Student Name: .... Student ID: ....

PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination: Semester II   Academic Year: 2010

Date: 3 March 2011   Time: 13.30-16.30

Subject: 241-360 Introduction to Communication Systems and Networks Room: A201

1. This exam paper has 2 parts:
   - Part I: There are 20 multi-choice questions, with negative marking,
   - Part II: There are 11 questions. Please give your answers with some explanations clearly.
2. All kinds of dictionaries, calculators, and electronic devices are not allowed.
3. All notes and books are not allowed.
4. Total marks are 170

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Part I: _____

Part II

1	2	3	4	5	6	7	8	9	10	11

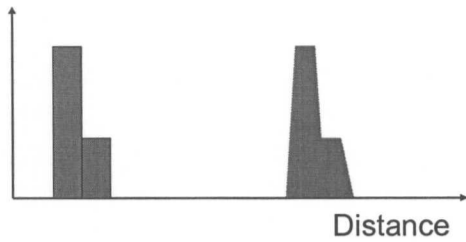**Part I: Total marks are 40.**

Marking scheme:

- o 2 marks for the right answer of each question,
- o -1 (minus one) for each wrong answer
- o No penalty if you leave an empty answer.
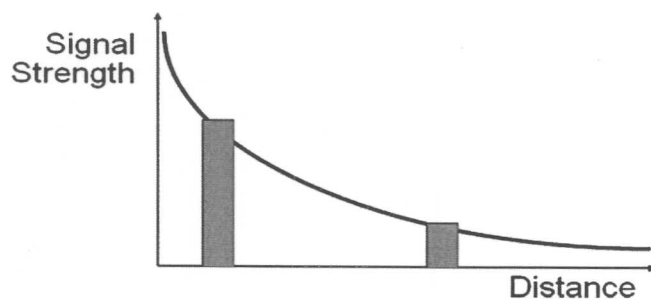
1. What is the cause called?
a) Attenuation
b) Distortion

c) Propagation
d) Phase shift
e) No correct answer

2. What is the cause called?

Distance

a) Attenuation
b) Distortion
c) Propagation
d) Phase shift
e) No correct answer

3. Which one is NOT true?
   a) A simplex channel is unidirectional, which means data can only be sent in one direction.
   b) A half-duplex channel allows information to flow in either direction (but not simultaneously).
   c) A full-duplex channel allows data to be sent in both directions simultaneously.
   d) A full-duplex can be constructed by using 2 simplex channels.
   e) No correct answer.

4. Which one is different from others?
   a) Coaxial, Twisted pair (UTP), Shielded twisted pair (STP)
   b) Coaxial, Twisted pair (UTP), Fiber optic
   c) Microwave, Satellite, Fiber optic
   d) Infrared, Microwave, Radio.
   e) Microwave, Radio, Satellite

5. Which one is NOT advantage of using fiber optic
   a) Very low attenuation
   b) Noise immunity
   c) Extremely high bandwidth
   d) Difficult to splice
   e) No corrosion

6. What is the cause of "fading"
   a) Multipath propagation
   b) Interference from other users
   c) Modulation problem
   d) Carrier signal lost
   e) Attenuation

7. Which one is NOT advantage of synchronous transmission?
   a) Low overhead
   b) Large blocks of bits transmitted
   c) Used at higher speeds than asynchrous
   d) A loss of synchronization

e) All of above

8. Select the correct answer
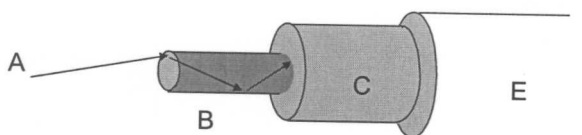
a) A = Core, B = Light, C = Jacket, E = Cladding
b) A = Light, B = Cladding, C = Jacket, E = Core

b) Synchronous Time Division Multiplexing

c) Statistical Time Division Multiplexing

d) Asynchronous Time Division Multiplexing

e) Wave length Division Multiplexing

13. Which one is TRUE for WDM?

a) Wavelength Division Multiplexing is TDM

b) Wavelength Division Multiplexing uses base-band frequency

c) Wavelength Division Multiplexing uses laser to transmit light at disfferenct frequencies

d) Wavelength Division Multiplexing can only be used in single mode optic fiber

e) Wavelength Division Multiplexing is better than Dense WDM

14. Below is DWDM. Each wave length carries 10 Gbps of information. What is the capacity of the link?
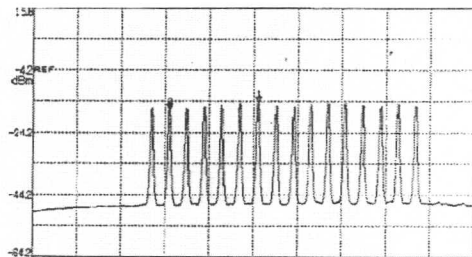
a) 10 Gbps

b) 100 Gbps

c) 160 Gbps

d) 200 Gbps

e) 1 Tbps

15. Which one is NOT true for TDM?

a) Time slots are pre-assigned to sources

b) Time slots are allocated even if there is no data

c) The sequence of slots assigned to a source is called a channel.

d) The slot length equals the transmitter buffer size, typically, one bit or one character.

e) Bit interleaving is used with asynchronous sources.

16. Which one does characterise "Statistical Multiplexing"?

a) Traffic is sent on demand, so channel is fully utilized if there is enough demand

b) Any number of flows

c) Need to control sharing:

d) Resources are not guaranteed

e) All of the above

17. Which one does characterise TDM?

a) TDM may under utilize channel with idle senders

b) Applicable only to fixed number of flows

c) Requires precise timer (or oscillator and guard bands for FDM)

d) Resources are guaranteed

e) All of the above

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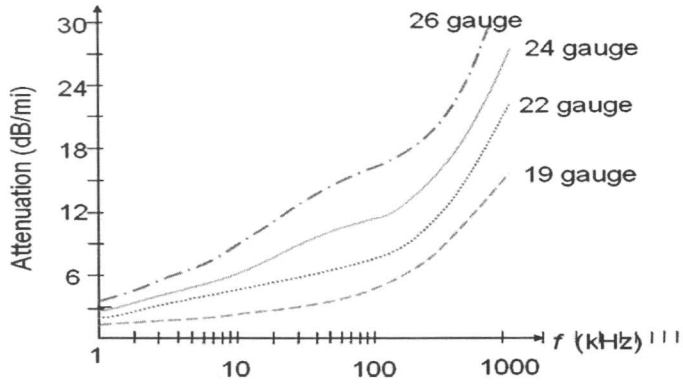
a) Higher gauge number, higher attenuation
b) Lower gauge number, higher frequency
c) 19 gauge cable gives a longer distance than others
d) At 100 kHz frequency, 22 gauge cable has a lower attenuation than 26 gauge cable
e) All are correct.

19. 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

20. Which point is the best for fiber optic to use? (2 marks)
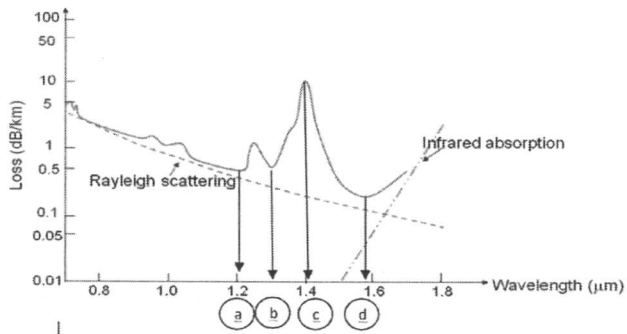
Part II: Total Marks are 130

Please answer the following questions

1. Consider asynchronous transmission in the form of 8-bit characters with one start bit and one 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? (Hint: As long as this total discrepancy is less than half bit time (50 µsec), there is no error) (10 marks)

Data bits

Line idle | Start bit | 1 2 3 4 5 6 7 8 | Stop bit

3T/2 T T T T T T T

Receiver samples the bits

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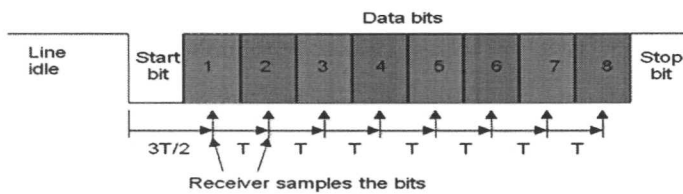
2. Five channels, each with a 100-KHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 15 KHz between the channels to prevent interference? (10 marks)

Guard band

100 kHz | 100 kHz | 100 kHz | 100 kHz | 100 kHz

kHz

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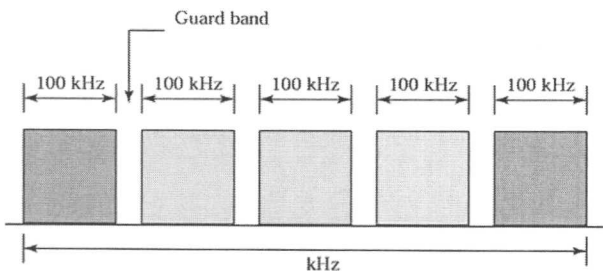
3. Four channels are multiplexed using TDM. If each channel sends 200 bytes/s and we multiplex two bytes per channel (a unit = 2 bytes), If 1 synchronizing bit is added to each frame, please find (15 marks)
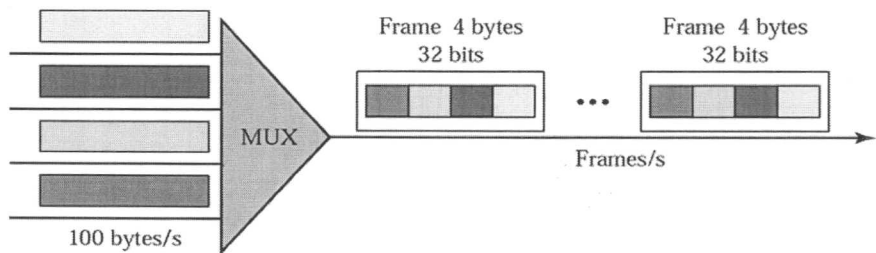
3.1 The bit rate of each source.

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3.2 The duration of each bit in each source.

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3.3 The frame rate.

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3.4 The duration of each frame.

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3.5 The number of bits in each frame.

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3.6 The bit rate of the link.

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4. From the picture given below, please calculate the link capacity (5 marks)

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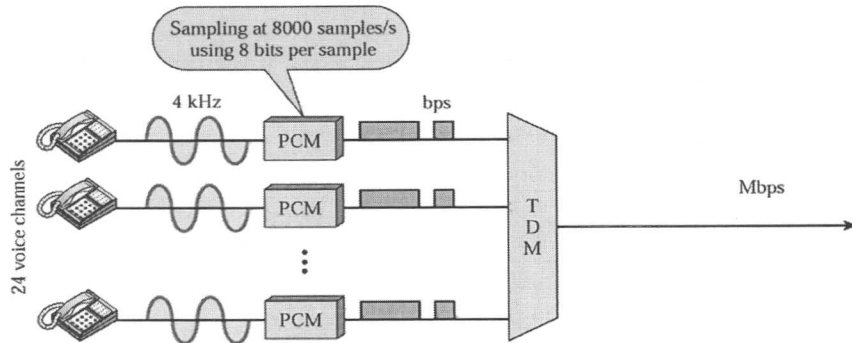
5. Hamming Code can be applied for FEC (forward Error Correction) technique, as shown below

Figure 1 Redundant bit calculation using Hamming Code

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

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

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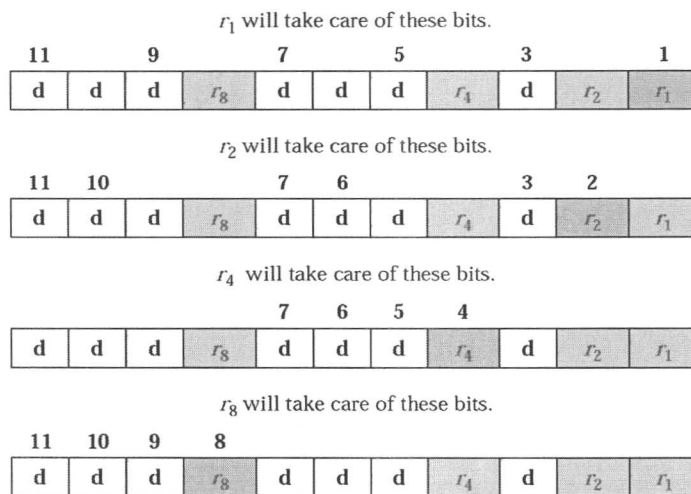
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6. Assume that we are using two-dimensional parity check. If we use 'even parity' for this information transmitting, please fill in all parity check bits in the table below. (10 marks)

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1 0 0 1 0
0 1 0 0 0
1 0 0 1 0   Last column consists
            of check bits for each
1 1 0 1 1   row
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Bottom row consists of
check bit for each column

Student Name: ……………………………………………………… Student ID: ………………………………

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7. Below is the Selective Repeat ARQ operation. Answer the following questions: (10 Marks)
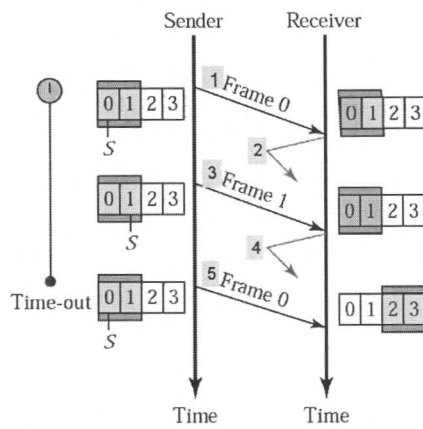
7.1 The figure shows upto step no. 5. Please draw for step no. 6 and 7. (5 marks)

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7.2 If ACK of step no 4 is received by the sender, what will happen in step no. 5? (5 marks)

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8. The figure below is Selective Repeat ARQ. In this condition, window sizes (both sender and receiver) are greater than 2^{m-1} (Window size $> 2^{m-1}$). Please draw the receiving windows at the receiver at point (A), (B), (C), and (D). (10 marks)

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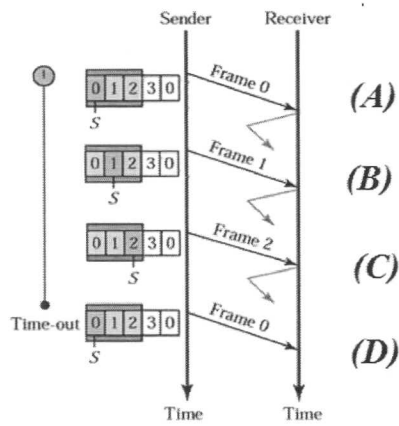
9. In a Stop-and-Wait ARQ system, the bandwidth of the line is 10 Mbps, and 1 bit takes 10 ms to make a round trip. What is the bandwidth-delay product? If the system data frames are 1000 bits in length, how long does it take to transmit 10 Mbytes data? Assume that all data are received correctly, e.g.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

Sender   Receiver

$S = 0$ Frame 0 $R = 0$
           ACK 1
$S = 1$ Frame 1 $R = 1$
           ACK 0
$S = 0$
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Time   Time

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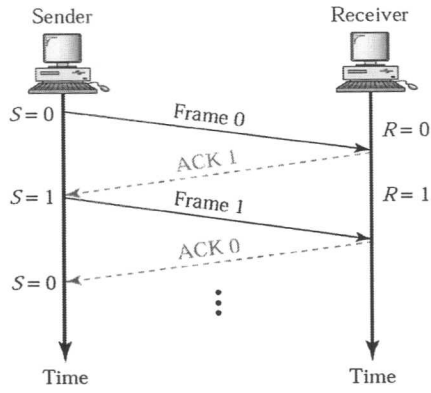
10. Suppose the following block of 16 bits is to be sent using a checksum of 8 bits. The receiver got the following binary stream: (10 Marks)

10101001 00111001 00011101

The receiver is using internet check sum method to do error detection. Is this result okay to the receiver? What is the check sum value on the receiver side?

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11. A student sends binary data 1,1,0,1,0,0 to a lecturer using (9,6) Polynomial Coding for error detection. The process uses Generator Polynomial with $g(x) = x^3+x+1$. Please answer the following questions.

11.1   What is Codeword from the student? (5 marks)

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11.2   At the receiver's end if the data are correct, please show how to verify it. (5 marks)

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