THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING
ECU4305 – DATA COMMUNICATION SYSTEMS
FINAL EXAMINATION– 2005/2006 CLOSED BOOK

024

DATE: 23rd April 2006 0930 hrs – 1230 hrs

Answer any 5 questions. All questions carry equal marks.

1. (a) For a WAN consisting of 6 nodes,
   - draw the topology with the least number of point to point links
   - draw a topology that best improves the resilience of this network by adding a single link.
   - draw another topology that will maximize the resilience for the whole network
   - draw a topology that will minimize the delays between one node and all of the others. *[08 marks]*

   (b) Explain the disadvantages of CSMA/CD protocol used in Ethernet and state how these disadvantages are eliminated in Network Switches. *[05 marks]*

   (c) Answer the following with respect to Ethernet:
   1. Explain the significance of Minimum Frame Size. *[03 marks]*
   2. Maximum distance between two nodes in Ethernet with repeaters as per standard is 2.5km and propagation time for the return trip is given as 50 μs. Compute the minimum frame size for following networks. *[04 marks]*
      (a) Ethernet
      (b) Fast Ethernet
      (c) Gigabit Ethernet

2. Answer the following questions with respect to ISO OSI 7 layer model:

   (a) What is meant by a layered communication structure and what advantages are obtained from using such an architecture? *[05 marks]*

   (b) Compare and contrast connection-oriented and connectionless protocols using appropriate examples. *[04 marks]*

   (c) Write short notes on the following. *[06 marks]*
      1. flow control
      2. medium access control
      3. encapsulation

   (d) Describe the need for two layers "network layer" and "transport layer"? *[05 marks]*

3. (a) Compare and contrast virtual circuit and datagram operation of packet switching. *[04 marks]*

(b) Explain in detail how Transport Control Protocol achieves its reliability. *[04 marks]*

(c) "Connectionless type of communication does not always mean unreliable communication". Critically discuss this statement. *[04 marks]*

(d) Briefly describe suitable transport layer protocols for the following operations along with justification for your choice. [*[08 marks]*

1. Database queries
2. Audio and Video Streaming
3. Email
4. File Transfer

4. (a) Briefly describe the need for "CIDR". *[03 marks]*

(b) Briefly describe the meaning of subnetting and its advantages. *[04 marks]*

(c) A service provider has a network 193.200.12.0. It plans to offer this network for 5 of its clients who have the following requirements:

- Client A : 100 IP addresses
- Client B : 14 IP addresses
- Client C : 27 IP addresses
- Client D : 50 IP addresses
- Client E : 6 IP Addresses

Prepare the subnet work plan for the given network, clearly indicating each sub-network in CIDR notation, its corresponding sub-net mask and the broadcast address. Clearly state your assumptions, if any. *[12 marks]*

5. (a) One of the most crucial aspects of packet switching network design is *routing.*

(i) Describe what is meant by *routing.*

(ii) Describe two ways in which the performance of a routing strategy may be judged. *[06 marks]*

(b) *Flooding is a simple* routing technique.

(i) Describe the technique briefly.

(ii) State its advantages and disadvantages compared to *fixed routing.* *[06 marks]*

(c) **Fig. Q5** shows a packet switched network. Node 1 has a packet to be sent to Node 6. Flooding is used as the routing technique.

(i) Show using sketches, the sequence of events that occur.

(ii) What are the measures that could be taken to discard duplicate packets at Node 6?

(iii) What are the measures that could be taken to stop packets from infinitely circulating in the network. *[08 marks]*

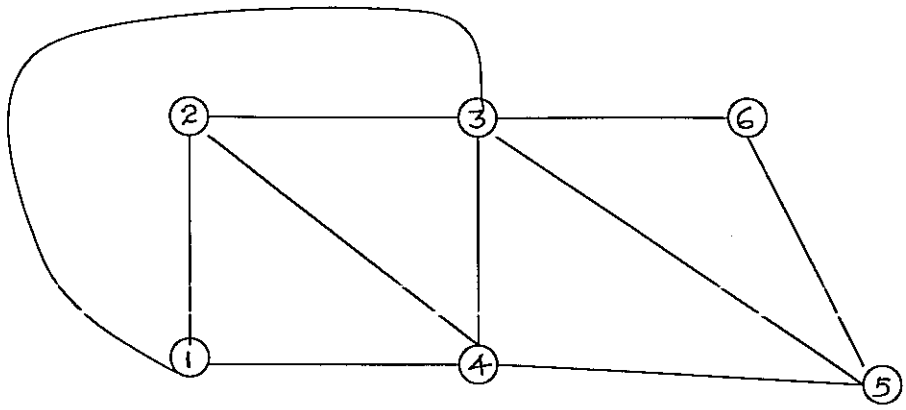

Fig. Q5

6. (a) State Shannon's Law.
   (i) What is the maximum capacity of a channel in bits/s, if bandwidth of the channel is 3kHz and the signal to noise ratio is 30dB ? *[05 marks]*
   (ii) Briefly explain "Pulse Code Modulation" and show how the basic voice data rate is derived. *[05 marks]*

   (b) Consider an audio signal with spectral components in the range 30 to 15000Hz. Assume that a sampling rate of 44000 samples per second will be used to generate a PCM signal. *[10 marks]*
   (i) For SNR = 30dB, what is the number of uniform quantization levels needed ?
   (ii) What data rate is required?

7. (a) Briefly explain the application layer protocol "DNS". *[05 marks]*
   (b) Compare "Go Back N" and "Selective Repeat ARQ" methods of flow control. What is the most commonly used and why ? *[05 marks]*
   (c) How does Frame Relay eliminates much of the overhead found in X.25? *[04 marks]*
   (d) What are the protocols used in Frame Relay *[06 marks]*
   (i) to provide a reliable data link control?
   (ii) for error control and flow control?
   (iii) to transfer information between end users?

8. (a) What is the most commonly used error detection method in packet switching networks? *[03 marks]*
   (b) An 8-bit message frame 10101011 at the data link layer to be transmitted. Given a generator polynomial $P(x)=x^4+x^2+x^0$. Calculate the Frame Check Sequence (FCS) that must be appended to the frame. *[06 marks]*
   (c) Show how the frame can be determined to have arrived at its destination without error. *[05 marks]*
   (d) Suppose the channel introduces errors at positions 1 and 5 (from left) of the message. What is the received bit stream? Can the error be detected? *[06 marks]*