

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2011-2012

DURATION: 3 Hours

FULL MARKS: 150

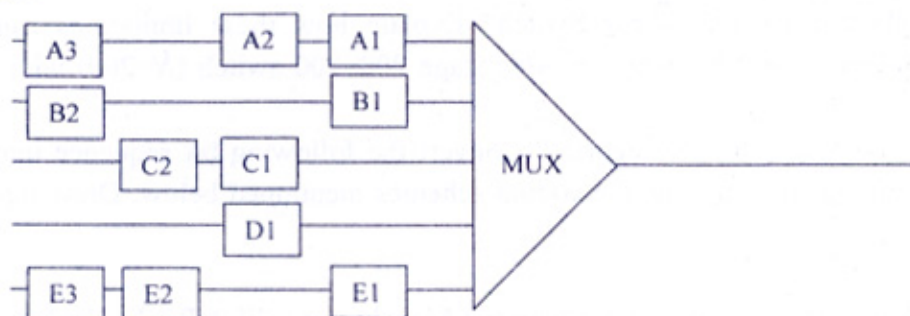
CSE 4405: Data and Telecommunications

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any 6 (**six**) of them.

Figures in the right margin indicate marks.

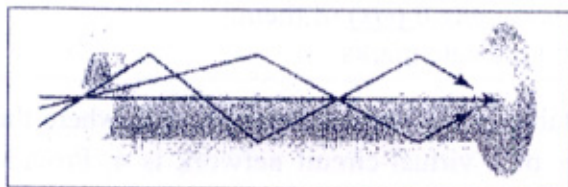
1. a) The minimum number of columns in a routing table of a datagram network is 2, where the minimum number of columns in a routing table of a virtual-circuit network is 4. Provide specific network scenarios for both to explain the reason. [Hint: Is the difference related to the type of addresses carried in the packets of each network?] 10
- b) Unguided signals can travel from the source to the destination in several ways. Explain these different propagation techniques. Among these techniques, which one is able to reach the longest distance in lower output power? 7
- c) Explain some scenarios where a user will prefer metallic cables over optical fiber cables. Justify your answer. 8
2. a) What is the significance of twisting in twisted-pair cable? 5
- b) WDM is conceptually the same as FDM. However, there are some basic differences. What are those? 4
- c) In statistical TDM, each data unit carries the destination address. However, synchronous TDM does not need addressing. Explain the reason behind this difference. 6
- d) Draw the sequence of output frames for the input lines in the following figure for both synchronous and statistical TDM. For your convenience, assume any reasonable slot size and destination address for statistical TDM. Find the efficiency of both methods from your output. 10



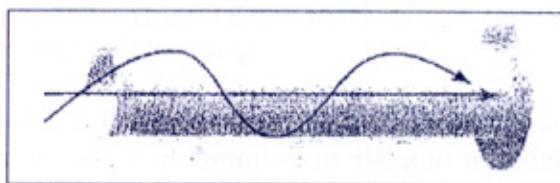
3. a) What type of wireless transmission wave should be ideal for communication in each of the following scenarios? 6
 - i. Short distance one-to-one communication with high data rate.
 - ii. Long distance broadcasting.

Explain the properties of each of the waves that make it ideal for the scenario.

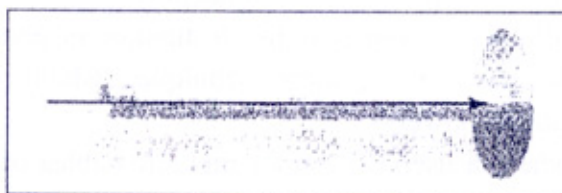
- b) Explain how the setup request and the acknowledgment are used to build the switching tables of a virtual-circuit network. Draw suitable figures to illustrate your explanation. 14
- c) Explain the necessity of analog-to-analog conversion with appropriate example. 5
4. a) Determine the propagation modes of the optical channels shown in the following figures. Explain the physical characteristics of these channels as well as how these characteristics allow propagation of light signals. 12



(i)



(ii)



(iii)

- b) Draw the spread signal of the original signal 1101 for DSSS using the spreading code 1011011100. 5
- c) Explain the purposes of a pseudorandom code generator in frequency hopping spread spectrum. 5
- d) Among multilevel multiplexing, multiple-slot allocation, and pulse stuffing suggest which method is applicable if the input data rates of the sources are 46 kbps, 47 kbps, and 50 kbps. 3
5. a) Which problem of NRZ coding scheme motivated the invention of RZ coding? 4
- b) What are the limitations of a Crossbar Switch? Explain how these limitations can be removed using Multistage switch. Design a three-stage 200×200 switch ($N=200$) with $k=4$ and $n=20$. 12
- c) What are the different line coding categories? Convert the following bit sequence into its corresponding digital signal using the line coding schemes mentioned below. Draw figures only. 9
- Bit sequence: 1101010
- Line coding schemes: i. Manchester ii. Differential Manchester iii. NRZ-I iv. RZ
6. a) How can we determine the amplitude and phase of a signal element from constellation diagram? Explain with suitable figure. 4
- b) Plot the following sine waves in both frequency-domain and time-domain: 6
- i. Frequency: 6 Hz, Peak amplitude: 5V ii. Frequency: 3 Hz, Peak amplitude: 3V

- c) Define the following terms: 10
 i. Phase ii. Bandwidth iii. First harmonic iv. Bit Length v. Attenuation
- d) Define SNR and SNR_{dB} . Calculate the capacity (C) of an extremely noisy channel. [Hint: The value of SNR is almost 0]. 5
7. a) Explain the relationship between bandwidth and throughput. What is the total delay (latency) 10
 for a frame of size 10 million bits that is being sent on a link with 15 routers each having a queuing time of $2 \mu\text{s}$ and a processing time of $1 \mu\text{s}$. The length of the link is 3000 Km. The speed of light inside the link is $2 \times 10^8 \text{ m/s}$. The link has a bandwidth of 6 Mbps. Which component of the total delay is dominant? Which one is negligible?
- b) If the number of signal levels is increased, will it also increase the data rate of the channel? 10
 Explain your answer for both noiseless and noisy channels with the help of the Nyquist Bit Rate and the Shannon Capacity formulas, respectively.
- c) Draw a diagram that relates layers of the TCP/IP protocol suite with that of the OSI model. 5
8. a) Define the different levels of addressing used in the TCP/IP protocol suite. Explain their 12
 significance with specific example.
- b) Determine the layer(s) of the OSI model that is/are responsible for each of the following 8
 tasks:
- | | | |
|-------------------------|--------------------|-------------------------|
| i. Synchronization | ii. Encryption | iii. Logical addressing |
| iv. Physical addressing | v. Routing | vi. Flow control |
| vii. Access control | viii. Segmentation | |
- c) If you are given enough resources to implement any kind of physical topology in order to set 5
 up a LAN in IUT, which one will you go with? Defend your choice.