



COMSATS University Islamabad (CUI)

Department of Computer Science

Terminal Examination Fall - 2022

BSE-5A/B,BCS-5A/B,BDS-4A,BAI-4A SEMESTER

Course: CSC339 Data Comm. & Computer Networks

Instructor: Dr. Mariam Akbar, Dr. Sheneela Naz, Mr. Saleem Raza, Mr. Zulfikar

Maximum Marks: 50

Dated: January 21, 2023

Time Allowed: 180 Minutes

- All questions are self-explanatory and require no further explanations during exam time.
- All questions must be answered at the question paper (in space provided)
- Make sure that you have signed the attendance sheet before leaving the examination room.
- Attempt all questions.

(CLO – 1: Summarize the fundamental concepts of computer networks)

Q.# 1. Consider the scenario shown in Figure in which a server is connected to a router by a 100Mbps link with a 50ms propagation delay. Initially, this router is also connected to two routers, each over a 50Mbps link with a 200ms propagation delay. A 1Gbps link connects a host and a cache (if present) to each of these routers and we assume that this link has 0 propagation delay. All packets in the network are 20,000 bits long.

[10 marks: 2+2+2+2+2]

- 1.1) What is the end-to-end delay from when a packet is transmitted by the server to when it is received by the client? In this case, we assume there are no caches, there's no queuing delay at the routers, and the packet processing delays at routers and nodes are all 0.

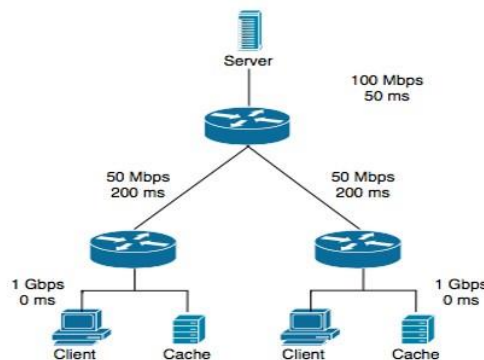


Figure 1

- 1.2) Here we assume that client hosts send requests for files directly to the server (caches are not used or off in this case). What is the maximum rate at which the server can deliver data to a single client if we assume no other clients are making requests?

- 1.3) Suppose two hosts, A, and B, are separated by 20,000 kilometers and are connected by a direct link of $R = 2$ Mbps. Suppose the propagation speed over the link is 2.5×10^8 meters/sec. Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?

- 1.4) Consider a server-side socket that is used to communicate from server to client. In the case of a TCP socket, can data be read from the server-side socket have been sent by more than one client? Explain briefly. In the case of a UDP socket, can data be read from the server-side socket have been sent by more than one client? Explain briefly.

- 1.5) Does the Internet checksum always detect errors in the transmitted segment?

- 1.6) [Through NAT a private network can communicate with the public network. In the following figure write the source and destination IP addresses in the blanks.

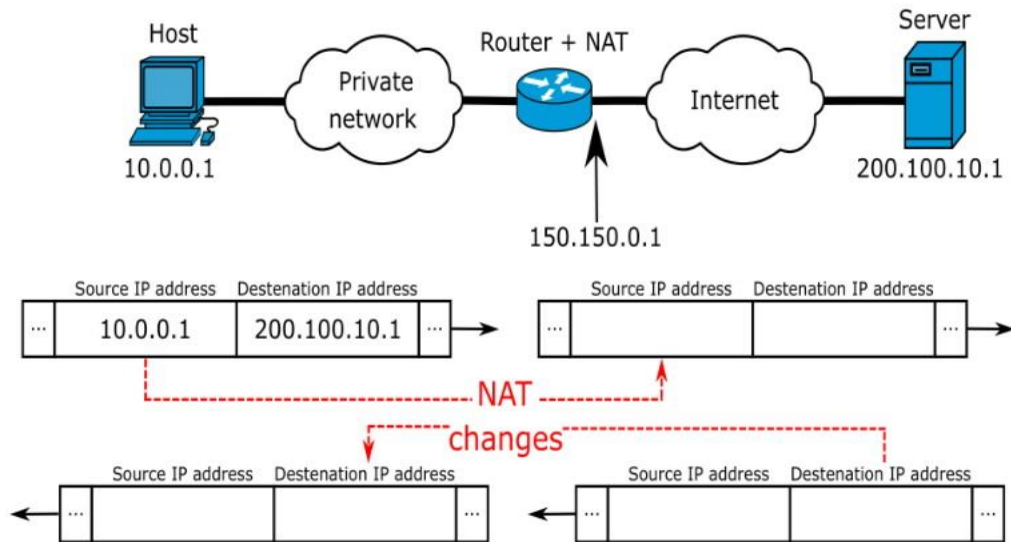


Figure 2

(CLO – 2: Apply the concepts of computer networks to solve its related problems)

Q.# 2. Calculate and sketch (where asked)

[10marks:2+2+2+2+2]

2.1) The loss in a cable is usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with -0.3 dB/km has a power of 5 mW, what is the power of the signal at 5 km?

2.2) A slotted ALOHA network transmits 200-bit frames using a shared channel with a 200-kbps bandwidth. Find the throughput if the system (all stations together) produces

- a. 1000 frames per second
- b. 500 frames per second
- c. 250 frames per second

- 2.3) A nonperiodic composite signal has a bandwidth of 200 kHz, with a middle frequency of 140 kHz and peak amplitude of 20 V. The two extreme frequencies have an amplitude of 0. Draw the frequency domain of the signal.

- 2.4) We have a channel with a 1-MHz bandwidth. The SNR for this channel is 63. What are the appropriate bit rate and signal level?

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- 2.5) What are the propagation time and the transmission time for a 5-MB (megabyte) message (an image) if the bandwidth of the network is 1 Mbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s.

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(CLO – 3: Analyze various protocols, algorithms and there functions in a network)

Q.# 3. Complete the following scenarios and answer relevant questions.

[14marks:5+3+3+2+2]

3.1) Let's assume that a user connects a laptop to his university's Ethernet switch and downloads a Web page (say the home page of www.google.com). As we now know, there's a lot going on "under the hood" to satisfy this seemingly simple request.

Briefly list down the protocols involved along with their function in each step / layer till the web page appears on user's screen.

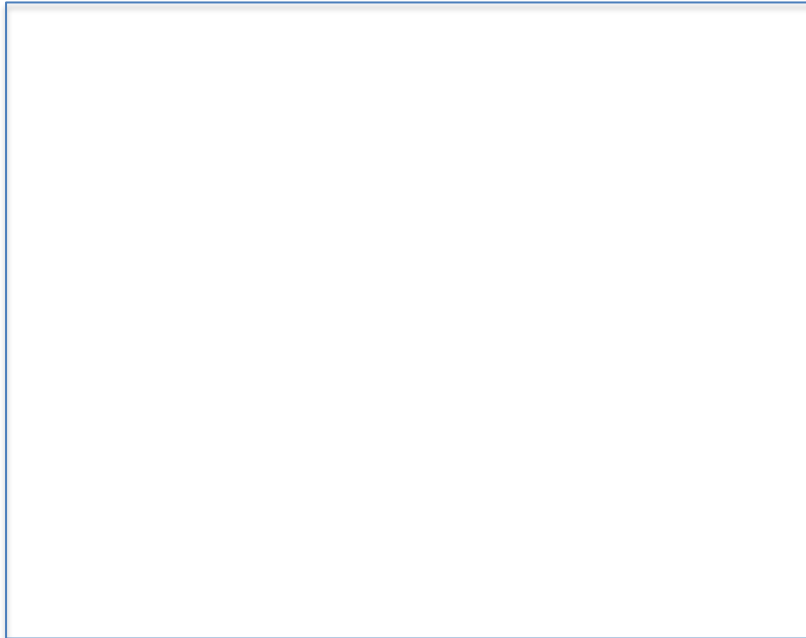
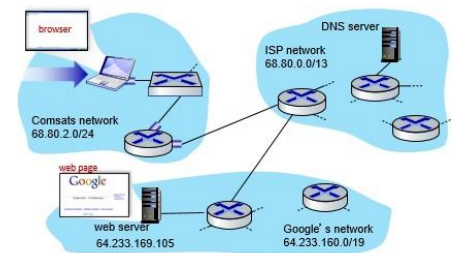
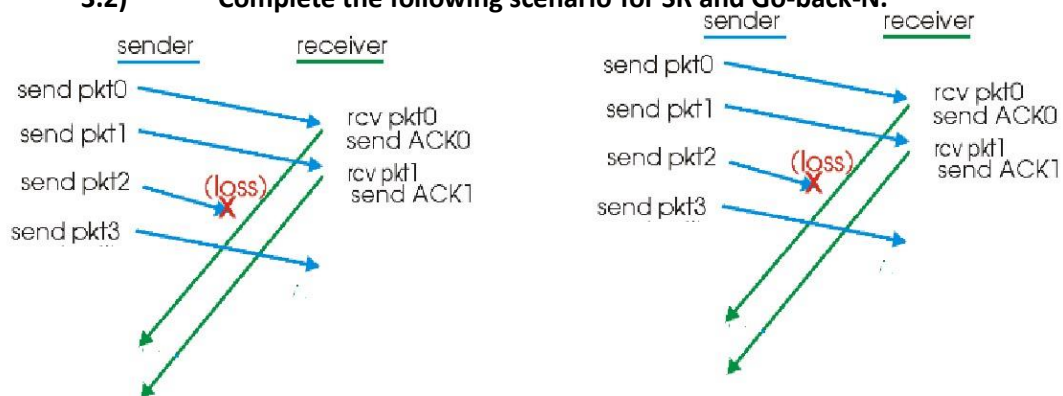


Figure 3

3.2) Complete the following scenario for SR and Go-back-N.



Go-Back-N in operation

Selective Repeat

Figure 4

3.3) Consider the network shown below in **Figure 5**. Show the operation of Dijkstra's

algorithm for computing the least cost path from A to all destinations. Also, draw the minimum spanning tree from A to all destinations.

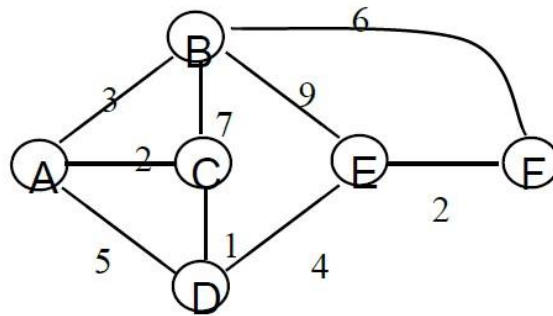


Figure 5

- 3.4) A network using *CSMA/CD* has a bandwidth of 10 Mbps. If the maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal) is 25.611S, what is the minimum size of the frame?

- 3.5) Consider the network shown in **Figure 6**. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intraAS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4.

- 3.5.1) Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP?

- 3.5.2) Router 3a learns about x from which routing protocol?

3.5.3) Router 1c learns about x from which routing protocol?

3.5.4) Router 1d learns about x from which routing protocol?

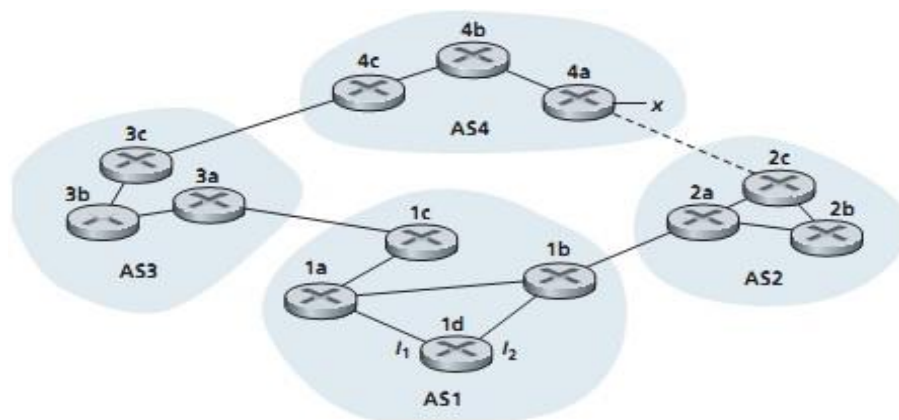


Figure 6

(CLO – 4: Comprehend the fundamentals of wireless and mobile networks along with the security issues)

Q.# 4. Answer the followings.

[16marks:2+2+2+2+1+2+2+3]

4.1) Let's you want to share a file confidentially with your friend via a symmetric key cryptosystem. How Public Key cryptosystem can be used to securely transmit the key along with determining the integrity of the file.

4.2) In what way does a hash provide a better message integrity check than a checksum (such as the Internet checksum)?

- 4.3) It is claimed that without Authentication, Message Integrity becomes useless and vice versa. Do you agree with it? Why /why not?

- 4.4) To enable secure communication, the website presents a certificate mentioning its public key. Is it secure enough? Why / why not?

- 4.5) What does “triangle routing” mean in mobile and wireless networks?

- 4.6) Suppose the IEEE 802.11 RTS and CTS frames were as long as the standard DATA and ACK frames. Would there be any advantage to using the CTS and RTS frames? Why or why not?

- 4.7) As a mobile node gets farther and farther away from a base station, what are two actions that a base station could take to ensure that the loss probability of a transmitted frame does not increase?

- 4.8) Differentiate between

4.8.1) Path loss vs. Multipath propagation

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4.8.2) Active vs. passive scanning

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4.8.3) Visited vs. home networks

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*******BEST OF LUCK*******