19Z504 Computer Networks
Assignment Presentation Topic

1. Dial-up modems, ISDN, HFC and ADSL are all used for residential access. For each of

   these access technologies, provide a range of transmission rates and comment on

   whether the bandwidth is shared or dedicated.

2. What is meant by the term "Integrated Services Digital Network"? Give three reasons a

3. Company might choose an ISDN link in preference to a leased line by listing out services of ISDN

4. Suppose you are sending a search request in Google web page, from your laptop
   and this request reaches a server belonging to Google.
   For this situation, trace the flow of information from application layer in your machine,
   down to the physical layer, to the destination server's physical layer and finally up to its
   application layer. Discuss all issues that the packets will undergo during this path.(4,5)

5. Transferring of files using FTP(modes) (6&7)
6. Software-defined networking (SDN). (8, 9 members)
7. How to Build Virtual Private Networks(VPN) (10,11 members)
8. Role of network protocol in IoT(12,13 members)
9. Bluetooth (piconet , scatter net, Bluetooth versions) and ZigBee. (14,15,16 members)
10. (i) Email (SMTP,POP3, IMAP) (ii) Suppose Alice, with a Web-based e-mail account (such as Hotmail or Gmail), sends a message to Bob, who accesses his mail from his mail server using POP3. Discuss how the message gets from Alice's host to Bob's host. Be sure to list the series of application-layer protocols that are used to move the message between the two hosts. (17,18,19 members)
    a. DNS (2 types of DNS query resolution: **iterative and recursive,** Fully Qu**alified Domain Name(FQDN)** Partially Qualified Domain Name**(PQDN)** (20,21 members)
11. Quic and Dash protocol architecture(22,23 members)
12. (i) Role of proxy, web server, HTTP (24,25 members)
    (Ii) Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport and application- layer protocols besides HTTP are needed in this scenario?)
    Iii.Identify the correct order in which the following actions take place in an interaction between a web browser and a web server.
    A. The web browser requests a webpage using HTTP.
    B. The web browser establishes a TCP connection with the web server.
    C. The web server sends the requested webpage using HTTP.

D. The web browser resolves the domain name using DNS.

Iv. A graphical HTML browser resident at a network client machine Q accesses a static HTML webpage from a HTTP server S. The static HTML page has exactly one static embedded image which is also at S. Assuming no caching, which one of the following is correct about the HTML webpage loading (including the embedded image)?

A. Q needs to send at least 2 HTTP requests to S, each necessarily in a separate TCP connection to server S

B. Q needs to send at least 2 HTTP requests to S, but a single TCP connection to server S is sufficient

C. A single HTTP request from Q to S is sufficient, and a single TCP connection between Q and S is necessary for this

D. A single HTTP request from Q to S is sufficient, and this is possible without any TCP connection between Q and S

13. First generation(1G) to current generation Technology (26,27,28 members)

14. ARP & RARP(frame format) (29,30 members)

15. Explain ICMP with packet format. (31,32 members)

16. SCTP compare with TCP, UDP (33)

17. Token Ring and FDDI compare and contrast with Ethernet.

18. Consider an application that transmits data at a steady rate (for example, the sender generates an N bit unit of data every k time units, where k is small and fixed). Also, when such an application starts, it will continue running for a relatively long period of time. Answer the following questions, briefly justifying your answer:

    a. Would a packet switched network or a circuit switched network be more appropriate for this application? Why?

    b. Suppose that a packet switched network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed? Why?

20 Suppose you would like to urgently deliver 40 terabytes data from Boston to Los Angeles. You have available a 100 Mbps dedicated link for data transfer. Would you prefer to transmit the data via this link or instead use FedEx overnight delivery? Explain.

21 Design and describe an application-level protocol to be used between an automatic teller machine and a banks centralized computer. Your protocol should allow a users card and password to be verified, the account balance (which is maintained at the centralized computer) to be queried, and an account withdrawal to be made (that is, money disbursed to the user). Your protocol entities should be able to handle the all-too-common case in which there is not enough money in the account to cover the withdrawal. Specify your protocol by listing the messages exchanged and the action taken by the automatic teller machine or the banks centralized computer on transmission and receipt of messages.

    22

c) Using the network diagram below create an addressing scheme which utilizes variable-length subnet masks. This company will be using the class C address of 210.10.10.0. Complete the following table. Remember to start with your largest groups first.

Subnet Name	Subnet Mask (/X)	Subnetwork Address	First Usable Host	Last Usable Host	Broadcast Address

23

A client C and a server S establish a connection using TCP. The initial sequence number is 2000 from C to S and 9500 from S to C. Show the Sequence Number and Acknowledgment Number and the Control Flags set in each segment in the flow diagram during(i) Connection Establishment (ii) Normal Data Transfer (iii) Data Transfer with segment loss and (iv) Connection Termination. Assume the segment size to be 500 bytes. You can make other assumptions if necessary.

24

i) DNS uses UDP instead of TCP. Give reasons.

ii) If a DNS packet is lost, there is no automatic recovery. Does this cause a problem, and if so, how is it solved?

25

Illustrate how an email server works. What are the steps involved in an SMTP session between a SMTP client and an SMTP server? What are the entities involved in this transfer? Between which of these entities does the SMTP protocol operate? Differentiate POP3 and IMAP protocol?

26 Suppose TCP operates over a 1-Gbps link. Assuming TCP could utilize the full bandwidth continuously, how long would it take the sequence numbers to wrap around completely?

27 You are hired to design a reliable byte-stream protocol that uses a sliding window (like TCP). This protocol will run over a 100-Mbps network. The RTT of the network is 100 ms, and the maximum segment lifetime is 60 seconds. (a) How

many bits would you include in the AdvertisedWindow and SequenceNum fields of your protocol header?

28 Consider the effect of using slow start on a line with a 10 msec RTT and no congestion. The receiver window is 24 KB and the maximum segment size is 2 KB. How long does it take before the first full window can be sent?

29 On a TCP connection, current congestion window size is 4 KB. The window advertised by the receiver is 6 KB. The last byte sent by the sender is 10240 and the last byte acknowledged by the receiver is 8192. a) What is the current window size at the sender?
b) What is the amount of free space in the sender window

30. Consider a TCP connection between a client and a server with the following specifications; the round trip time is 6 ms, the size of the receiver advertised window is 50 KB, slow-start threshold at the client is 32 KB, and the maximum segment size is 2 KB. The connection is established at time t=0. Assume that there are no timeouts and errors during transmission. Then the size of the congestion window (in KB) at time t+60 ms after all acknowledgments are processed is _____.

31. Consider an instance of TCP's Additive Increase Multiplicative Decrease (AIMD) algorithm where the window size at the start of the slow start phase is 2 MSS and the threshold at the start of the first transmission is 8 MSS. Assume that a timeout occurs during the fifth transmission. Find the congestion window size at the end of the tenth transmission. _____
32. Suppose that the maximum transmit window size for a TCP connection is 12000 bytes. Each packet consists of 2000 bytes. At some point of time, the connection is slow start phase with a current transmit window of 4000 bytes. Subsequently, the transmitter receiver two acknowledgments. Assume that no packet are lost and there are no time- outs. What is the maximum possible value of the current transmit window?
33. Discuss the working of Bellman Ford Distance Vector Algorithm with a neat example. Show how the routing table converges to a steady state. Illustrate under what circumstances, the algorithm fails and suggest a suitable solution for the same.
34. i In an IPv4 datagram, the M bit is 0, the value of HLEN is 10, the value of total length is 400 and the fragment offset value is 300. The position of the datagram, the sequence numbers of the first and the last bytes of the payload, respectively are___.

Ii. If the IP header is 256 bits long, what will be the value of the "HLEN" field?

35 i. If a Company require 60 hosts then What is the best possible subnet mask?

ii. In class C , if subnet mask is 255.255.255.224 then calculates number of subnet?
36. Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram:
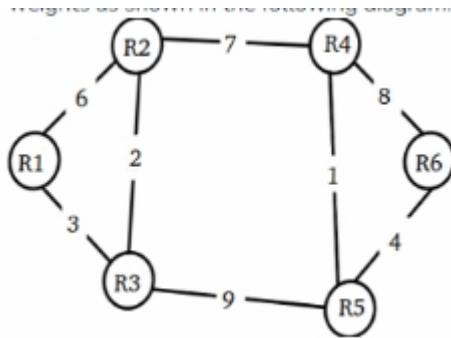
All the routers use the distance vector based routing algorithm to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbour with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data?

37. An IP router with a Maximum Transmission Unit (MTU) of 1500 bytes has received an IP packet of size 4404 bytes with an IP header of length 20 bytes. The values of the relevant fields(flag, id, offset, length) in the header of the third IP fragment generated by the router for this packet are_____.

38. Consider the given network implementation scenario. For the given classful NID 199.10.20.0/24, the requirement is to create 13 subnets. With given details, find the range of first and last valid IP in 13th subnet.

39. The routing table of a router is shown below:

Destination	Sub net mask	Interface
128.75.43.0	255.255.255.0	Eth0
128.75.43.0	255.255.255.128	Eth1
192.12.17.5	255.255.255.255	Eth3
default		Eth2

On which interfaces will the router forward packets addressed to destinations 128.75.43.16 and 192.12.17.10 respectively?

40. Consider three IP networks A, B and C. Host HA in network A sends messages each containing 180 bytes of application data to a host HC in network C. The TCP layer prefixes a 20 byte header to the message. This passes through an intermediate network B. The maximum packet size, including 20 byte IP header, in each network is A : 1000 bytes B : 100 bytes C : 1000 bytes The network A and B are connected through a 1 Mbps link, while B and C are connected by a 512 Kbps link (bps = bits per second).

Assuming that the packets are correctly delivered, how many bytes, including headers, are delivered to the IP layer at the destination for one application message, in the best case consider only data packets.

41. Explain the purpose of the following protocol
    a. Session Maintenance Protocol
    b. Real - time Streaming Protocol
    c. Real - time Transport Control Protocol
    d. Session Initiation Protocol

42. Consider the set of activities related to e-mail

    A : Send an e-mail from a mail client to mail server

    B : Download e-mail headers from mail box and retrieve mails from server to a cache

    C : Checking e-mail through a web browser. What are the application level protocols used for each activity in the same sequence is--------

43. What are the characteristic of firewall? What is the advantage of setting up a DMZ(Demilitarized Zone) with two firewalls?

44. An organization has a class C network 200.1.1 and wants to form subnets for four departments, with hosts as follows

   A: 72hosts   B : 35hosts   C: 20hosts   D: 18hosts . There are 145 hosts in all. (a) Give a possible arrangement of subnet masks to make this possible.

45. Consider a server sending a 64 MB audio file to a receiver over a 1Mbps connection using packets of size 1 MB. After a packet is sent, the sender waits until an ACK packet of size 8 bytes is received before a new packet can be sent (no pipelining). Find the latency of the connection if the data transfer lasts 10 minutes in total. Assume that the packet processing delays at the sender and the receiver are negligible.

46. .i. What is the subnetwork address if the destination address is 200.45.34.56 given that the subnet mask is 255.255.240.0?
    ii. Briefly discuss about the different addresses used in an Internet protocol stack. Consider router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.
    (61,62members)

47. An ISP is granted a block of addresses starting with 150.80.0.0/16.The ISP wants to
distribute these blocks to2600 customers as follows:
  i. The first group has 200 medium size businesses: each needs approximately 128
addresses.
  ii. The Second group has 400 small businesses: each needs approximately 16 addresses.
  iii. The Third group has 2000 households: each needs 4 addresses.
  Design the sub blocks and give the slash notation for each sub block. Find out how many
  addresses are still available after these allocations. And also find out the subnet mask for the
  each sub blocks. . (63,64members)

48. Consider sending a 2400 byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation?

49. Assume that Source S and Destination D are connected through an intermediate router R. How many times a packet has to visit the network layer and data link layer during a transmission from S to D?

50. Assume a propagation speed of 100km/hour. Suppose the caravan travels 150 km, beginning in front of one tollbooth, passing through a second tollbooth, and finishing just after a third tollbooth, each tollbooth services a car at a rate of one car per 12 seconds.

a. What is the end – to- end delay?

b. Repeat (a), assuming that there are eight cars in the caravan instead of 10.

51. Compare and contrast SMTP, MIME

52. Suppose we want to transmit the message 11001001 and protect it from errors using the
      CRC polynomial $x3 + 1$.   (69,7 0members)

(a) Use polynomial long division to determine the message that should be transmitted.
(b) Suppose the leftmost bit of the message is inverted due to noise on the transmission link.
What is the result of the receiver's CRC calculation? How does the receiver know that an
error has occurred?

53. Consider a message from TCP layer contains 1044 bytes of data including the header. It is passed to network layer's IP protocol for delivery **across 3 networks** with MTUs **1024and 500 and 200.** Show the values of all the Flag bits and offset field of IP header and the size of each data packet when it passes though each network and reach the destination host. (Assume all IP and TCP headers are 20 bytes).

54. For the network given in the Figure 1, give the datagram forwarding table (both initial and final) for each node. The links are labeled with relative costs; your table should forward each packet via the lowest-cost path to its destination using distance vector routing. **(72,73 members)**
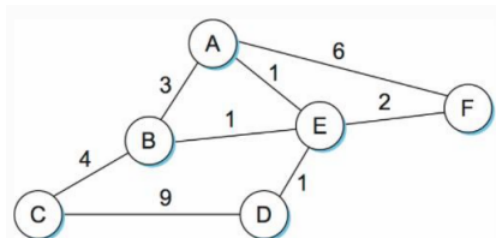

Figure 1

ii. Consider the figure 2. Initially both the node A and B know how to reach node C. But suddenly the link B to C goes down. What will happen in distance routing and also discuss how to overcome that problem?
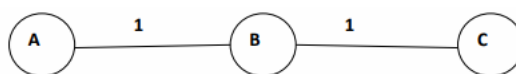

Figure 2

55. A router maintains the following routing table and it can deliver the packets directly . **(74,75 members)**
to hosts through interfaces and can forward the packet to the routers Rn (n =2, 3, &4).

SubnetNumber	SubnetMask	NextHop
128.96.170.0	255.255.254.0	Interface 0
128.96.168.0	255.255.254.0	Interface 1
128.96.166.0	255.255.254.0	R2
128.96.164.0	255.255.252.0	R3
(default)		R4

With the following destination IP addresses, what does the router do?
(a) 128.96.171.91
(b) 128.96.167.152
(c) 128.96.163.153
(d) 128.96.169.193
(e) 128.96.165.122

56. . An organization is granted the block Address 200.10.20.0. The administrator

wants to create four subnets and find the following for each subnet **(76,77 members)**

a. IP Address of the subnet
b. Total number of IP Addresses
c. Total number of hosts that can be configured
d. Range of IP Addresses
e. Direct Broadcast Address
f. Limited Broadcast Address

57. a. What is the sub network address if the destination address is 200.45.34.56 and the subnet M ask is 255.255.240.0?

b. Find out the network mask for the network with the network address 10.58.24.0 and the broadcast address 10.58.31.255

58. Explain WiMAX (79,80)

59 . For the network as shown, the IP addresses of the four subnets are: **(81,82 members)**

Subnet A: 215.1.2.0

Subnet B: 215.1.2.64

Subnet C: 215.1.2.128

Subnet D: 215.1.2.192

• The routing table of the internal router R is:

Destination	Subnet Mask	Interface
215.1.2.0	255.255.255.192	a
215.1.2.64	255.255.255.192	b
215.1.2.128	255.255.255.192	c
215.1.2.192	255.255.255.192	d
Default	0.0.0.0	e

The routing table of the internal router R is:

How will packets with the following destination IP addresses be forwarded by the router R?

a.   **215.1.2.33   b) 215.1.2.78   c) 215.1.2.144   d) 215.1.2 200**

- A part of the IP routing table of a router R is shown below.

  Determine the interface to which incoming IP packets with the following destination IP addresses will be forwarded: (i) 135.46.63.10, (ii) 135.46.52.2, (iii) 190.53.41.50.

Destination	Submet Mask	Flag	Gateway / Next hop	Interface (Output Port)
135.46.56.0	/22	G = 0	-	135.46.59.4
135.46.60.0	/22	G = 0	-	135.46.62.5
190.53.0.0	/24	G = 1	128.156.79.45	128.156.79.46
190.53.40.0	/23	G = 1	156.18.19.43	156.18.19.98
0.0.0.0	/0	G = 1	134.54.78.84	134.54.78.95

60. (83,84)
61(85)

- For the following routing table of a router, on which interface will the router forward packets addressed to the destination **144.16.68.131**?

Destination	Subnet Mask	Interface
144.16.0.0	255.255.0.0	eth0
144.16.64.0	255.255.224.0	eth1
144.16.68.0	255.255.255.0	eth2
144.16.68.64	255.255.255.224	eth3
default	0.0.0.0	eth1