

Birla Institute of Technology and Science, Pilani
First Semester 2016-17
BITS F372/EEE F346 DATA COMMUNICATIONS AND NETWORKS
COMPREHENSIVE EXAM (December 14, 2016)
Part-A (Closed Book)

Max. Marks: 60

Max. Time: 90 min.

*Note: - Answer in same sequence of questions and all sections of a question at same place.
All questions carry equal marks. Keep your Answers short and to-the-point.*

1. (a) Why are protocols needed?
(b) What does the Shannon capacity have to do with communications?
(c) An analog signal with a bandwidth of 20 kHz is sampled and passed through a 30 kbps channel; find SNR (in dB).
(d) What is the maximum data rate of a channel with a bandwidth of 200 kHz if four levels of digital signaling are used?
2. (a) A cable company uses one of the cable TV channels (Bandwidth = 6 MHz) to provide digital communication to each resident. What is the available data rate for each resident if the company uses a 64-QAM technique?
(b) Assume that a voice channel occupies a bandwidth of 4 kHz. We need to multiplex 12 voice channels with guard bands of 500 Hz using FDM. Calculate the required bandwidth.
(c) Why does a circuit-switched network need end to end addressing while no addresses are required during data transfer phase?
(d) Why minimum number of columns in routing table within a datagram network is smaller than that of virtual circuit network?
3. (a) How many IP addresses and link-layer addresses should a router have when is connected to five links?
(b) Explain with reason, if two data words of 16 bit length are swapped during transmission, can traditional checksum detect this error?
(c) Explain why there is no need for CRC in the simple protocol.
(d) Explain why collision is an issue in random access protocols but not in controlled access protocols.
4. (a) Why is there no need for CSMA/CD on a full duplex Ethernet LAN?
(b) Why is multiplexing more efficient if all data units are of same size?
(c) Explain why fragmentation is recommended in Wireless LAN.
(d) Explain which is better, a low or a high frequency reuse factor in cellular networks.
5. (a) What does it mean when we say, a switch can filter traffic?
(b) Why are routing and packetizing responsibilities of network layer, and not of transport layer?
(c) Explain why registration request and reply are encapsulated in UDP datagram and not directly to IP datagram.
(d) Explain why policy routing can be implemented on an inter-domain routing but not on intra-domain routing.
6. (a) Explain why PIM is called *Protocol Independent Multicast*.
(b) Explain advantages of IPv6 when compared to IPv4.
(c) Explain why process numbers assigned by operating systems can't be used instead of port numbers.
(d) Explain how TCP which uses unreliable service of IP provides reliable communication.

-----END-----

Birla Institute of Technology and Science, Pilani
First Semester 2016-17
BITS F372/EEE F346 DATA COMMUNICATIONS AND NETWORKS
COMPREHENSIVE EXAM (December 14, 2016)
Part-B (Open Book)

Max. Marks: 80

Time: 90 min.

Note:- Answer in same sequence of questions. All questions carry equal marks.

1. What is the total delay (latency) for a frame size of 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 2800 km. The speed of light inside the link is $2.2 \times 10^8 \text{ m/s}$. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one is negligible?
2. What is the result of scrambling the sequence 11100000000000 using one of the following scrambling techniques? Assume that the last non-zero signal level has been positive. (a) B8ZS (b) HDB3 (the number of non-zero pulses is odd after last substitution).
3. A space division switch with 10,000 inputs and outputs is required to design an exchange. What is the total number of cross-points when one single crossbar switch is used? Compare with situation if a non-blocking three-stage switch based on the Clos criteria is used.
4. A sender needs to send the four data items 0×3456 , $0 \times ABCC$, $0 \times 02BC$, and $0 \times EEEE$. (a) Find the checksum at sender site. (b) Find the checksum if $0 \times ABCE$ is received at receiver site as second item. (c) Find the checksum if $0 \times 02BA$ is received as third item along with situation already mentioned in part (b).
5. Design two simple algorithms for bit-stuffing. First one adds bits at sender while the second one removes bits at receiver.
6. Create a system of three LANs with four bridges. The bridges (B1 to B4) connect the LAN as follows:- B1 connects LAN 1 and LAN 2; B2 connects LAN 1 and LAN 3; B3 connects LAN 2 and LAN 3; B4 connects LAN 1, LAN 2, and LAN 3. Choose B1 as the root bridge. Show forwarding and blocking ports after applying the spanning tree procedure.
7. An ISP is granted a block of addresses starting with 120.60.4.0/22. The ISP wants to distribute these blocks to 16 organizations with each organization receiving just 50 addresses. Design the sub-block and give the slash notation for each sub-block. Find out how many addresses are still available after these allocations.
8. A router with IPv4 address 123.45.21.12 and Ethernet physical address 23: 45: BA: 00: 67: CD has received a packet for a host destination with IP address 124.10.78.10. Show the entries in the ARP request packet sent by the router. Assume no sub-netting. Also, Show the entries in the ARP packet sent in response to request packet by router.

-----END-----