1. Name the physical topology used by high speed LANs.
2. How many bits are used by Unicode coding system to represent a symbol or character?
3. Define Jitter. In which type of data communication it has significant role?
4. Which name is assigned to a Protocol Data Unit in different layers in TCP/IP stack?
5. Which protocol will be used in Transport Layer for following application: File Transfer, Streaming multimedia, Mail transfer, Network Management? Why?
6. Write the two major advantages of unguided media for communication.
7. What difference does it make to the network layer if the underlying data link layer provides a connection-oriented service versus a connectionless service?
8. Explain the following parameters for 100BASE-T Ethernet standard: cable category type, number of active pairs of wires, throughput, and maximum distance of network segment.
9. Which ISM radio band is used by Microwave ovens, Bluetooth devices, Wi-fi devices, T.V. Remote?
10. A bit stream 10011101 is to be transmitted using the standard CRC method using the generator polynomial x^3+1. Compute the actual bit pattern that will be transmitted.
11. Which type of errors can be detected by CRC using generator polynomial $X^3 + 1$? Explain.
12. Consider a code with only four valid codeword: 0000000000; 0000011111; 1111100000; and 1111111111. How many errors it can detect and/or correct?
13. Illustrate the calculation for a frame 1101011011 using the generator $x^4 + x + 1$. Can it detect all single bit errors?
14. Frames of 1000 bits are sent over a 1-Mbps channel using a geostationary satellite whose propagation time for the earth is 290 msec. Acknowledgements are always piggybacked onto data frames. The headers are very short. Three-bit sequence numbers are used. What is the maximum achievable channel utilization for the case when stop-and-wait is used?
15. Consider two hosts A and B connected by a single link of rate *r* bits/sec. The two hosts are separated by *d* meters. Signal propagation is *p* meters per second. Host A is sending to host B a packet of size *S* bits. Answer the following question. (For Part d to f give the answer by using the terms: *reached/leaving/at/on Host A/Host B/link*)
    a)What is the propagation delay t_{pr}?
    b) What is the transmission delay, t_{tr} , of the packet?
    c) Ignoring any possible processing and queuing delays, what is the end-to-end delay?
    d) If Host A starts to transmit the packet at time $t = 0$, where is the last bit of packet at time $t = t_{tr}$?
    e) Suppose that $t_{pr} >> t_{tr}$. At time $t = t_{tr}$ where is the first bit of the packet?
    f) Suppose that $t_{pr} << t_{tr}$. At time $t = t_{tr}$ where is the first bit of the packet?
16. One hundred stations on a pure ALOHA network share a 1-Mbps channel. If frames are 1000 bits long, find the throughput if each station is sending 10 frames per second.

17. Consider the delay experienced by a successful transmission of a packet for pure ALOHA versus slotted ALOHA at very low load (i.e., when there are very few stations trying to send). In which case delay is less? Explain your answer.

18. A 12-bit Hamming code whose hexadecimal value is OxF4C arrives at a receiver. Assuming that not more than one bit is in error, what was the original 8-bit data value in hexadecimal?

19. Suppose a user has two different browsers (say Chrome and Mozilla) active at the same time, and both are accessing the same server to retrieve HTTP documents at the same time. How does the server differentiate between the two applications?

20. A system has an n-layer protocol hierarchy. Applications generate messages of length M bytes. At each of the layers, an h-byte header is added. What fraction of the network bandwidth is filled with headers?

21. Give two reasons why networks might use an error-correcting code instead of error detection and retransmission.

22. If flow control and error control are performed at the data link layer, then why should it be done at the transport layer? In which type of networks it is necessary to do it at transport layer?

23. Give one reason that we may want to continue using NAT even if we could use IPv6.

24. A channel has a bit rate of 4 kbps and a propagation delay of 20 msec. For what range of frame sizes does stop and wait give an efficiency of at least 50 percent?

25. Consider an error correction code in which each 2-bit message **M** is appended with a 3-bit check sequence **C(M)** to form a 5-bit codeword, as follows:

M:	00	01	10	11
C(M):	000	101	110	011
Codeword	00000	01101	10110	11011

If the decoder receives the following sequence of codewords from the channel:
11111 10100 00010 11101 01011 00000.
What sequence of 2-bit messages will it output? What is Hamming distance of this code-book? Under what assumption is the output of the decoder equal to the input of the encoder?

26. Consider an error-detecting CRC with the generator 110110. If bit sequence 11111011111000 is received, find the original data bit sequence assuming no error has occurred.

27. Give an example of a general case for 4-bit error which will go undetected by Two-dimensional parity.

28. For an information of 2-bits, CRC bits are generated with $g(x) = x^3 + x^2 + 1$.
a) The received bits are {01011}. Are there any errors?
b) Compute all possible codewords of this codebook.

c) Prove that all 2-bit error patterns can be detected.

29. Assuming there are N active stations and if a station transmits with probability p in a slot, show that the efficiency of slotted Aloha is $Np(1-p)^{N-1}$. Find the value of p that maximizes this expression. Using the value of p found, find the efficiency of slotted Aloha by letting N approach infinity. Hint: $(1-1/N)^N$ approaches 1/e as N approaches infinity.

30. Imagine that we want to design a code with **m** message bits and **r** check-bits that will allow all single errors to be corrected (Assume odd parity is used).
(a) Let m = 5. Determine the smallest required r for correcting single-bit errors.
(b) Let the original message is 11010, what is the sent message on pattern of Hamming Code? (That is, the message including the original message bits and the checkbits)

31. Below is a captured TCP/IP packet. From the beginning, this packet contains MAC destination address, MAC source address, 2-byte upper layer protocol type-field and then followed by IP header and TCP header. Assume there are no OPTION fields in any layer's header. Decode the packet for the following fields: MAC source and destination addresses, IP source and destination addresses (in standard dotted-decimal format), TCP source and destination port numbers.

    00 60 CF 20 2B 8B 00 60 CF 20 2B 7F 08 00 45 00

    00 30 C4 B2 40 00 80 06 2A 08 83 F7 02 10 83 F7

    02 0F 0B 0B 00 50 50 20 0D 16 00 00 00 00 70 02

    40 00 CE 80 00 00 02 04 05 B4 01 01 04 02

32. Which service is used to detect the reachability of a remote computer?

    A FTP B SMTP C PING D Telnet

33. Which class of IP addresses uses Subnet mask 255.255.0.0?

    A Class A B Class B C Class C D Class D

34. Which one of the following is true for collision domain for ports of a switch in the network?

    A Single B Two C Separate D Shared

35. WI-FI is often used as a synonym for which of the following IEEE technology?

    A 802.1 B 802.5 C 802.9 D 802.11

36. Telecommunication network belongs to which category of networks?

    A Message Switched B Packet Switched C Cell Switched D Circuit Switched

37. What is the multicast address for IP-address 192.168.1.5?

    A 192.168.1.1 B 192.168.1.254 C 192.168.1.255 D None of these

38. Which of the following is a loop-back address?

A 127.0.0.1 B 127.127.0.1 C 127.127.127.1 D None of these

39. How many bits are present in Ethernet's MAC address?

A 32 B 48 C 64 D 128

40. A group of N stations share a 56 kbps pure ALOHA channel. Each station outputs a 1000 bit frame on an average of once every 100 seconds. What is the maximum value of N? Use the throughput concept of pure ALOHA to get the usable bandwidth that is used for error-free data transmission by the stations.

41. Consider an optical fibre link of length 1000 Kilometres with a 1 Gigabits/sec data rate connecting a sending and receiving node. Assume a fixed packet length of 1250 bytes. Assume that the sender always has packets to send and packets are never lost or corrupted. Light rays travel at $2x10^8$ m/s in fibre optics cable. What is the utilization of this link for a stop-and-wait (SAW) protocol? What is the necessary window size to achieve 100% utilization for a sliding window (SW) protocol?

42. There are three nodes A, B, and C in a network. A is connected to B which is further connected with C. Distance between A and B is 4000 Kms and that between B and C is 100 Kms. The data rate between A and B is 100 kbps. The propagation delay is 5 μsec/km for both lines. There are full-duplex, error-free lines between all three nodes. All data frames are 1000 bits long; ACK frames are separate frames of negligible length. Between A and B, a sliding window protocol is used, with a window size of 3 (three). Between B and C, stop and wait is used. Compute the time taken by the last bit of a frame send from A to reach B after the start of that frame from A. How much time an ACK from B will take to reach A? Determine the minimum transmission rate required between nodes B and C so that the buffers at node B are not flooded.

43. Compute the fraction of the bandwidth that is wasted on overhead (headers and retransmissions) for Selective Repeat on a heavily-loaded 50-kbps satellite channel with data frames consisting of 40 header and 3960 data bits. Assume that the signal propagation time from the earth to the satellite is 270 msec. ACK frames never occur. NAK frames are 40 bits. The error rate for data frames is 1 percent, and the error rate for NAK frames is negligible. The sequence numbers are 8 bits.

44. Which header files are required for using following system calls in a C program in Linux operating system: fork( ), bind( ), kill( ), exec( )?

45. Explain the structure named **"sockaddr_in"** used in Socket programming. Also, write the C statements to fill a variable of this structure type for Internet family, 3456 port and local IP address.

46. Which command on Linux can you issue to do following:
    (i) Get Information about all active sockets on local host.
    (ii) Scan ports on a range of IP-addresses.
    (iii) Update or query run-level information for system services like xinetd, ftpd, sshd etc.
    (iv) Get the value of PATH variable.

47. Write a C program in which a process creates a child process and waits for its child process to exit. Child process prints the process-id of itself and its parent. Parent process handles ctrl-c signal and instead of default action on receiving this signal, it just prints that message "Signal Received".

48. Explain the process of debugging a C/C++ executable file using gdb by highlighting the usage of its most useful commands.

49. What do you understand by byte-order? Which byte-order is used by Internet? How can you ensure that data is sent and received in proper byte order while communication?

50. Write the complete Linux command to perform the following:
    a. Send a signal SIGINT using its integer value to a process having process-id 1234.
    b. Specify a library named **"libpcap.so"** available in directory **"/var/lib/pktcap"** to gcc compiler.