

2014 - 15

**COMPUTER NETWORKS****IT - 503**

Time - Three Hours

Full Marks - 70

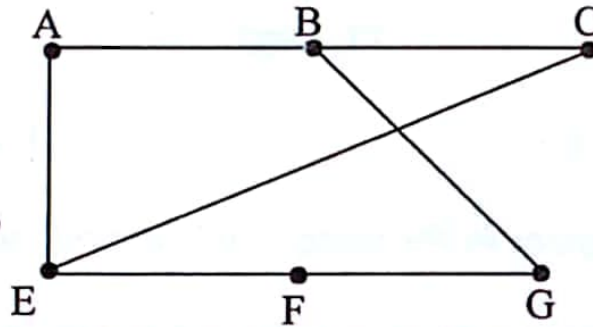
*The figures in the margin indicate full marks.*

Answer all the questions in order and maintain the groups.

Answer at *least two* questions from each group.**Group A**

1. Short Questions: (Answer *any seven*) 7×2
  - (a) 3-Way Handshake method
  - (b) What is super netting ? Give example.
  - (c) Draw and point out different fields of an ARP packet format.
  - (d) Discuss all TCP control bits.
  - (e) Different types of IP Addressing Notations. Give example.
  - (f) Use of Loopback Address.
  - (g) Mention the names of two dynamic routing algorithms.
  - (h) Use of time to live (TTL) field in IP.

2. (a) Consider this network: Suppose router B receives vectors from its neighbors A, C, G as given below. The estimated delay to its neighbors are  $BA=12\text{msec}$ ,  $BC=10\text{ msc}$  and  $BG=7\text{ msc}$  respectively. Calculate the vector of B that represents the best distance from all the routers in the network and the node to reach them. 4



	A	B	C	E	F	G
Routing table A	0	12	25	40	14	23
Routing table C	24	36	0	18	27	31
Routing table G	32	33	11	6	7	0

(b) What is count to infinity problem? With example discuss. 4

(c) How RARP works? 3

(d) What is the limitation of ARP and how it is solved? 2+1

3. (a) Discuss how TCP and IP work together ? 5

(b) Draw and discuss different fields of UDP frame format. 3

(c) A supernet has a mask 255.240.0.0 and a first address 136.26.46.0, How many blocks are there in this supernet?

1

(d) Given the IP address 201.14.78.65 and the subnet mask 255.255.255.224, what is the subnet address ?

1

(e) Discuss the use of routing table. Give example.

4

4. (a) Write down the 5 different steps of Link state routing.

3

(b) Consider this address: 197.34.79.0. Specify its class. Calculate the custom subnet mask to create 12 subnets from this address. Specify the number of addresses in each subnet. Specify the address range for each subnet. 1+2+1+3

(c) What is the first address in the block if one of the addresses is 176.104.123.182/19 ?

1

(d) Which of the following can be the beginning address of a block that contains 2048 addresses'?

2

205.16.48.0, 190.16.42.0, 17.17.32.0, 123.45.25.0

(e) Hexadecimal notation of the IP address 11000001 10000011 00011011 11111111

1

### Group - B

5. (a) A Modulation scheme uses 16 phases and two amplitudes for each possible phase for representing 32 distinct symbols. Draw the constellation diagram for the modulation scheme. If the symbol transmission rate for the channel is 10,000 symbols per second then find the information transmission rate of the channel in bits (of information) per second. 3+3=6



(b) "Signals travel faster in free space or coaxial cables than in optical fibre" - justify. 3

(c) A link has a bandwidth of 1Mbps and the length of the link is 1000 km. If packets of size 10Kbits are to be transmitted through the link, what will be the packet transmission time and packet propagation time? Assume a fibre optic link with velocity 200000 km/s. Also calculate the round trip time of the link.

2+2+1

6. (a) Why backward error correction method is not suitable for real time application? Let each message have  $m$  number of data-bits and we are interested in correcting all errors involving at most  $k$  number of bits by adding up  $c$  number of check bits into the message. Derive a relationship between  $m$ ,  $k$  and  $c$ .

2+4=6

(b) A link has capacity of 100 Mbps, the packets are of size 10000 bits and length of the link is 1000km. If the velocity of the signal through the link is 200000 km/s, find the optimum window size (in terms of number of packets) to be used for selective repeat or go back  $n$  protocols. State the fundamental advantages and disadvantages of selective repeat protocol over go back  $n$  protocol.

2+3=5

(c) Let  $m(x)$  be the message polynomial and  $g(x)$  be the generator polynomial then how can you generate the transmitted message  $T(x)$  in a CRC coding system? How can you check the error at the receiving side ?

2+1=3

7. (a) Show that the maximum achievable throughput of the ALOHA MAC protocol is 18%. 4

(b) Explain the working principle of CSMA/CD protocol and distinguish between  $1$ -persistent and nonpersistent versions of it. Explain how  $p$ -persistence is achieved through adaptation of  $p$  using exponential back-off algorithm.

2+1+2=5

(c) With an example, explain how packet switching can achieve much higher statistical multiplexing gain than conventional circuit switching? What is the penalty against the gain ? 4+1=5

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**2016-17**  
**Computer Networks**  
**IT-503**

**Full Marks: 70**

**Time: 3 hours**

**Answer any five Questions.  $5 \times 14 = 70$**

1. (a) A modulation scheme uses 2 amplitudes and 8 phases for each amplitude. Show a possible constellation diagram of the scheme. If the symbol transmission rate of the channel is 4000 symbols per second, then find the information carrying capacity of the channel in bits per second. (4)
- (b) A typical data source can be in two possible states i.e, either **ON** or **OFF**. When in **ON** state, it sends data at the rate of 10Mbps but during **OFF** state it sends nothing. The stationary probabilities of **ON** and **OFF** states are 0.1 and 0.9. If the sources are to be multiplexed using TDM within a link of bandwidth 100Mbps, then how many such sources can be multiplexed? If statistical multiplexing is used with infinite buffering, then how many sources can be multiplexed? What is the value of statistical multiplexing gain and what penalty do we pay for this gain? ( $2 + 2 + 2 = 6$ )
- (c) The capacity of an wired network is always significantly higher than that of its wireless counterpart. Show two fundamental reasons behind the wide gap. (4)
2. (a) Say the bit pattern 01111110 is being used to mark the beginning and end of a frame. If the user's data contains a sequence 0111110101, then how should you modify the sequence using stuffed bits, before sending? Also, explain how destuffing can be applied at the receiving side to get back the original sequence? ( $2 + 2 = 4$ )
- (b) A link has a bitrate of 10Mbps and its length is 2000Km. If the packets are 10Kbits long, then find the transmission time and propagation time of a packet through the link. Assume that the velocity of signal in the link is  $2 \times 10^5$  Kmps. Also calculate the round-trip-time of packet transmission. What should be the optimum window size (in terms of number of packets) to achieve 100% efficiency? What should be the maximum sequence number of the packets? ( $1+1+2+2+1 = 7$ )
- (c) What should be the minimum Hamming distance of a coding scheme if it is to be designed to correct all error upto  $d$  number of bits?



Justify your answer. A coding scheme can detect all errors upto 4 bits - what should be the minimum Hamming distance? ( $2 + 1 = 3$ )

3. (a) Compare the performance of 1-persistent CSMA and non-persistent CSMA on the basis of collision probability and idle-time of the channel. Which protocol would you prefer under light condition and heavy load condition. ( $2 + 1 = 3$ )
- (b) How does a node update its collision window value if it experiences a collision and if it has successfully transmitted a frame? In this context, explain how an adaptive  $p$ -persistent CSMA system evolves with time. Will the size of collision windows of all the nodes be same? ( $2 + 2 + 1 = 5$ )
- (c) With neat sketches explain the hidden station and exposed station problems encountered in wireless LAN. Explain how the hidden node problem can be solved using RTS/CTS signalling. Can you solve the exposed station problem with the same signalling scheme? ( $2 + 3 + 1 = 6$ )
4. (a) 'The routing decision is initially taken by the source node but all the intermediate nodes decide the actual route independently' - why is it designed so? What is the fundamental difference between distance-vector and link-state routing? Which one of them is more advantageous? ( $2 + 2 + 1 = 5$ )
- (b) Customers arrive at a bank counter according to Poisson's process with an average rate of arrival 16 customers per hour. The capacity of the serving clerk is 20 customers per hour. If the service times are exponentially distributed, find the average number of customers in the queue. Also compute the average waiting time of a customer being served at the counter. ( $2 + 1 = 3$ )
- (c) A network switch has 4 input ports and 4 output ports. The packets coming through any of the input ports are destined for all the output ports with uniform probability. The arrival process is Poisson's process with average of 800 packets per input port per second. The output ports are equipped with buffers and can transmit 1000 packets per second. When buffer length is infinite, find the average buffer occupancy and average time spent by a packet in the queue including its own service time. If the length of the buffer is 200 packets, then what is the probability that a packet will be lost? If the length of the buffer is made 400 packets, then what is the loss probability? ( $2 + 1 + 1 + 2 = 6$ )
5. (a) Why the IP protocol had been designed as 'connectionless and unreliable'? Why hierarchical addressing had been adopted in the Internet? ( $2 + 2 = 4$ )
- (b) Why is it necessary to include the 'header-length' field in the IP-header? If you want that the packets in an IP network should never

visit more than 16 nodes, how will you implement this using standard IPV4 headers? ( $2 + 3 = 5$ )

- (c) A node receives an IP-datagram of length  $4KB$  through a serial link. The packet is to be delivered through a link that allows a maximum frame-length of  $1.5KB$ . How many fragments must be created from the original datagram? Show the 'identification field', 'fragment-offset field', and 'MF flag' for each of the fragments. ( $1+1+2+1 = 5$ )
6. (a) How does TCP guaranty connection oriented transport service using underlying connectionless IP protocol? With a neat sketch illustrate the connection establishment phase of TCP. ( $2 + 2 = 4$ )
- (b) What is the significance of *ACK* and *WINDOW* fields of TCP header? ( $2 + 1 = 3$ )
- (c) A file of size  $90KB$  is to be sent using TCP protocol through a route having average RTT value of  $10ms$ . Assume that the *WINDOW* field and *THWND* value are very high (practically infinite) and segment size is  $1.5KB$ . If there is no error in the channel, then how long will it take to send the complete file? If an error occurs in the  $31^{st}$  segment and no more error occurs after that, then how long will it take to transmit the file? ( $3 + 4 = 7$ ).
7. (a) With a neat sketch, explain how discretionary access control is implemented in a computer system. What is the difference between authorisation and authentication? ( $3 + 2 = 5$ )
- (b) What is the fundamental limitation of symmetric key based encryption? How has it been eliminated using public-private key pair? Mention two important operational characteristics of public-private key pair. ( $1 + 2 + 2 = 5$ )
- (c) How one way hashing can maintain the integrity of message? How can you use public-private key pair to sign a message digitally? ( $2+2 = 4$ )

End



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Q. No. IT 503 / 025

B.Tech / Odd  
(2015-16) / Reg.

2015-16

## COMPUTER NETWORKS

IT 503

Full Marks : 70

Time : 3 hours

*The figures in the margin indicate full marks.*

The answers should be to the point without unnecessary elaborations.

Answer Q. No. 1 and any five from the rest.

1. I. Which of the following uses UDP as the transport protocol ? 1

- (A) HTTP
- (B) Telnet
- (C) DNS
- (D) SMTP

- II. Which one of the following is not a client-server application ? 1

- (A) Internet chat
- (B) Web browsing
- (C) E-mail
- (D) Ping

- (III) The transport layer protocols used for real time multimedia, file transfer, DNS and email, respectively are 1

- (A) TCP, UDP, UDP and TCP
- (B) UDP, TCP, TCP and UDP
- (C) UDP, TCP, UDP and TCP
- (D) TCP, UDP, TCP and UDP

IV. In the slow start phase of the TCP congestion control algorithm, the size of the congestion window 1

- (A) does not increase
- (B) increases linearly
- (C) increases quadratically
- (D) increases exponentially

V. What is the maximum window size for data transmission using the selective reject protocol with n-bit frame sequence number is 2

- (A)  $2^n$  (B)  $2^{n-1}$   $2^n-1$  (D)  $2^{n-2}$

VI. End-to-end connectivity is provided from host-host in 1

- (A) the network layer
- (B) the transport layer
- (C) the session layer
- (D) it is a combined functionality of the network and the data link layer

VII. An attempt to make a computer resource unavailable to its intended users is called 1

- (A) denial-of-service attack
- (B) virus attack
- (C) worms attack
- (D) botnet process

VIII. In computer security, ..... means that the information in a computer system only be accessible for reading by authorized parties. 1

- (A) Confidentiality
- (B) Integrity
- (C) Availability
- (D) Authenticity

IX. Packets of the same session may be routed through different paths in : 1

- (A) TCP, but not UDP
- (B) TCP and UDP
- (C) UDP, but not TCP
- (D) Neither TCP nor UDP

X. Which of the following system calls results in the sending of SYN packets ? 1

- (A) socket      (B) bind      (C) listen      (D) connect

XI. Two computers C1 and C2 are configured as follows. C1 has IP address 203.197.2.53 and netmask 255.255.128.0. C2 has IP address 203.197.75.201 and netmask 255.255.192.0. which one of the following statements is true ? 2

- (A) C1 and C2 both assume they are on the same network
- (B) C2 assumes C1 is on same network, but C1 assumes C2 is on a different network
- (C) C1 assumes C2 is on same network, but C2 assumes C1 is on a different network



(D) C1 and C2 both assume they are on different networks.

XII. The address of a class B host is to be split into subnets with a 6-bit subnet number. What is the maximum number of subnets and the maximum number of hosts in each subnet ?  
2

(A) 62 subnets and 262142 hosts.

(B) 64 subnets and 262142 hosts.

(C) 62 subnets and 1022 hosts.

(D) 64 subnets and 1024 hosts.

2. (a) Why MANET ? Other existing networks are not enough ?  
1

(b) What is "hidden-terminal" problem in MANET ? Write the solution to the problem.  
2

(c) Why Reactive routing protocol is more suitable than Proactive routing protocol in MANET ? What is hybrid routing protocol and why do we use it ? Write the name of the most used reactive routing protocol and how it works (only steps).  
2 + 2 + 3

(d) Why "HTTPS" is preferred over HTTP in handling user's accounts ?  
1

3. (a) Why block cipher is suitable than stream cipher ? Differentiate between substitution cipher and transposition cipher.  
2

(b) Why Triple DES ?  
2

(c) Explain the Diffie-Hellman key exchange mechanism. What is the man-in-the-middle attack related to Diffie-Hellman key exchange ?  
2

(d) Which would be more suitable for email filtering: packet-level filter or application level filter ? How does a packet filtering router typically filters packets ? Why we use digital signature ? 3

(e) In public key cryptography, how are the keys used for authentication applications ? Which one is faster RSA or DES ? 2

4. (a) Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D. 2



Fig. 4(a) Two Routers connecting source and destination.

(b) Why dynamic routing algorithms are preferred over static routing ? With an example illustrate how a link failure may lead to count to infinity problem in distance vector routing protocol.  $2 + 3 = 5$

(c) What information are contained in a Link-State (LS) Packet ? How LS does a node recompute the routes after receiving an LS packet ?  $1 + 1 = 2$

(d) "Each source node computes its best route to the destinations using shortest path algorithms but still all intermediate nodes route packets according to their independent decision"— why ? 2

5. (a) In Fig. 4 (a), the capacities of the links SR, RR and RD are 15, 20 and 15 packets per second. The traffic loads on the links are 10, 18 and 10 packets per second respectively. Find the average amount of delay suffered by the packets in traversing from S to R. Assume that the inter-arrival time of packets to the links are exponentially distributed. 3



(b) How does a TCP sender update the current value of RTT and how does it compute the RTO values from RTT? Write down the congestion window (CWND) update rules in slow start (SS) and congestion avoidance (CA) phases of TCP. 4

(c) A file of size 60 KB is to be transferred using a TCP connection (simple 1<sup>st</sup> generation TCP). The RTT of the path is assumed to be constant at 10 ms and the maximum segment size of the links is considered as 1.5KB. If there is no error in the segment transmission then what is the time required for transmitting the whole file to the destination? If an error occurs at the 15<sup>th</sup> segment and no error thereafter, then what will be the time required for sending the file?  $2 + 2 = 4$

6. (a) A modulation scheme uses 8 phases and two amplitude for implementing 16-array modulation. Show a representative constellation diagram for the same on amplitude phase plane. A communication channel can transmit 10K symbols per second. Now if you use the afore-said modulation scheme then what will be bit rate over the channel.  $2 + 2 = 4$

(b) The sending node and the receiving node are connected by a link of length 100Km and bit rate 100Mbps. Find the propagation time and transmission time of a packet of size 10 Kbits through the link. Assume that the signal travels at the speed of  $2 \times 10^5$  Km per second through the link. Also find the round trip time (RTT) of the link and maximum possible sliding window size for the link.  $1 + 1 + 1 + 1 = 4$

(c) What are the relative advantages of selective repeat and go-back-N protocols? Why backward error correction schemes are not suitable for real-time voice or video traffic?  $2 + 1 = 3$



7. (a) Let  $M(x)=100101$  and the generator polynomial  $g(x)=1001$ . If CRC is being used for error detection then show the bit pattern of the transmitted message  $T(x)$ . Also explain how the receiver can check error by knowing the  $g(x)$ :  $2 + 1 = 3$

(b) Explain the functioning of CSMA/CD protocol used for efficient use of the capacity of shared channel. Explain the relative advantages and disadvantages of 1-persistent CSMA and non-persistent CSMA/CD.  $2 + 2 = 4$

(c) What is the significance of collision window ? How can you update the value of collision window to achieve p-persistent CSMA that offers high throughput at varying load condition ? With reason clarify whether all the stations within the LAN will have collision window of the same size ?  $1 + 2 + 1 = 4$

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