

Date: 13.09.17

# Ahsanullah University of Science & Technology

Department of Computer Science and Engineering

Year: 4<sup>th</sup>, Semester: 1<sup>st</sup>, Final Examination (Spring 2017)

Course No: CSE 4101, Course Title: Computer Networks

Time: 3 Hours

Full Marks: 70

[There are Seven (7) Questions. Answer any Five (5) Questions.]

[Marks allotted are indicated in the margin.]

- Q1. a) Discuss the uses of computer network in terms of - i) access to remote information [3]  
and ii) peer to peer communication.
- b) A company has a fully connected mesh network consisting of 25 devices. Calculate [2]  
the total number of cable links needed and the number of ports for each device.
- c) Explain the operations of any two of the following: [4]  
i. Broadcast Links and Point to Point Links  
ii. PAN and LAN  
iii. Star Topology and Hybrid Topology
- d) Explain the rationale behind the OSI seven-layer model. Briefly describe the role of [5]  
each layer with its main functions.
- Q2. a) Write short notes on: i) Coaxial cable; ii) Radio Waves. [4]
- b) How does sky propagation differ from line-of-sight propagation? [2]
- c) What are the steps involved in establishing a connection in circuit switch network? [2]
- d) Consider a packet of length 1500 bytes which begins at end system A and travels [6]  
over three links to a destination end system B. These three links are connected by two  
packet switches. The propagation speed on all three links are  $2.5 \times 10^8$  m/s. The  
transmission rate of 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> links are 500 Kbps, 1 Mbps and 2 Mbps  
respectively. The packet switch processing delay is 3 msec. The length of 1<sup>st</sup>, 2<sup>nd</sup> and  
3<sup>rd</sup> links are 5000 km, 4000 km and 1000 km respectively.
- i. What is the end-to-end delay?
- ii. Suppose Host A begins to transmit the packet at time  $t = 0$ . Where is  
the last bit of the packet at time  $t = d_{trans1}$ ?
- iii. Suppose  $d_{prop1}$  is greater than  $d_{trans1}$ . Where is the first bit of the  
packet at time  $t = d_{trans1}$ ?
- iv. Suppose  $d_{prop1}$  is less than  $d_{trans1}$ . Where is the first bit of the packet at  
time  $t = d_{trans1}$ ?
- v. Assuming no other traffic in the network, what is the throughput for  
the file transfer?
- vi. Suppose the file is 4 million bytes. How long will it take to transfer  
the file to Host B?

2 > 1  
1 < 2

- Q3. a) Briefly describe the services provided by the data link layer to the network layer. [3]
- b) Compare and contrast byte-stuffing and bit-stuffing. Which technique is used in byte-oriented protocols? Which technique is used in bit-oriented protocols? Byte stuff the data: ESC A B Flag A B ESC ESC ESC B Flag C. [3]
- c) In Selective Repeat ARQ, the size of the sender window must be equal to  $2^{m-1}$ , where  $m$  is the number of bits used for the representation of sequence numbers. Show in an example, by drawing a message sequence, why the size of the sender window must be equal to  $2^{m-1}$ . [4]
- d) Consider the Hamming code  $C(n, k)$  with  $d_{min} = 3$ , where  $n$  is the size of codeword and  $k = 11$  is the size of dataword. [4]
- Find the value of codeword  $n$ .
  - What is the codeword for the dataword 11000100110.
  - The codeword 010001010110000 is received. Find out the dataword by considering error correction process.
- Q4. a) Discuss pure ALOHA protocol for channel accessing. Derive the expression of throughput for Aloha protocol. If the network transmits 200-bit frames on a shared channel of 200 kbps then show the situation of maximum throughput for this protocol. [4]
- b) What is the basic principle of  $p$  persistent CSMA protocol? [2]
- c) Discuss the modes for propagation light along optical channels. [3]
- d) In a CSMA/CD network, the data rate is 10 Mbps, the distance between station A and C is 2000 m, and the propagation speed is  $2 \times 10^8$  m/s. Station A starts sending a long frame at time  $t_1 = 0 \mu s$ ; station C starts sending a long frame at time  $t_2 = 3 \mu s$ . The size of the frame is long enough to guarantee the detection of collision by both stations. [5]
- Draw a diagram where station C hears the collision at time  $t_3$  and station A hears the collision at time  $t_4$ . Find the value of  $t_3$  and  $t_4$ .
  - Find the number of bits station A and station C have sent before detecting the collision.
  - If the jam sequence transmission time is  $25 \mu s$  and number of attempts  $k = 2$ , then find the back-off time  $T_B$  for station A.
- Q5. a) Describe datagram networks and virtual-circuit networks. Do the routers in both datagram networks and virtual-circuit networks use forwarding tables? If so, describe the forwarding tables for both classes of networks. [3]
- b) Consider the subnet at Fig. 5(b). Distance vector routing is used, and the following vectors have just come in to router C from: [4]
- B: (5, 0, 8, 12, 6, 2);  
 D: (16, 12, 6, 0, 9, 10);  
 E: (7, 6, 3, 9, 0, 4).
- The cost of the links from C to B, D, and E, are 6, 3, and 5, respectively. What is C's new routing table? Give both the outgoing line to use and the cost.



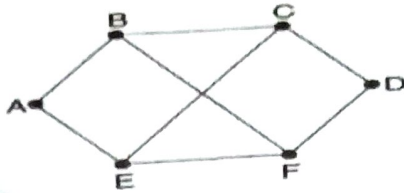


Fig: 5(b)

- c) Consider the following network. With the indicated link costs, use Dijkstra's [4] shortest-path algorithm to compute the shortest path from t to all network nodes.

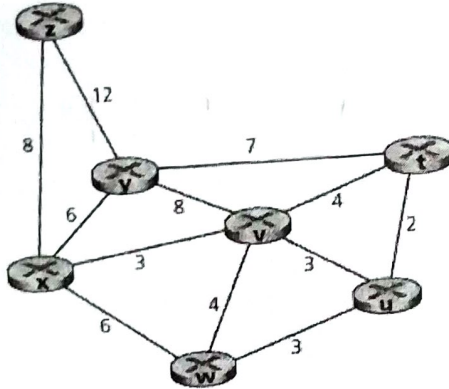


Fig: 5(c)

- d) Answer the following for the subnet below:

[3]

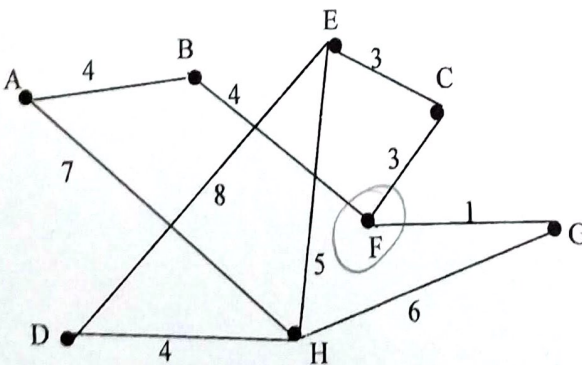


Fig: 5(d)

- Draw the sink tree (consider router E as root).
- Generate link state packets for all routers (consider Seq. = 20 and Age = 60).
- Create the packet buffer table for router H.

Q6. a) Describe the Token Bucket algorithm for traffic shaping. [3]

- b) Show that the hierarchical routing saves the memory for routing tables and searching time in routing packets. [3]

- c) Consider that the token arrival rate is 2 mbps and the capacity of bucket is 500 kb [2]  
with maximum output rate 25 mbps. Calculate the burst length.
- d) An organization is granted the block 211.17.180.0/24. The administrator wants to [6]  
create 32 subnets.
- Find the subnet mask.
  - Find the number of addresses in each subnet.
  - Find the first and last addresses in subnet 1.
  - Find the first and last addresses in subnet 32.

- Q7. a) How to provide communication to the top layer of a five-layer network? [3]
- b) Break the following columnar transposition cipher into plain text using ACTION as [4]  
the key.

TMEATNNEHIACHTCAIESPIFELCEROGOENENARNRFIDEEPHEDEB

- c) What is an advantage of a hierarchical name space over a flat name space for a [2]  
system the size of the Internet?
- d) The Sonali Bank Ltd., uses RSA and has picked two prime numbers  $p=11$  and  $q=5$ . [5]  
The bank wants to send a secret message "million" to its head office. How are they  
going to send it?