

Noorul Islam College of Engineering, Kumara coil
QUESTION BANK

Class : S5 M.Sc Software Engineering

Subject: XCS353 – COMPUTER NETWORKS

UNIT I

1. List out the various error detecting algorithm?

- CRC(Cyclic Redundancy check)
- Two dimensional parity
- Check sum

2. What is ARQ?

The general strategy of using acknowledgements and timeouts to implement reliable delivery is called automatic repeat request (ARQ).

3. What is the key idea of Stop & Wait Protocol?

After transmitting one frame, the sender waits for an acknowledgment before transmitting the next frame. If the acknowledgement does not arrive after a certain period of time, the sender times out and retransmit the original frame.

4. What is CSMA/CD?

CSMA/CD stands for Carrier Sense Multiple Access with Collision Detect. Ethernet is a multiple access network (shared link) and the carrier sense means that all the nodes can distinguish between an idle and busy link. Collision detect means that a node listens as it transmits and can therefore detect when a frame it is transmitting has interfered with a frame transmitted by another node.

5. Write short notes on Ethernet?

Carrier Sense Multiple Access with Collision Detect. Ether net is a multiple access network (shared link) and the carrier sense means that all the nodes can distinguish between an idle and busy link. Collision detect means that a node listens as it transmits and can therefore detect when a frame it is transmitting has interfered with a frame transmitted by another node.

6. What is transceiver?

Transceiver is a small device directly attached to the tap and detects when the line is idle and drives the signal when the host is transmitting.

7. What is Repeater?

Repeater propagate the signal from one segment to another

8. What is a Hub?

Hub (MultiWay Repeater) propagates the signal onto a number of segments, possibly with different types of cable.

9. Write short notes on Ethernet address?

Ethernet host in the world has a unique address. The address belongs to the adaptor, not the host; it is usually burned into ROM. It has six hexadecimal numbers separated by colons. Example 8:0:2b:e4:b1:2.

11. Write short notes on promiscuous mode?

In promiscuous mode it delivers all received frames to the host, but this is not the normal mode.

12. Why Ethernet is called 1 persistent protocol?

Ethernet is said to be a 1 persistent protocol because an adaptor with a frame to send transmits with probability 1 whenever a busy line goes idle.

13. What is an exponential back off?

Once an adaptor has detected a collision and stopped its transmission, it waits a certain amount of time and tries again. Each time it tries to transmit but fails, the adaptor doubles the amount of time it waits before trying again. This strategy of doubling the delay interval between each transmission attempt is a general technique known as exponential back off.

14. What are the advantages of Ethernet?

- Easy to admin and maintain
- No switch, Router and configuration table
- Easy to add a new Host
- Inexpensive one

15. Write short notes on Token Ring?

a number of stations connected by transmission links in a ring topology. Information flows in one direction along the ring from source to destination and back to source. Medium access control is provided by a small frame, the token, which circulates around the ring when all stations are idle. Only the station possessing the token is allowed to transmit at any given time.

16. Write short notes on FDDI?

- FDDI uses a ring topology of multimode or single mode optical fiber transmission links operating at 100 Mbps to span up to 200 kms and permits up to 500 stations.
- Employs dual counter-rotating rings.
- 16 and 48-bit addresses are allowed.
- In FDDI, token is absorbed by station and released as soon as it completes the frame transmission {multi-token operation}.

17. What are the 2 different classes of traffic used in FDDI?

FDDI is designed to handle two types of traffic:

- Synchronous frames that typically have tighter delay requirements (e.g., voice and video)
- Asynchronous frames have greater delay tolerances (e.g., data traffic)

18. What is a Packet Switch?

A packet switch is a device with several inputs and outputs leading to and from the hosts that the switch interconnects. The core job of a switch is to take packets that arrive on an input and forward them to the right outputs.

19. Write short notes on Switch Congestion?

If the packet arrival rate exceeds the capacity of the output rate of a switch, the switch queues the packet. If the switch is over loaded, the packet may be loosed. If it occurs often, the switch is said to be congested.

20. What do you mean Packet Switching?

The process of forwarding packets from an input of a switch to one or more outputs of the switch is known as packet switching.

21. Define Network Topology?

The Network Topology defines the structure of the network. Ring, Bus, Star these are the examples of network topology.

22. What are the characteristics of Connectionless networks?

- A host can send a packet anywhere at any time
- When a Host sends a packet, it has no way of knowing if the network is capable of delivering it or if the destination host is even up and running.
- Each packet is forwarded independently.
- A Switch or link failure might not have any serious effect on communication.

23. What are the fields available in the VC table in a Switch?

- A virtual circuit identifier
- An incoming interface on which packets for this arrive at the switch
- An outgoing interface in which packets for this VC leave the switch
- A potentially different VCI that will be used for outgoing packets

24. What do you mean by signaling?

Signaling is a mechanism to establishing connection state between a source and destination. Here a host can send messages into the network to cause the state to be established.

25. Write short notes on virtual circuit switching?

Virtual circuit switching is a connection oriented mechanism used for packet forwarding. In this approach it establishes a connection state between the source and destination before sending the packets.

26. What is Packet Contention?

Contention occurs when multiple packets have to be queued at switch because they are competing for the same output link.

27. Write short notes on Source Routing?

Source Routing is a mechanism to forward the packets in a switch, in this all the information about network topology that is required to switch a packet across the network is provided by the source host.

28. Define Bridge?

Bridge is nothing but a switch that is used to forward packets between shared – media LANs such as Ethernet.

29. Define Spanning Tree?

Spanning Tree is a sub graph that covers all the vertices, but contains no cycles.

30. What are the Limitations of Bridges?

- Scale - the ability to extend the network (only a few LANs can be connected)
- Heterogeneity – bridges are fairly limited in the kinds of networks they can interconnect.

31. What is Virtual LAN?

Virtual LAN increase the scalability of extended LAN and allow a single extended LAN to be partitioned into several seemingly separate LANs.

32. What is ATM?

ATM stands for Asynchronous transfer Mode. It is connection oriented, packet switched technology.

33. Write Short notes on segmentation and reassembly?

The process of fragment the high level messages into packets at the source host and transmit the packets over the network and then reassemble the fragments back together at the destination is often called segmentation and reassembly(SAR).

34. Write short notes on CS-PDU?

CS-PDU stands for Convergence sub layer protocol data unit which defines a way of encapsulating variable length PDUs prior to segmenting them into cells.

35. What is routing or forwarding table?

The forwarding table contains the information that switches need to forward datagram in the network. The switch consults with the forwarding table and forwards the frames in the right ports.

36. What is a Cell?

Cell is nothing but packets which are both fixed in length and small in size, used in ATM.

37. What is ATM adaptation Layer?

A protocol which sits in between the ATM and the variable-length packet protocols that might use ATM (such as IP) is Called ATM Adaptation Layer.

38. Define Inter network?

Interconnected connection of networks is known as Inter network.

39. What are the problems of interconnecting various networks?

- Heterogeneity – problem of establishing connectivity between host on different networks
- Scale – (the ability to add nodes to the networks) it lead to the problem of routing and addressing

40. Define Router or Gateways?

Router is a node that interconnects the networks.

41. What is MTU?

MTU stands for Maximum Transmission Unit, Which specifies the largest datagram that it can carry in a frame.

42. How IP address is hierarchical?

IP address is hierarchical, by which means that they are made up of many interconnected networks. IP addresses consist of 2 parts, a network part and a host part. the network part of an IP address identifies the network to which the host is attached.

43. List out the various addressing schemes in IP?

CLASS – A -> Network – 8 bit	Host – 24 bit
CLASS – B -> Network – 16 bit	Host – 16 bit
CLASS – C -> Network – 24 bit	Host – 8 bit

44. Differentiate Bridges, Switches and Routers?

Bridges are Link level nodes they forward frame from one link to another to implement an extended LAN, Switches are network level nodes they forward datagram from one network to another to implement a packet switched network and routers are internet level nodes they forward datagram from another to implement an internet.

45. What is hierarchical aggregation?

Hierarchical aggregation is a mechanism to reduce the amount of information that is stored in each node and that is exchanged between nodes. In this letting routers deal only with reaching the right network; the information that a router needs to deliver a datagram to any node on a given network is represented by a single aggregated piece of information.

46. Write short notes on centralized and distributed routers?

In the centralized router, the ip-forwarding algorithm is done in single processing engine that handles the traffic from all ports. In distributed forwarding model, there are several processing engines, perhaps one per port, or more tan one per line card (serve one or more physical ports).

47. What is a network processor?

A network processor is a device, which is used in the design of routers. And it is a programmable device more highly optimized for networking task.

48. What is Link level address?

Link level address is nothing but the Ethernet card address, 48 bit long world wide unique address..

49. What is the job of an ARP?

The ARP enables each host on a network to build up a table of mapping between the IP address and Link level address.

50. What is the responsibility of a DHCP server?

Dynamic Host Configuration Protocol is responsible for providing configuration information to hosts.

51. Write Short notes on ICMP?

ICMP stands for Internet Control Message Protocol. It can be act as companion protocol of IP, that defines a collection of error message that are sent back to the source host whenever a router or host unable to process an IP datagram successfully.

52. Write short notes on VPN?

VPN stands for Virtual Private Network. VPN enables private communication in a public network by establishing a Virtual circuit between the source and destination.

53. What is IP tunnel?

IP tunnel is a virtual point-to-point link between a pair of nodes that are actually separated by arbitrary number of networks. The virtual link is created within the router at the entrance to the tunnel by providing it with the ip address of the router at the entrance to the tunnel by providing it with the IP address of the router at the far end of the tunnel.

54. What is forwarding?

Forwarding consists of taking a packet, looking at its destination address, consulting a table, and sending the packet in a direction determined by the table.

55. What is Routing?

Routing is the process by which forwarding tables are build, which contains the mapping information IP with MAC address.

56. What is Routing domain?

Routing domain is an inter network in which all the routers are under the same administrative control (e.g.: a single university campus).

57. What is convergence?

The process of getting consistent routing information to all other nodes is called convergence.

58. What do you mean by triggered update?

Triggered update is a mechanism used in RIP, whenever a node receives an update from one of its neighbors that causes it to change one of its neighbors that causes it to change one of the routes in its routing table.

59. Write short notes on Reliable Flooding?

Reliable Flooding is the process of making sure that all the nodes participating in the routing protocol get a copy of the link-state information from all the other nodes.

60. Write short notes on OSPF?

The OSPF stands for Open Shortest Path first Protocol. It adds quite number of features to the basic link-state algorithm such as authentication of routing messages and additional hierarchy.

61. What is Home agent and Home address?

The home agent is the router, which is located on the “home” network of the mobile host. The mobile host is assumed to have a permanent IP address, called its home address, which has a network number equal to that of the home network, and thus of the home agent.

62. What do mean by foreign agent?

It is router, which is located on a network to which the mobile node attaches itself when it is away from its home network.

63. What is NSFNET?

NSFNET stands for the regional networks are connected by a nationwide backbone, which is funded by National Science Foundation (NSF) and was therefore called the NSFNET backbone

64. What do you mean by subletting?

Sub netting provides an elegantly simple way to reduce the total number of network numbers that are assigned. The idea is to take a single IP network number and allocate the IP address with that network number to several physical networks, which are now referred to as subnets.

65. What is the use of CIDR?

CIDR tries to balance the desire to minimize the number of routes that a router needs to know against the need to hand out addresses efficiently.

66. What is an Autonomous system or routing Domain?

An autonomous system is one, which is under the control of a single administrative entity.

67. Write short notes on EGB?

EGB stands for Exterior Gateway Protocol. It is an inter domain protocol that has a number of limitations such as it is concerned on topology.

68. What are the various types of autonomous systems?

- Stub AS – an AS that has only a single connection to other AS
- Multihomed AS – an AS that has connections to more than one other AS but that refuses to carry transit traffic
- Transit AS – an AS that has connections to more than one other AS and is designed to carry both transit and local traffic.

69. Define Local traffic and transit traffic?

Local traffic is nothing but a traffic that originates at or terminates on nodes within an AS, and transit traffic as traffic that passes through an AS.

70. How does BGP cancel the previously advertised path?

BGP can cancel the previously advertised path with a form of negative advertisement known as a withdrawn route.

71. What is Routing Area?

An area is asset of routers that are administratively configured to exchange link state information with each other.

72. What is ABR?

A router that is a member of both the backbone area and a non backbone area is an area border router (ABR)

73. Write short notes on Ipv6?

Ipv6 do not have classes, but the address space is still subdivided in various ways based on the leading bits. Rather than specifying different address classes, the leading bits specify different uses of the Ipv6 address.

74. What is the Address notation of Ipv6?

Ipv6 address notation is x:x: x:x: x:x: x:x where each x is a hexadecimal representation of 16-bit piece of the address.

75. Give the ipv6 provider based Unicast address?

- Registry ID – m bit
- Provider ID - n bit
- Subscriber ID – o bit
- Subnet ID – p bit
- Interface ID 125-m-n-o-p

76. What do you mean by auto configuration?

The 2 steps involved auto configuration is as follows

Obtain an interface ID that is unique on the link to which the host is attached.

Obtain the correct address prefix for this subnet.

77. What is an End-to-End Protocol?

The process-to-process communication channel is the role played by the transport level of the network architecture, which, because it supports communication between the end application programs, is sometimes called the end-to-end protocol.

78. List out the properties that a transport can be expected to provide?

- Guarantees message delivery
- Delivers message in the same order they are sent
- Delivers at most one copy of each message
- Supports arbitrarily large message

79. Write short notes on UDP?

UDP stands for User Datagram Protocol. It is transport layer protocol that extends the host-to-host delivery service of the underlying network into a process-to-process communication service.

80. What is called pseudo header?

UDP computes its checksum over the UDP header, the contents of the message body, and something called the pseudo header that consists of three fields from the IP header – protocol number, source IP address, and destination IP address plus the UDP length.

81. What is TCP?

TCP is a protocol which guarantees the reliable, in-order delivery of a stream of bytes. It is a full duplex protocol, meaning that each TCP connection supports a pair of byte streams, one flowing in each direction.

82. What are the basic requirements of a network design?

- Connectivity
- Efficient Resource Sharing
- Functionality
- Reliability
- Security
- Performance

83. Who are the persons involved to identify the requirements of a network?

- **Network users** want the network to provide services that their applications need; e.g., guarantee that each message will be delivered in order, without errors, and within a pre-defined delay
- **Network designers** want a cost-effective design; e.g., network resources are efficiently utilized and fairly allocated to users
- **Network providers** want a system that is easy to administer and manage; e.g., faults can be easily found, system can be hot-swapped,

84. List out the basic building blocks of a network?

Building Blocks

Links: coax cable, optical fiber...
Nodes: general-purpose workstations

85. What are the different types of Direct Links?

Direct Links

- a) point-to-point: dedicated link connecting two nodes
- b) multiple access: many nodes access a shared “broadcast” medium

86. What is an address?

Address: byte-string that identifies a node; usually unique

87. What is routing?

Routing: process of determining how to forward messages towards the destination node based on its address

88. What are the different types of address?

- unicast: node-specific
- broadcast: all nodes on the network
- multicast: some subset of nodes on the network

89. Define Network?

Network is two or more nodes connected by a direct link, or two or more networks connected by one or more nodes

90. What is Multiplexing?

Multiplexing is nothing but a system resource is shared among users.

1. Explain the various Error detection techniques in detail?

- Bit errors in communication links occur due to noise of various kinds
- Error detection vs error correction
 - Best choice for low error probability?
- Basic idea in error detection: together with n -bit message, send k “redundant” bits that can detect *many* possible errors
 - k/n determines efficiency of error detecting code

One- and Two-dimensional parity

2-dim parity catches all 1-, 2-, and 3-bit errors (and most 4-bit errors)

Checksums

- Add up all words of message, and transmit sum together with message
- Receiver performs same calculation
 - if received sum is different, discard message
- Internet checksum:
 - Split message in 16-bit words
 - Perform ones complement arithmetic in 16-bit words

- Negative number x : binary complement of positive $-x$
 - If sum generates carryout, increment result
 - 16-bit overhead for arbitrary large message
 - Rath Cyclic Redundancy Check (CRC)
- Cyclic Redundancy Check (CRC)
- - Represent $(n+1)$ -bit message x with n -th degree binary polynomial $M(x)$
 - e.g., 10011010: $x^7+x^4+x^3+x$
 - Sender & receiver agree on *divisor* polynomial $C(x)$ of degree k
 - e.g., $C(x) = x^3+x^2+1$ ($k=3$)
 - Multiply $M(x)$ with x^k : $T(x)$
 - $T(x) = 10011010000$
 - Divide $T(x)$ by $C(x)$ in *mod-2 polynomial arithmetic*
 - quotient $Q(x)$, remainder $R(x)$
 - Send $T(x) - R(x) = C(x) * Q(x)$ to receiver
 - If no errors, $T(x)-R(x)$ should be divisible by $C(x)$

2. Describe Ethernet (802.3) in detail?

Carrier Sense Multiple Access with Collision Detect. Ether net is a multiple access network (shared link) and the carrier sense means that all the nodes can distinguish between an idle and busy link. Collision detect means that a node listens as it transmits and can therefore detect when a frame it is transmitting has interfered with a frame transmitted by another node.

MAC Frame

Preamble: 7 octets of alternating 1's and 0's used to establish synchronization

Start Frame Delimiter (SFD): The sequence 10101011 used to indicate the start of the frame.

Destination address (DA): address of the station for which the frame is intended (MAC address of interface)

Source address (SA): The address of the station that sent the frame

Length/Type: Length of the LLC data field (<1500 octets), or the type of protocol (if not 802.3)

Pad: added to make sure the transmission time of the packet is at least as long as the propagation time through the network (required for efficient use of CSMA/CD)

FCS: 32 bit CRC

3. Explain the Token Ring and FDDI in detail?

Token ring :: a number of stations connected by transmission links in a ring topology. Information flows *in one direction along the ring* from source to destination and back to source.

Medium access control is provided by a small frame, **the token** that circulates around the ring when all stations are idle. **Only the station possessing the token is allowed to transmit at any given time.**

- When a station wishes to transmit, it must wait for token to pass by and **seize the token**.
 - One approach: change one bit in token which transforms it into a “*start-of-frame sequence*” and appends frame for transmission.
 - Second approach: station claims token by removing it from the ring.
- The data frame circles the ring and is removed by the transmitting station.
- Each station interrogates passing frame. If destined for station, it copies the frame into local buffer. **{Normally, there is a one bit delay as the frame passes through a station.}**
- 4 and 16 Mbps using twisted-pair cabling with differential Manchester line encoding.
- Maximum number of stations is 250.
- **4Mbps 802.5 token ring** uses *single frame operation*.
- **4 Mbps IBM token ring** uses *single token operation*.
- Both 802.5 and IBM 16Mbps token rings use *multi-token operation*.
- 802.5 have 8 priority levels provided via two 3-bit fields (priority and reservation) in data and token frames.
- Permits 16-bit and 48-bit addresses (same as 802.3).

- FDDI: Fiber Distributed Data Interface.
 - FDDI is a high speed token ring fiber optical cable based technology.
 - This technology can ‘self-heal’, which means that the hardware can automatically detect and correct hardware problems.
 - FDDI consists of two independent rings to connect each computer. Data flows in opposite direction in each ring.
 - FDDI can have two types of Network Interface Cards, A and B, that connect to it.
 - Class A Network Interface Cards connect to both rings while class B Network Interface Cards connect to only one ring.
- FDDI: Fiber Distributed Data Interface.
 - Only class A cards can be used to heal broken rings. Thus the number of class A cards define the fault tolerant characteristics of the network.
 - When an error occurs the nearest computer routes frames from the inner ring to the outer ring.

4. Explain the Stop and Wait protocol in detail?

1. A stop-and-Wait protocol

- Assumptions
 - All packets are received
 - Packets may be corrupted (i.e., bits may be flipped)
 - Checksum to detect bit errors
- How to recover from errors? Use ARQ mechanism
 - acknowledgements (ACKs)*: receiver explicitly tells sender that packet received correctly
 - negative acknowledgements (NAKs)*: receiver explicitly tells sender that packet had errors
 - sender retransmits pkt on receipt of NAK
- What about error correcting codes?

Handling Duplicate Packets

- sender adds *sequence number* to each packet
- sender retransmits current packet if ACK/NAK garbled
- receiver discards (doesn't deliver up) duplicate packet

Sender:

- seq # added to pkt
- Two seq. #'s (0,1) will suffice. Why?
- must check if received ACK/NAK corrupted
- twice as many states
 - state must "remember" whether "current" pkt has 0 or 1 seq. #

Receiver:

- must check if received packet is duplicate
 - state indicates whether 0 or 1 is expected pkt seq #
- note: receiver can *not* know if its last ACK/NAK received OK at sender

rdt2.2: a NAK-free protocol

- same functionality as rdt2.1, using ACKs only
- instead of NAK, receiver sends ACK for last pkt received OK
 - receiver must *explicitly* include seq # of pkt being ACKed
- duplicate ACK at sender results in same action as NAK: *retransmit current pkt*

5. Explain the Spanning tree algorithm in detail?

- ▶ LANs have physical limitations (e.g., 2500m)
- ▶ Connect two or more LANs with a bridge
 - Bridges use "accept and forward" strategy
 - level 2 connection (does not add packet header)

Learning Bridges

- ▶ Do not forward when unnecessary

- ▶ Maintain forwarding table
- ▶ Learn table entries based on source address
- ▶ Table is an optimization; need not be complete
- ▶ Always forward broadcast frames

Spanning Tree Algorithm

- ▶ Problem: loops in cabling can make packets forwarded forever - no mechanism to remove looping frames
 - We can remove loops by maintaining state in the packet, but for layer-2 switching - we are not allowed to change the packet
 - Extra cabling can be good for redundancy if we can remove loops dynamically
- ▶ Bridges run a distributed spanning tree algorithm
 - select which bridges actively forward
 - developed by Radia Perlman
 - now IEEE 802.1 specification
- ▶ Each bridge has unique id (e.g., B1, B2, B3)
- ▶ Select bridge with smallest id as root
 - How to choose root: next slides
- ▶ Select bridge on each LAN closest to root as designated bridge (use id to break ties)
 - Each bridge forwards frames over each LAN for which it is the designated bridge
 - Root forwards over all its ports
- ▶ Bridges exchange configuration messages
 - id for bridge sending the message
 - id for what the sending bridge believes to be root bridge
 - distance (hops) from sending bridge to root bridge
- ▶ Each bridge records current best configuration message for each port
- ▶ Initially, each bridge believes it is the root
- ▶ When a bridge learns that it is not root, stop generating configuration messages
 - in steady state, only root generates configuration messages
- ▶ When a bridge learns that it is not the designated bridge, stop forwarding configuration messages
 - in steady state, only designated bridges forward configuration messages
- ▶ Root continues to periodically send configuration messages
- ▶ If any bridge does not receive configuration message after a period of time, it starts generating configuration messages claiming to be the root

6. Explain the OSI reference Model in detail?

- Open Systems Interconnect (OSI) Architecture

- International Standards Organization (ISO)
- International Telecommunications Union (ITU, formerly CCITT)
- X dot series: X.25, X.400, X.500
- Primarily a reference model
- Application: Application specific protocols
- Presentation: Format of exchanged data
- Session: Name space for connection. Mgmt (tie multiple transport streams together)
- Transport: Process-to-process channel (end-to-end)
- Network: Host-to-host packet delivery (routing)
- Data Link: Framing of data bits (single hop issues)
- Physical: Transmission of raw bits

7. Explain the various encoding schemes in detail

Encoding Schemes

- Non return to Zero-Level (NRZ-L)
- Non return to Zero Inverted (NRZI)
- Manchester
- 4B/5B

Non return to Zero-Level (NRZ-L)

- Two different voltages for 0 and 1 bits
- Voltage constant during bit interval
 - no transition I.e. no return to zero voltage
- e.g. Absence of voltage for zero, constant positive voltage for one
- More often, negative voltage for one value and positive for the other
- This is NRZ-L

Non return to Zero Inverted (NRZI)

- Non return to zero inverted on ones
- Constant voltage pulse for duration of bit
- Data encoded as presence or absence of signal transition at beginning of bit time
- Transition (low to high or high to low) denotes a binary 1
- No transition denotes binary 0
- An example of differential encoding

8. Explain Internet Architecture (TCP/IP) in detail?

- Developed with ARPANET and NSFNET
- Internet Engineering Task Force (IETF)
 - Culture: implement, then standardize

- OSI culture: standardize, then implement
- Popular with release of Berkeley Software Distribution (BSD) Unix; *i.e.*, free software
- Standard suggestions debated publicly through requests for comments (RFCs)

- No strict layering
- Hourglass shape – IP is the focal point
- Design and implementation go hand-in-hand (must provide an implementation when presenting a new specification).

Application
TCP UDP
IP
Network