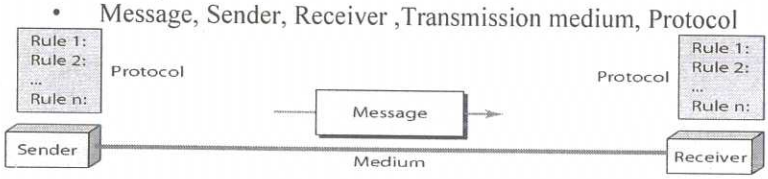
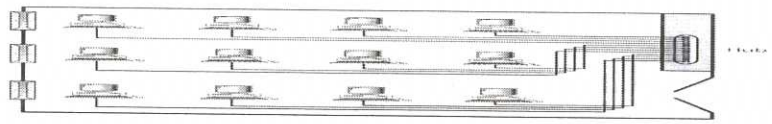
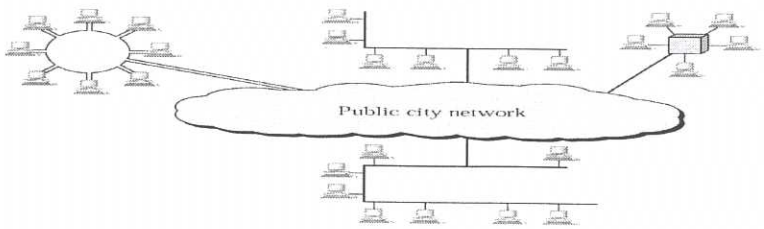
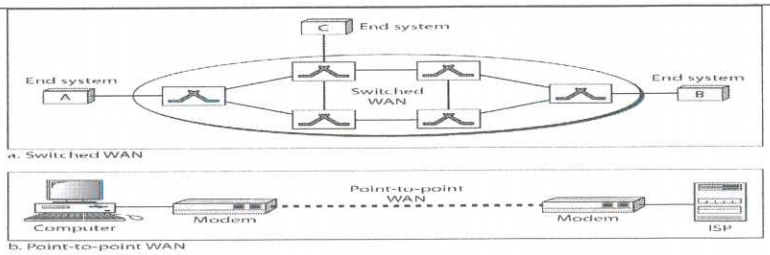
SCHEME OF EVALUATION

SCORING INDICATOR

Revision: 2015	Course Code: 4132			
Course Title: DATA COMMUNICATION				
Qstn NO	Scoring indicator	Split up score	Sub total	Total
I				
1.	A set of rules that govern data communication.	2	2	
2.	Analog data - information that is continuous. Eg: human voice Digital data- information that has discrete states. Eg: data are stored in computer memory in the form of 0s and 1s.	1+1	2	
3.	Input ports, output ports, the routing processor, and the switching fabric	0.5*4	2	
4.	Extra bits added with data in order to detect or correct errors. Eg: parity bit.	2	2	
5.	In bit oriented framing a single bit is stuffed to prevent the pattern from a flag. In bit stuffing, if a 0 and five consecutive 1 bits are encountered, an extra 0 is added.	2	2	10
II				
1.	Have five components • Message, Sender, Receiver ,Transmission medium, Protocol  	5 1	6	6
2.	3 different categories-LAN, MAN, WAN LAN-Usually privately owned-A network for a single office, building, or campus ≤ a few Km -Common LAN topologies: bus, ring, star • 	2	6	
	MAN-Designed to extend to an entire city-Cable TV network, a company's connected LANs-Owned by a private or a public company  	2	6	6
	WAN-Long distance transmission, e.g., a country, a continent, the world	2		



a. Switched WAN

b. Point-to-point WAN

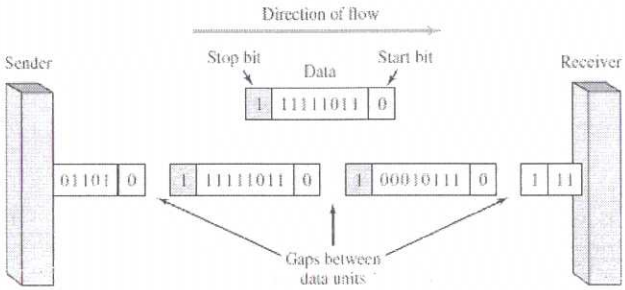
3.

Parallel Communication	Serial Communication
can send data *n* bits at a time	can send data *1* bit at a time .
Use *n* wires to send *n* bits	Use *only one* wire
no conversion devices are required	conversion devices are required
advantage is high speed	slow .
more expensive	less expensive

3*2 | 6 | 6

4.

Figure 4.34 *Asynchronous transmission*



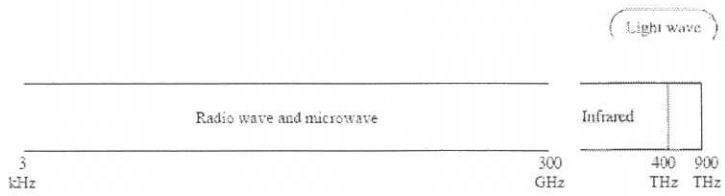
2+4 | Fig+Expln | 6 | 6

5. Pair of twisted conductors

- Twisting reduces interference -Cheap medium
- Commonly used for communications within buildings and in telephone networks
- Produced in unshielded (UTP) and shielded (STP) forms, and in different performance categories.
- . Neighbor pairs typically have different twist lengths to reduce crosstalk.

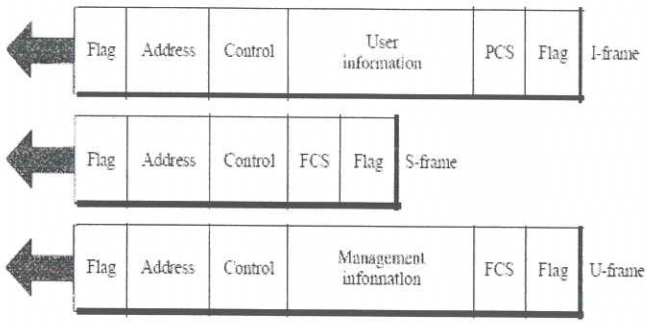
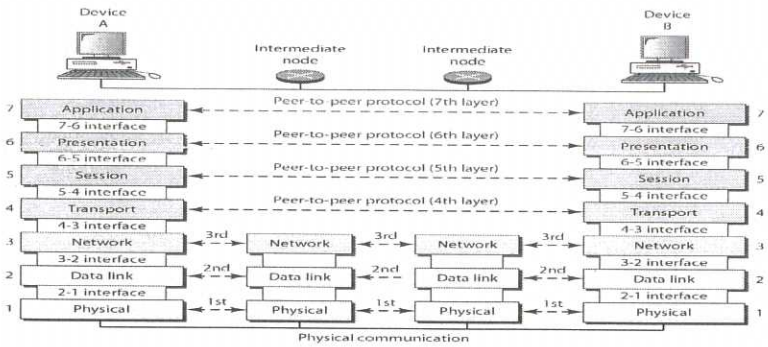
2+4 | 6 | 6

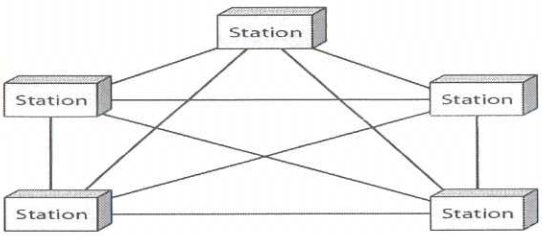
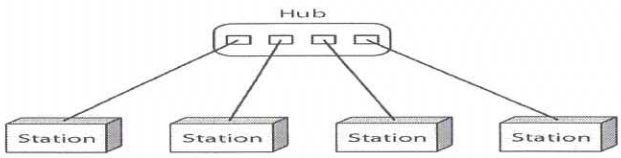
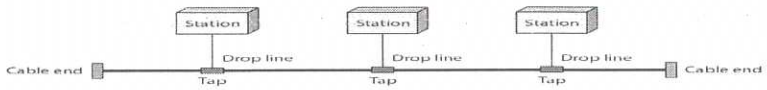
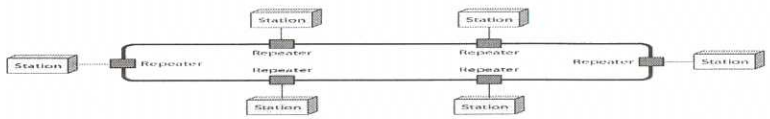
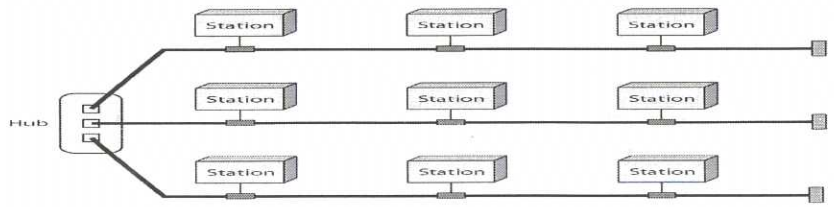
6. Radio waves- Microwaves and Infrared waves

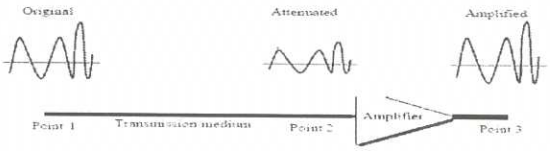


2*3 | 6 | 6

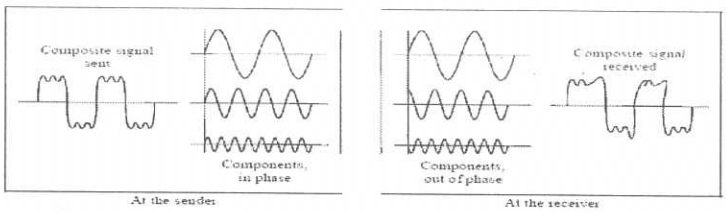
7. High-level Data Link Control is bit-oriented protocol-Provides two common transfer modes:normal response mode (NRM)& asynchronous balanced mode (ABM).

	NRM:the station configuration is unbalanced. Have one primary station and multiple secondary stations. A primary station can send commands a secondary station can only respond. The NRM is used for both point-to-point and multiple-point links. ABM: the configuration is balanced. The link is point-to-point, and each station can function as a primary and a secondary. HDLC defines three types of frames: information frames (I-frames), supervisory frames (S-frames), and unnumbered frames (U-frames).. I-frames are used to transport user data and control information relating to user data, S-frames are used only to transport control information. U-frames are reserved for system management.  	2 2 2	6	6
III a	 1. Physical Layer-Physical characteristics of Interfaces and media-Representation of bits-how 0's and 1's are changed to signals.-Data rate- no of bits transmitted per second. Synchronization of bits-Sender and receiver must be synchronized at bit level. Line configuration- Physical topology - Transmission mode 2. Data link layer- is responsible for moving frames from one hop (node) to the next-Transform the physical layer to a reliable (error-free) link-Framing-Physical addressing-Flow control-Error control-Access control 3. Network layer- is responsible for the delivery of packets from the source host to the destination host-Logical addressing and routing 4. Transport layer -is responsible for delivery of a message from one process to another- Service-point (port) addressing-Segmentation and reassembly-Connection control-Flow control-Error control 5. Session layer- is responsible for dialog control and synchronization 6. Presentation layer- is responsible for translation, compression, and encryption	Fig: 3 listing-2 Exp: 7*1.5	3 2 10	15

	7. Application layer -is responsible for providing services to the user-Network virtual terminal-Mail services-File transfer, access, and management-Directory services			
IV a	1. Mesh Topology-Dedicated point-to-point link to every other nodes -A mesh network with *n* nodes has *n(n-1)/2* links. Advantages: No traffic problems, robust, security, easy fault identification & isolation.Disadvantages: Difficult installation/reconfiguration, space, cost .  Star Topology-Dedicated point-to-point link *only to* a central controller, called ***hub.*** Hub acts as an exchange: No direct traffic between devices.Advantages: Less expensive, robust .Disadvantages: dependency of the whole on one single point.  Bus Topology-One long cable that links all nodes .Advantages: Easy installation, cheap .Disadvantages: Difficult reconfiguration, no fault isolation, a fault or break in the bus stops all transmission	3*5		
	 Ring Topology-Dedicated point-to-point link only with the two nodes on each sides One direction- repeater .Advantages: Easy reconfiguration, fault isolation Disadvantage: Unidirectional traffic, a break in the ring cab disable the entire network		15	15
	 Hybrid Topology-Combination of more than one topologies.Example: Main star topology with each branch connecting several stations in a bus topology.To share the advantages from various topologies			
	 			
V a	Transmission impairments are-Attenuation, Delay distortion and noises Attenuation means a loss of energy. When a signal travels through a medium, it loses some of its energy in overcoming the resistance of the medium.. To compensate for this loss, amplifiers are used to amplify the signal.			

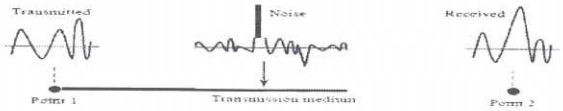


Distortion means that the signal changes its form or shape. occur in acomposite signal made of different frequencies. 3



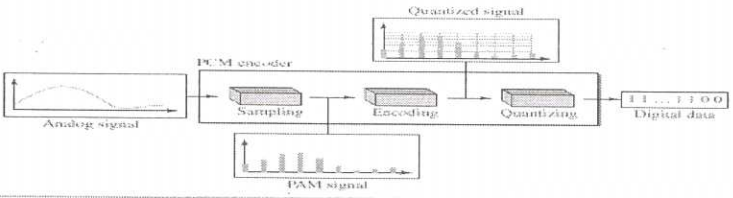
9

Noise is another cause of impairment. Several types -thermal noise, induced noise, crosstalk, and impulse noise. Thermal noise is the random motion of electrons in a wire which creates an extra signal not originally sent by the transmitter. Induced noise comes from sources such as motors and appliances. Crosstalk is the effect of one wire on the other. Impulse noise is a spike that comes from power lines, lightning . 3



V b. A PCM-Pulse Code Modulation- encoder has three processes 3 15

Figure 4.21 *Components of PCM encoder*



1. The analog signal is sampled.
2. The sampled signal is quantized.
3. The quantized values are encoded as streams of bits.

Sampling- The analog signal is sampled every T_s s, where T_s is the sample interval or period. The sampling process is sometimes referred to as pulse amplitude modulation (PAM).The result is still an analog signal with nonintegral values.

Quantization-Quantization is a method of assigning integral values in the specific range to sampled instances.

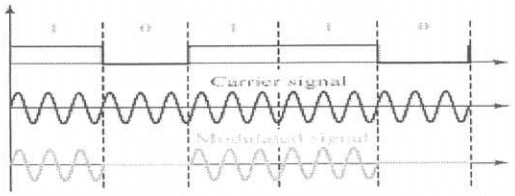
Encoding-After each sample is quantized and the number of bits per sample is decided, each sample can be changed to an n_b-bit code word 6 6

. Digital information changes the carrier signal by modifying one or more of its characteristics (amplitude, frequency, or phase).

This kind of modification is called modulation (shift keying).

VI a AMPLITUDE SHIFT KEYING (ASK)- the amplitude of the carrier signal is varied to create signal elements. Both frequency and phase remain constant while the amplitude changes.

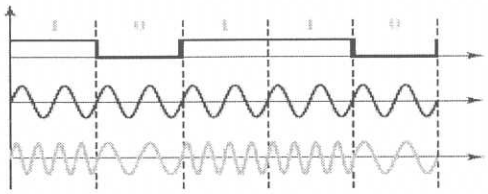
Figure 5.4 *Implementation of binary ASK*



3

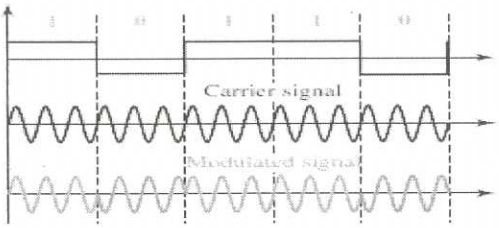
Frequency shift keying(FSK)-the frequency of the carrier signal is varied to represent data.Both peak amplitude and phase remain constant for all signal elements.

Figure 5.7 *Implementation of BFSK*



Phase shift keying(PSK)- the phase of the carrier is varied to represent two or more different signal elements. Both peak amplitude and frequency remain constant as the phase changes. 3

Figure 5.10 *Implementation of BASK*



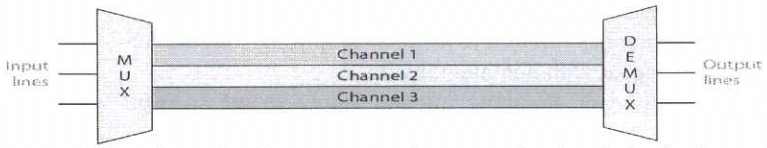
VI b

3

Frequency-division multiplexing (FDM) is an analog technique that can be applied when the bandwidth of a link is greater than the combined bandwidths of the signals to be transmitted. Sgnals generated by each sending device modulate different carrier frequencies. These modulated signals are then combined into a single composite signal that can be transported by the link.. Channels can be separated by strips of unused bandwidth (***guard band***) to prevent overlapping.

3

9



3

VII a

Optical fiber is made of glass or plastic- transmits signals in the form of *light*- Depends on the density of the medium through which it is travelling-Has a cylindrical shape-Consists of concentric sections- core, cladding & jacket. Core- innermost section- Each fibre is surrounded by its own cladding- a glass or plastic coating –has optical properties. Interface between the core and cladding acts as a reflector to confine light. Jacket- The outermost layer- Composed of plastic and other material to protect against moisture,aberation,crushing

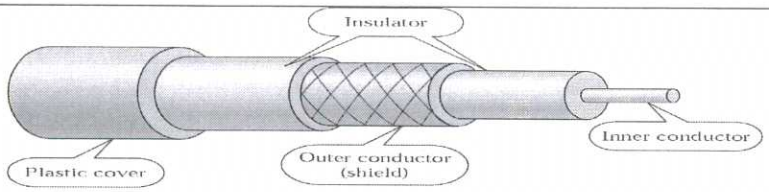
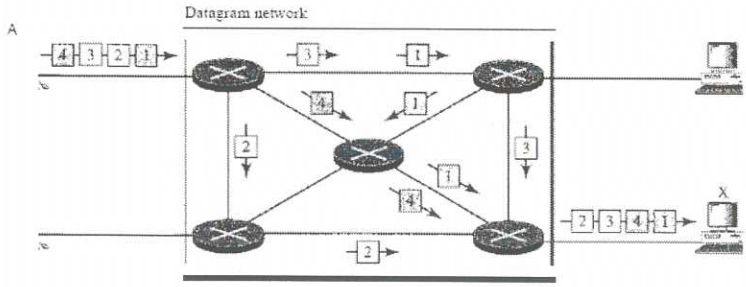
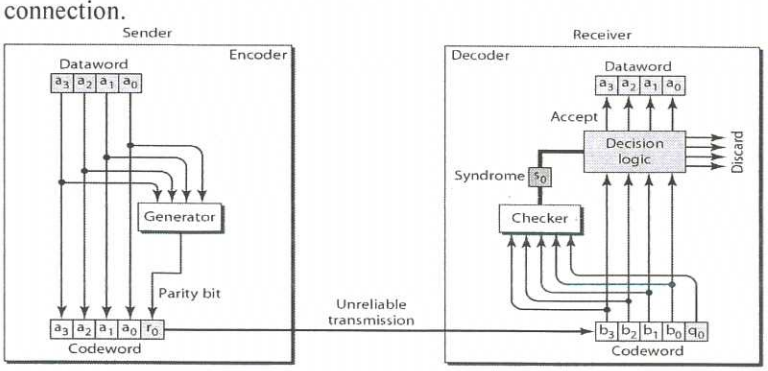
6

6

Advantages-Higher bandwidth Greater capacity -Less signal attenuation-Immunity to electromagnetic interference-Resistance to corrosive materials-Light weight- Greater immunity to tapping -Smaller size and lighter weight-Greater repeater spacing

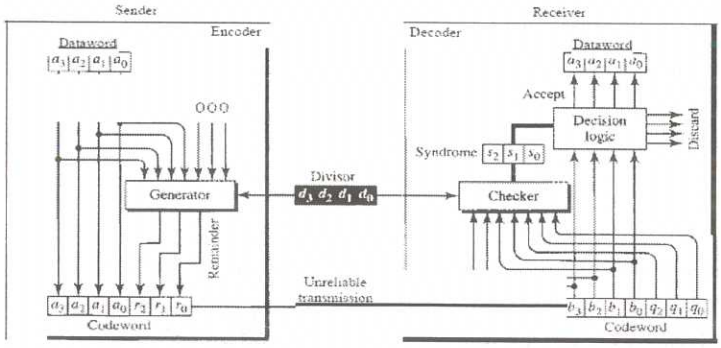
3

9

VII b.	 expln	6	6	
VIII a	**Packet Switching:** The message divided into packets of fixed or variable size-There is no resource allocation for a packet. -No reserved bandwidth and no scheduled processing time for each packet. Resources are allocated on demand on a first come, first-served basis.	3		
	Mainly two types: Datagram and Virtual cirtuits.	3	9	
	In a datagram network, each packet is treated independently of all others.Each switch has a routing table which is based on the destination address. The routing tables are dynamic and are updated periodically	3		
		3		
	A virtual-circuit network is a cross between a circuit-switched network and a datagram network. It has some characteristics of both. 1. As in a circuit-switched network, there are setup and teardown phases in addition to the data transfer phase 2. Resources can be allocated during the setup phase, as in a circuit-switched network, or on demand, as in a datagram network. As in a datagram network, data are packetized and each packet carries an address in the header. However, the address in the header has local jurisdiction not end-to-end jurisdiction. The final destination address is defined by virtual-circuit identifier			
VIII b	Circuit switching takes place at the physical layer-a set of switches connected by physical links-requires three phases:	3		
	connection setup, data transfer, and connection teardown.	3		
	Not efficient, because resources are allocated during the entire duration of the connection.		6	
IX a		3	9	
	Explanation	6		

IX b

Figure 10.14 *CRC encoder and decoder*



3

3

2

6

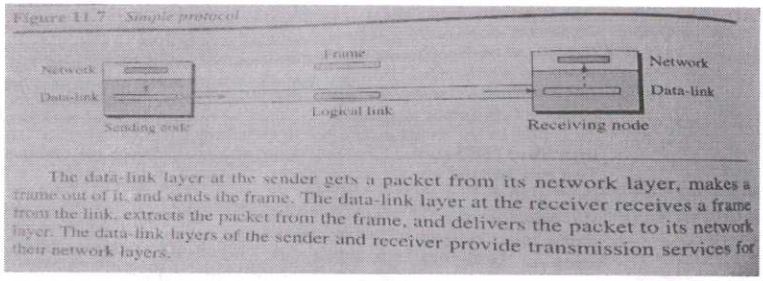
Explanation

X a

Mainly 2 types- simple and stop and wait

Simple Protocol

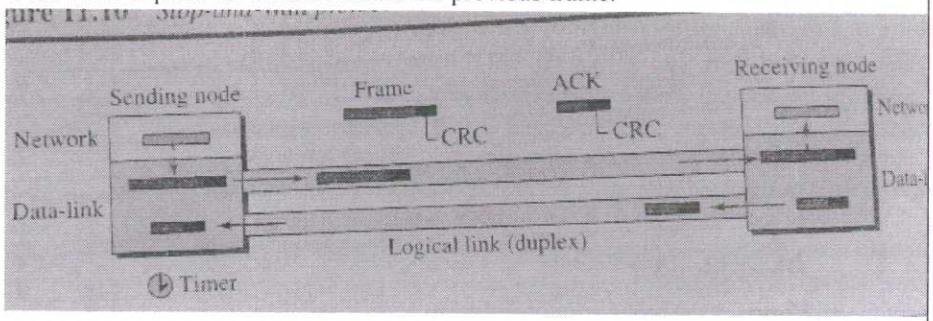
In this protocol neither flow control nor error control.



2

3

Stop-and-Wait Protocol-use both flow and error control. sender sends one frame at a time and wait for acknowledgement before sending the next one. To detect corrupted frame add CRC to each frame. . Every time the sender sends a frame it starts a timer, if the timer expires the sender resends the previous frame.



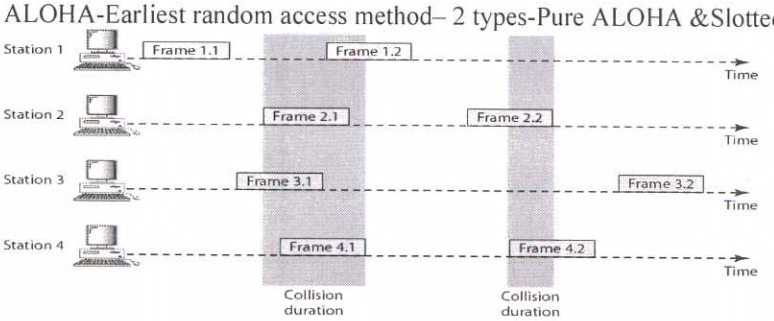
4

9

Give marks to any explanation regarding Datalink layer protocols

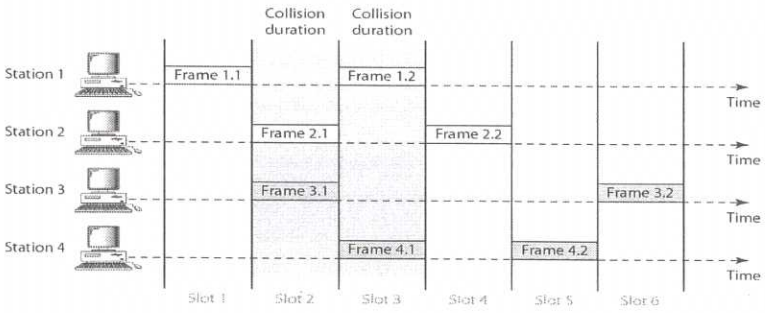
X b.

ALOHA-Earliest random access method– 2 types-Pure ALOHA &Slotted ALOHA



3

- Vulnerable time pure ALOHA network = 2 x T_{fr}

	• Slotted ALOHA vulnerable time = T_{fr} • More efficient  	3	6	