARQ

- 2.1 Why does the receiver not answer ACK (step no. 2) of Frame 0? (5 marks)
- 2.2 What happen if the receiver does not give ACK2 (step no. 3)? (5 marks)
- 2.3 What happen if the receiver does not send ACK 3 (step no. 7)? (5 marks)
- 2.4 In Go-Back-N ARQ, a window side must be least a number of data unit in one block. Why? (5 marks)

Answer

2.1

.....
.....
.....
.....
.....

2.2

.....
.....
.....

2.3

2.4

3. In a Stop-and-Wait ARQ system, the bandwidth of the line is 10 Mbps, and 1 bit takes 10 ms to make a round trip. What is the bandwidth-delay product? If the system data frames are 1000 bits in length, how long does it take to transmit 10 Mbytes data? Assume that all data are received correctly, e.g. no error and dropped. (10 Marks)

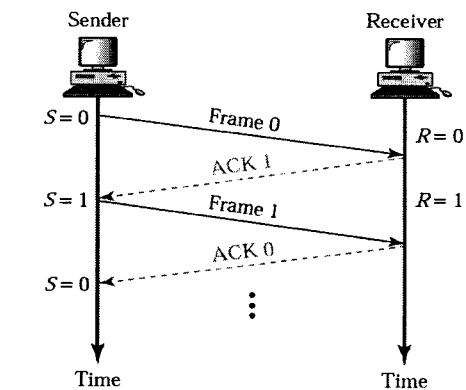


Figure 5 Stop-and-Wait ARQ operation

Answer

4. Below is the Selective Repeat ARQ operation. Answer the following questions: (10 Marks)

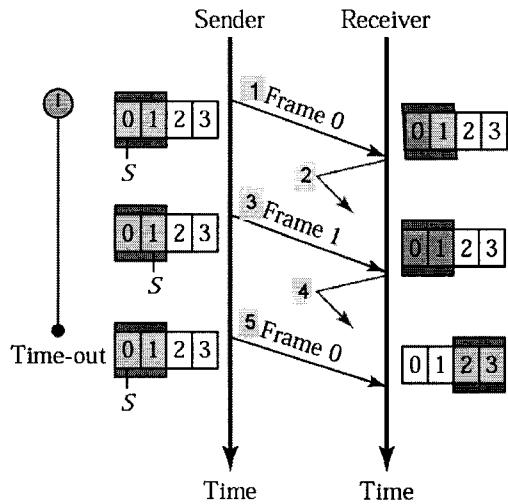


Figure 6 Selective Repeat ARQ operation

- a. What will happen in step no. 6 and 7? (5 marks)
 - b. If ACK of step no 4 is received by the sender, what will happen in step no. 5? (5 marks)

Answer

5. The figure below shows a sequence diagram of selective repeat ARQ protocol. The communication has some errors. Regarding to the mechanism of selective repeat ARQ protocol please give the frame number of (a) and (b) (5 marks)

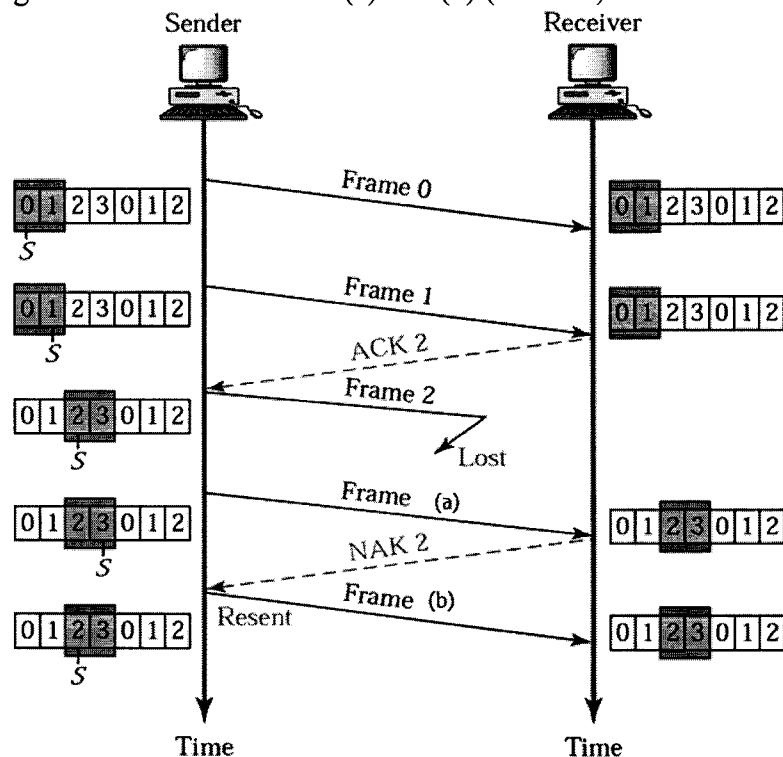


Figure 7 Selective repeat ARQ protocol

Answer

6. Stop-and-Wait ARQ Protocol

(30 marks)

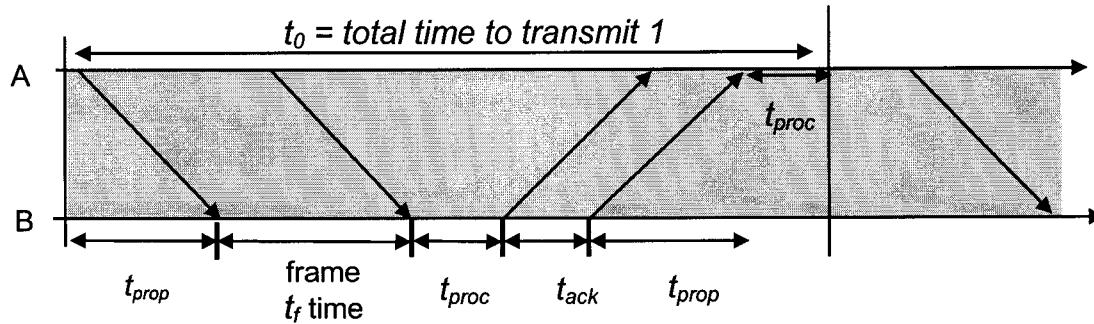


Figure 8 Stop-and-Wait ARQ mechanism

Stop-and-wait ARQ transmission efficiency is described by:

$$\eta_0 = \frac{R_{eff}}{R} = \frac{\frac{n_f - n_o}{t_0}}{R} = \frac{1 - \frac{n_o}{n_f}}{1 + \frac{n_a}{n_f} + \frac{2(t_{prop} + t_{proc})R}{n_f}}.$$

Assume that in our transmission system, the frame size is 1,250 bytes (including 250 bytes overhead), ACK frame size is 25 bytes. The channel bandwidth is 1 Mbps. What are the efficiency of the system when the round trip time are: (a) 1 ms, (b) 10 ms, and (c) 100 ms.

Section II

ตอบเป็นภาษาอังกฤษ

Error Detection and Correction

(50 marks)

7. Hamming Code can be applied for FEC (forward Error Correction) technique, as shown below
 r_1 will take care of these bits.

11	9	7	5	3	1					
d	d	d	r_8	d	d	d	r_4	d	r_2	r_1

r_2 will take care of these bits.

11	10	7	6	3	2					
d	d	d	r_8	d	d	d	r_4	d	r_2	r_1

r_4 will take care of these bits.

7	6	5	4							
d	d	d	r_8	d	d	d	r_4	d	r_2	r_1

r_8 will take care of these bits.

11	10	9	8							
d	d	d	r_8	d	d	d	r_4	d	r_2	r_1

Figure 9 Redundant bit calculation using Hamming Code

- 7.1 If the original data is 1001101, what is the data code after using Hamming Code? (10 marks)

- 7.2 If the following data is received by the receiver, 10010100101, is the data corrupted? If yes, what is bit number in error? (10 marks)

Answer

7.1

.....

.....

.....

.....

.....

.....

.....

.....

.....

7.2

8. Assume that we are using two-dimensional parity check. If we use ‘even parity’ for this information transmitting, please fill in all parity check bits in the table below. (10 marks)

1	0	0	1	0		—
0	1	0	0	0		—
1	0	0	1	0		—
1	1	0	1	1		—
—	—	—	—	—		—

Answer

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

9. Officer A sends his information to officer B using Linear Block Code. The information is 4 bits consisting of (1,0,0,1). Hence he is using (7,4) Linear Block Code. Please answer

9.1 What is the code word information (c)? (10 marks)

9.2 Show that by the time when officer B receives such information, how he knows the information is an error free. (10 marks)

Answer

.....

.....

.....

.....

Multiplexing

(65 marks)

- 10.(a) What is statistical multiplexing? (5 marks)
(b) Why is it different from conventional multiplexing? (5 marks)
(c) What are the advantages of the statistical MUX compared to the convention MUX? (5 marks)

Answer

10 (a)

ทุกรูปแบบสอน ไทยขึ้นตัวกีอูปรับตอกในรายวิชานี้และพัฒนาการเรียนหนังสือการศึกษา

.....
.....
.....

10 (b)

10 (c)

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

11. (a) What is the difference between circuit switching and packet switching? (5 marks)
(b) What are the advantages and disadvantages of packet switching (compared to circuit switching)? (5 marks)

Answer

11 (a)

11(b)

12. The Advanced Mobile Phone System (AMPS) uses two bands. The first band, 824 to 849 MHz, is used for sending; and 869 to 894 MHz is used for receiving. Each user has a bandwidth of 35 kHz in each direction, including guardband. The 3-kHz voice is modulated using Frequency Modulation (FM), creating 35 kHz of modulated signal. How many people can use their cellular phones simultaneously? (20 marks)

Answer

13. Two offices are communicating using TDM; four 2-Kbps connections are multiplexed together. A unit is 1 bit. Find

 - (a) the duration of 1 bit before multiplexing, (5 marks)
 - (b) the transmission rate of the link, (5 marks)
 - (c) the duration of a time slot, and (5 marks)
 - (d) the duration of a frame? (5 marks)