

**Fall 2019**

- 1 a) What do you mean by computer network? Explain client-server and peer-to-peer model of network.
- 1 b) How attenuation and distortion affect the quality of communication? Explain.
- 2 a) What do you mean by modulation? Explain amplitude modulation with advantages and disadvantages.
- 2 b) What is the purpose of Presentation layer in OSI reference model? How TCP/IP model is working without the Session and Presentation layer? Explain.
- 3 a) What do you mean by radio wave and microwave? Write the difference between satellite and terrestrial system.
- 3 b) Given a data word 1010011110 and the divisor polynomial  $X^4+X^3+X+1$ .  
 i. Show the generation of codeword at sender site (using binary division)  
 ii. Show the checking of codeword at receiver site (assuming no error)
- 4 a) Explain IPv6 address structure and differentiate between IPv4 and IPv6.
- 4 b) If two computers A and B are assigned with IP-Address 172.16.17.30/20 and 172.16.28.15/22. Find the subnet addresses they belong and determine whether they belong to same or different subnets.
- 5 a) What do you mean by routing? Explain static and dynamic routing with advantages and disadvantages.
- 5 b) What are the reasons for congestion in network? How Leaky Bucket algorithm control the congestion in network. Explain.
- 6 a) What does CIA triad of information security mean? Explain in brief.
- Confidentiality, integrity and availability, also known as the CIA triad, is a model designed to guide policies for information security within an organization. The model is also sometimes referred to as the AIC triad, (availability, integrity and confidentiality) and avoid confusion with the Central Intelligence Agency. The elements of the triad are considered the three most crucial components of security.

In this context, confidentiality is a set of rules that limits access to information, integrity is the assurance that the information is trustworthy and accurate, and availability is a guarantee of reliable access to the information by authorized people.

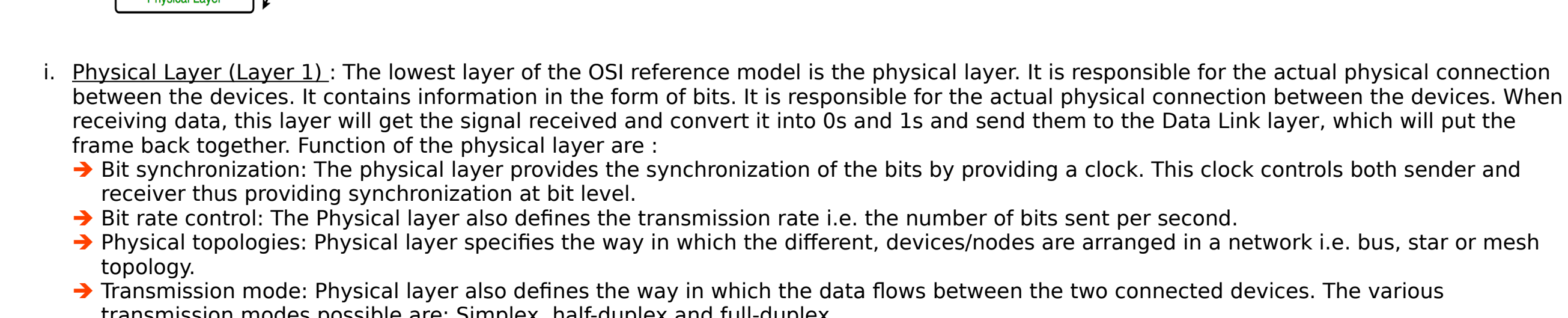
- 6 b) Explain the DORA (Discover, Offer, Request and Acknowledge) process of DHCP.
7. Write short notes on any two:  
 a) Packet Switching  
 b) Hamming Code  
 c) Sliding Window Protocol

**Spring, 2018**

**1 a) State pros and cons of Computer Network. Explain different Computer network models.**

- Pros of computer network are:
- Files can be shared easily between users.
  - Data is easy to backup as all the data is stored on the file server.
  - Security is good - users cannot see other users' files unlike on stand-alone machines.
  - Network users can communicate by email and instant messenger.
  - Site (software) licenses are likely to be cheaper than buying several standalone licenses.
- Cons of computer network are:
- Purchasing the network cabling and file servers can be expensive.
  - Managing a large computer network is complicated, requires training and a network manager usually needs to be employed.
  - If the file server goes down the files on the file server become inaccessible.
  - Viruses can spread to other computers throughout a computer network.
  - There is a danger of hacking, particularly with wide area networks. Security procedures are needed to prevent such abuse, eg a firewall.

**Different computer network models are:**



- Physical Layer (Layer 1):** The lowest layer of the OSI reference model is the physical layer. It is responsible for the actual physical connection between the devices. It contains information in the form of bits. It is responsible for the actual physical connection between the devices. When receiving data, this layer will get the signal received and convert it into 0s and 1s and send them to the Data Link layer, which will put the frame back together. Function of the physical layer are:
  - Bit synchronization: The physical layer provides the synchronization of the bits by providing a clock. This clock controls both sender and receiver thus providing synchronization at bit level.
  - Bit rate control: The Physical layer also defines the transmission rate i.e. the number of bits sent per second.
  - Physical topologies: Physical layer specifies the way in which the different, devices/nodes are arranged in a network i.e. bus, star or mesh topology.
  - Transmission mode: Physical layer also defines the way in which the data flows between the two connected devices. The various transmission modes possible are: Simplex, half-duplex and full-duplex.

Note: Hub, Repeater, Modem, Cables are Physical Layer devices.

- Data Link Layer (Layer 2):** The data link layer is responsible for the node to node delivery of the message. The main function of this layer is to make sure data transfer is error free from one node to another, over the physical layer. When a packet arrives in a network, it is the responsibility of DLL to transmit it to the Host using its MAC address. Data Link Layer is divided into two sub layers: Logical Link Control (LLC): It controls frame synchronization, flow control and error checking. Media Access Control (MAC): It is responsible for moving data packets to and from one Network Interface Card (NIC) to another across a shared channel. The functions of the data Link layer are:
  - Framing: Framing is a function of the data link layer. It provides a way for a sender to transmit a set of bits that are meaningful to the receiver. This can be accomplished by attaching special bit patterns to the beginning and end of the frame.
  - Error control: Data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.
  - Flow Control: The data rate exchanged over the internet by providing end-to-end communications that identify how it should be broken into packets, addressed, transmitted, routed and received at the destination. TCP/IP requires little central management, and it is designed to make networks reliable, with the ability to recover automatically from the failure of any device on the network.
  - Access control: When a single communication channel is shared by multiple devices, MAC sub-layer of data link layer helps to determine which device has control over the channel at a given time.

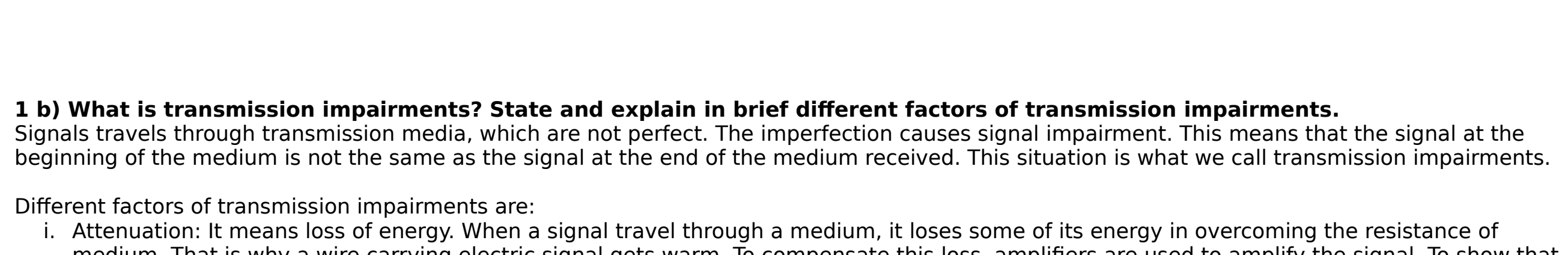
Note: Segment in Network layer is referred as Packet. Network layer is implemented by networking devices such as routers.

- Transport Layer (Layer 4):** It is the middle most layer in OSI model and it acts as Network Independent Layer. It has no idea about the functioning of lower layer i.e. physical, data link and network layers.
- Session Layer (Layer 5):** It is the fifth layer of OSI model and it provides appropriate sessions between users and entities, where user interacts. This layer can be used on the basis of resources available and it can be skipped too if not required. For example: Login Sessions in online banking.
- Presentation Layer (Layer 6):** It is the sixth layer of OSI model and it provides appropriate representation of data through various data presentation techniques.
- Application Layer (Layer 7):** It is the topmost layer of the OSI model and has the responsibility for providing interface between various users and application.

**b) TCP/IP Model:**

TCP/IP, or the Transmission Control Protocol/Internet Protocol, is a suite of communication protocols used to interconnect network devices on the internet. TCP/IP can also be used as a communications protocol in a private network (an intranet or an extranet). TCP/IP specifies how the data is exchanged over the internet by providing end-to-end communications that identify how it should be broken into packets, addressed, transmitted, routed and received at the destination. TCP/IP requires little central management, and it is designed to make networks reliable, with the ability to recover automatically from the failure of any device on the network.

The two main protocols in the internet protocol suite serve specific functions. TCP defines how applications can create channels of communication across a network. It also manages how a message is assembled into smaller packets before they are then transmitted over the internet and reassembled in the right order at the destination address. IP defines how to address and route each packet to make sure it reaches the right destination. Each gateway computer on the network checks this IP address to determine where to forward the message. TCP/IP functionality is divided into four layers, each of which include specific protocols.



- Application Layer:** This layer defines the protocol which enables user to interact with the network. For example, FTP, HTTP etc.
- Transport Layer:** This layer defines how data should flow between hosts. Major protocol at this layer is Transmission Control Protocol (TCP). This layer ensures data delivered between hosts is in-order and is responsible for end-to-end delivery.
- Internet Layer:** Also called the **Network Layer**, deals with packets and connects independent networks to transport the packets across network boundaries. The network layer protocols are the IP and the Internet Control Message Protocol (ICMP), which is used for error reporting.
- Physical Layer:** Consists of protocols that operate only on a link -- the network component that interconnects nodes or hosts in the network. The protocols in this layer include Ethernet for local area networks (LANs) and the Address Resolution Protocol.

**1 b) What is transmission impairments? State and explain in brief different factors of transmission impairments.**

Signals travels through transmission media, which are not perfect. The imperfection causes signal impairment. This means that the signal at the beginning of the medium is not the same as the signal at the end of the medium received. This situation is what we call transmission impairments.

- Different factors of transmission impairments are:
- Attenuation:** It means loss of energy. When a signal travel through a medium, it loses some of its energy in overcoming the resistance of medium. That is why a wire carrying electric signal gets warm. To compensate this loss, amplifiers are used to amplify the signal. To show that a signal has lost or gained strength, engineers use the SI unit of the decibel.
  - Distortion:** It means that the signal changes its form or shape. This is generally seen in composite signals with different frequencies. Each frequency component has its own propagation speed traveling through a medium. Every component arrive at different time which leads to delay distortion. Therefore, they have different phases at receiver end from what they had at senders end.
  - Noise:** The random or unwanted signal that mixes up with the original signal is called noise. There are four types of it which may corrupt the signal.
    - Induced noise: Induced noise comes from sources such as motors and appliances. These devices act as sending antenna and transmission medium act as receiving antenna.
    - Crosstalk noise: Crosstalk noise is when one wire affects the other wire.
    - Thermal noise: Thermal noise is movement of electrons in wire which creates an extra signal.
    - Impulse noise: Impulse noise is a signal with high energy that comes from lightning or power lines

**2 a) What is switching? Make comparison between circuit switching and packet switching.**

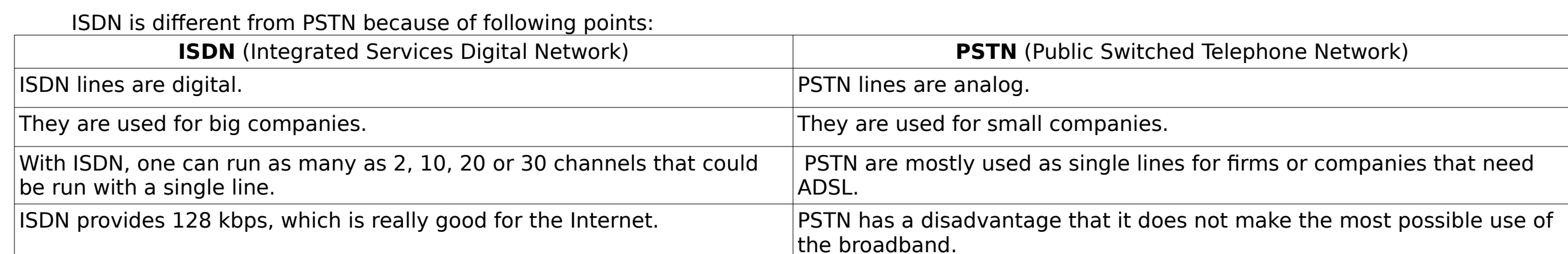
Switching is process to forward packets coming in from one port to a port leading towards the destination.

Circuit Switching	Packet Switching
is connection oriented.	It is connection-less.
is inflexible, because once a path is set all parts of a transmission follows the same path.	It is flexible, because a route is created for each packet to travel to the destination.
message is received in the order, sent from the source.	Packets of a message are received out of order and assembled at the destination.
circuit switching can be achieved using two technologies, either Space Division Switching or Time-Division Switching.	Packet Switching has two approaches Datagram Approach and Virtual Circuit Approach.
circuit switching is implemented at Physical Layer.	Packet Switching is implemented at Network Layer.

For Data transmission, Packet Switching is the more efficient than Circuit Switching whereas, when it comes to voice transmission Circuit switching is more efficient than packet switching.

**2 b) What is OSI reference model? Explain its layers with clear diagram.**

Open System Interconnect is an open standard for all communication systems. OSI model is established by International Organization (ISO). This model has seven layers:



**3 a) What is data transmission media? How ISDN is different from PSTN?**

Data transmission media is the physical media/device over which communication takes place in computer networks. For example, twisted pair cable, coaxial cable, fiber optics, etc.

ISDN is different from PSTN because of following points:

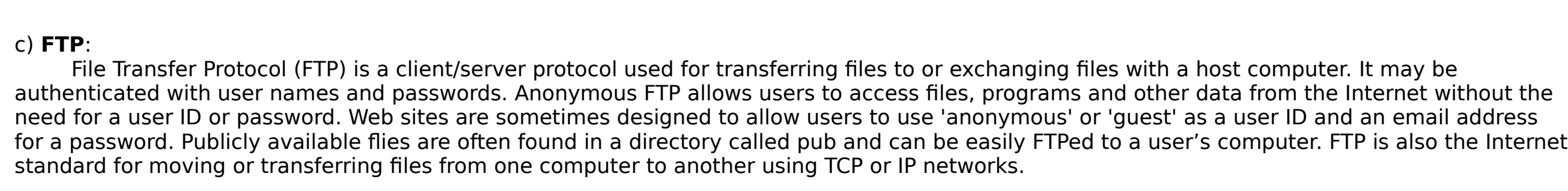
ISDN (Integrated Services Digital Network)	PSTN (Public Switched Telephone Network)
ISDN lines are digital.	PSTN lines are analog.
They are used for big companies.	They are used for small companies.
With ISDN, one can run as many as 2, 10, 20 or 30 channels that could be run with a single line.	PSTN are mostly used as single lines for firms or companies that need ADSL.
ISDN provides 128 kbps, which is really good for the Internet.	PSTN has a disadvantage that it does not make the most possible use of the broadband.
Two simultaneous connections are allowed in ISDN.	PSTN does not allow two simultaneous connections

- 3 b) Calculate CRC for 10 bit sequence 1010011010. The generator polynomial is  $x^4+3x+1$ .
- 4 a) What is unicasting and multicasting? Explain in brief about mobile IP frame format. Unicasting is communication between a single sender and a single receiver over a network. Multicasting is communication between a single sender and multiple receivers over a network.



- 4 b) A company is uses the ip address 197.70.64.10/9. What does it mean? Explain in brief about all the factors related with it.
- 5 a) What is sliding window protocol? Explain it with diagram.
- 5 b) Define routing. Differentiate between distance vector routing algorithm and flow based routing algorithm.
- 6 a) Explain the working process of DNS and DHCP with suitable example.
- 6 b) What are the necessity of cryptography in communication? Explain in brief about public key algorithm.
7. Write short notes on any two:  
 a) Internet multicasting

**4 a) Leaky Bucket Algorithm:**



- c) **FTP:** File Transfer Protocol (FTP) is a client/server protocol used for transferring files to or exchanging files with a host computer. It may be authenticated with user names and passwords. Anonymous FTP allows users to access files, programs and other data from the Internet without the need for a user ID or password. Web sites are sometimes designed to allow users to use 'anonymous' or 'guest' as a user ID and an email address for a password. Publicly available files are often found in a directory called pub and can be easily FTPed to a user's computer. FTP is also the internet standard for moving or transferring files from one computer to another using TCP or IP networks.

**Fall 2018**

- 1 a) What is computer network? Write down the application areas of computer networks in modern society.
- 1 b) What are transmission impairment? Differentiate between synchronous and asynchronous transmission.
- 2 a) Why modulation technique is important in data communication? Explain different types of modulation technique use in computer network.
- 2 b) What do you mean by protocol stack? Draw and explain working principle of OSI reference model.
- 3 a) What are the advantages of optical fiber? Explain the different types of transmission media use in computer network.
- 3 b) Describe the frame format of IPv6 and explain for each fields.

**4 a) What is cryptography? Explain the symmetric key algorithm and public key algorithm method.**

Cryptography is a method of protecting information and communications through the use of codes/algorithms so that only those for whom the information is intended can read and process it. The prefix "crypt" means "hidden" and the suffix "graphy" stands for "writing". Transformed unreadable data is called encrypted data which is almost impossible to decipher by third person like hackers.

Symmetric-key algorithms (aka secret key algorithm) are algorithms for cryptography that use the same cryptographic keys for both encryption of plain-text and decryption of cipher-text. It is a two-way algorithm because the mathematical algorithm is reversed when decryption the message along with using the same secret key. It is also known as private-key encryption and secure-key encryption.

A very simple example of how a symmetric key algorithm might work might be substituting the letter in the alphabet prior to the target letter for each one in a message. The resulting text - "gdtkkn," for example - would make no sense to someone who didn't know the algorithm used (x-1), but would be easily understood by the parties involved in the exchange as "hello."

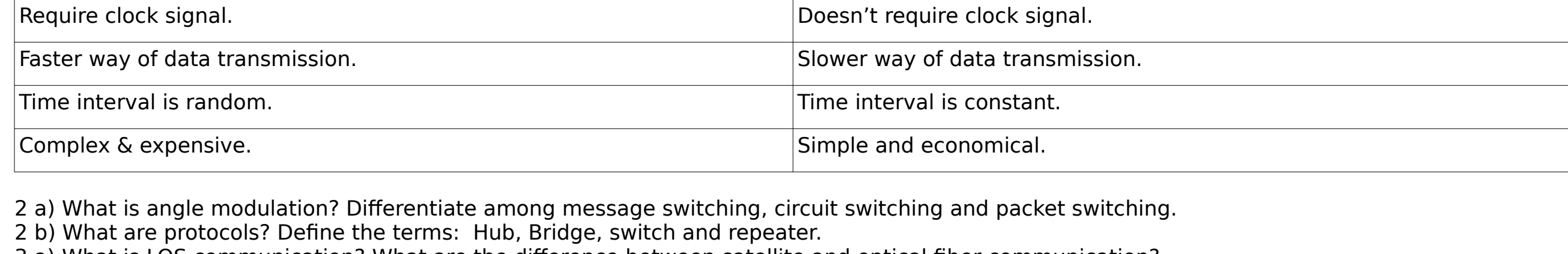
The problem with symmetric keys is how to securely get the secret keys to each end of the exchange party and keep them secure after that. For this reason, an public key algorithm is now often.

Public key algorithm (aka asymmetric key algorithm)

- 4 b) What do you mean by Routing? Explain shortest path Routing Algorithm and Flow based Routine Algorithm.
- 5 a) What is framing? Show the error correction by using CRC method on data 11101011 with generated polynomial equation.
- 5 b) You are given an IP address 172.80.10.0/18. As a network engineer design the possible subnets. Also calculate subnet mask, each network address, broadcast address and range of host IPs for each subnet.
- 6 a) What are the reasons for correction in network? Explain any one congestion control algorithm.

**6 a) Write short notes on:** Proxy server, Firewall and DHCP server.

**Proxy server:** A proxy server is a server (a computer system or an application) that acts as an intermediary for requests from clients seeking resources from other servers. A client connects to the proxy server, requesting some service, such as a file, connection, web page, or other resource available from a different server and the proxy server evaluates the request as a way to simplify and control its complexity. Proxies were invented to add structure and encapsulation to distributed systems.



So, how proxy operates?  
 Proxy server is a computer on the web that redirects your web browsing activity. Here's what that means.  
 • Normally, when you type in a website name (Amazon.com or any other), your Internet Service Provider (ISP) makes the request for you and connects you with the destination—and reveals your real IP address.  
 • When you use a proxy your online requests get rerouted.  
 • While using a proxy, your Internet request goes from your computer to your ISP as usual, but then gets sent to the proxy server, and then to the website/destination. Along the way, the proxy uses the IP address you chose in your setup, masking your real IP address.

Fig: Demonstration of how proxy server works. (Note that here "Alice" is just a computer users who is asking for some information and "Bob" is a web server relaying some information asked by the user.)

7. Write short notes on any two:  
 a) Selective repeat ARQ

i) The sliding window ARQ protocol which detects or corrects the error occurred in data layer. This protocol re-transmits that frame which is damaged or lost. The re-transmitted framed is received out in sequence.

b) **Circuit Switching** is a method of implementing a telecommunications network in which two network nodes establish a dedicated communication channel (circuit) through the network before the nodes can communicate.

Circuit switching systems are ideal for communication that are require data to be transmitted in real-time. These networks are also called correction-oriented networks.

c) **Hamming Code:** is a set of error correction codes that can be used to detect and correct bit errors that occur when data is moved or stored from sender to receiver.

It is developed by R.W. Hamming. It can detect upto 2-bits errors or correct 1-bit error without detection of uncorrected errors, and can detect only an odd number of bits in error.

Like other error detection code, hamming code makes use of the concept of parity and parity bits, which are bits that are added to data so that the validity of the data can be checked when it is read or after it has been received in data transmission.

**2017 Spring**

- 1 a) What is computer network? Write down the application areas of computer network.
- 1 b) Define frequency and bandwidth. Differentiate between synchronous and asynchronous transmission.

Synchronous Transmission	Asynchronous Transmission
Full duplex mode.	Half duplex.
Block pattern transmission.	Bit pattern transmission.
Require clock signal.	Doesn't require clock signal.
Faster way of data transmission.	Slower way of data transmission.
Time interval is random.	Time interval is constant.
Complex & expensive.	Simple and economical.

- 2 a) What is analog modulation? Differentiate among message switching, circuit switching and packet switching.
- 2 b) What are protocols? Define the terms: Hub, Bridge, switch and repeater.
- 3 a) What is LOS communication? What are the difference between satellite and optical fiber communication?
- 3 b) What is Side (LOS) is a type of propagation that can transmit and receive data only where transmit and receive stations are in view of the each other without any sort of an obstacle between them. FM, radio, microwave and satellite communication are examples of LOS communications.

- 3 b) What is error control? Explain in detail about Go-Back-N/ARQ mechanism for error control.
- 4 a) Describe the parity and checksum error detection method with examples.
- 4 b) Describe the parity and checksum error detection methods with examples.
- 5 a) For the given IP address 192.168.10.0/25, find the total hosts, total subnets, total usable hosts and also calculate the IP address range of all subnets.

**5 b) Explain the various classes of IPV4.**

IANA (Internet Assigned Numbers Authority) defined five classes of public IP as shown below:

Class	Theoretical Address Range	Binary Start	Used for
A	0.0.0.0 to 127.255.255.255	0	Very large network
B	128.0.0.0 to 191.255.255.255	10	Medium network
C	192.0.0.0 to 223.255.255.255	110	Small network
D	224.0.0.0 to 239.255.255.255	1110	Multicast
E	240.0.0.0 to 247.255.255.255	1111	Experiment

- 6 a) How do you understand by Routing? Discuss about the working of shortest path routing Algorithm.
- 6 b) How leaky bucket algorithm help the congestion control in data communication?
7. Write short notes on any two:  
 a) Proxy server  
 b) Private key cryptography  
 c) Internet protocol stack

**Fall 2017**

- 1 a) What is computer network? Differentiate between peer to peer network and client-server network.
- 1 b) What are transmission impairments? Explain various causes of impairments.
- 2 a) Why modulation is required for data transmission? Describe briefly the terms: PWM, PPM, PAM and PCM.
- 2 b) What are the logical protocols? Explain the layers of OSI reference model with its architecture.
- 3 a) What are the advantages of optical fiber? Explain the different types of transmission media with broad band coaxial cables.
- 3 b) What is the meaning of flow control and error control? Explain in detail about Stop-and-Wait ARQ mechanism for error control.
- 4 a) Describe the parity and checksum error detection methods with examples.
- 4 b) Explain IPv6 in brief with header format.
- 5 a) Given IP address 156.154.81.56/26, calculate the total IP address, usable IP address, the subnet mask, network address and broadcast address.
- 5 b) What is internet multicasting? What are the difference between OSI reference model and TCP/IP model?
- 6 a) What do mean by static routing and dynamic routing? Explain Dijkstra's shortest path routing algorithm?
- 6 b) How leaky bucket algorithm help in congestion control during data transmission?
7. Write short notes on any two:  
 a) HTTP  
 b) Asymmetric key cryptography  
 c) Difference between hub and repeater

**Spring 2015**

- 1 a) What is client server model? How it is differs from peer to peer network model?
- 1 b) How can you define the bandwidth of the system? What are the differences between synchronous and asynchronous transmission?
- 2 a) Why data modulation is used in computer networks? Explain different types of modulation techniques used.
- 2 b) What is OSI reference model? Explain its layering function with diagram.
- 3 a) What are transmission media? Explain different types of transmission media use in computer network.
- 3 b) How errors are occurred in network? Write the error detection and correction method in data link layer.
- 4 a) What is framing? Show the error correction by using CRC method on data 11101111 with generation polynomial  $x^3+1$  equation.
- 4 b) What do mean by static routing and dynamic routing? Explain Dijkstra's shortest path routing algorithm?
- 5 a) What is adaptive routing table? Explain distance vector routing.
- 6 a) Differentiate between Virtual Circuit and Datagram with suitable example.
- 6 b) Define Cryptography. Explain the symmetric key algorithm and public key algorithm method.

- 7) Write short on:  
 i) **Mobile IP:** Mobile IP (or MIP) is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining a permanent IP address. This standard that allows users with mobile devices whose IP addresses are associated with one network to stay connected when moving to a network with a different IP address. When a user leaves the network with which his device is associated (home network) and enters the domain of a foreign network, the foreign network uses the Mobile IP protocol to inform the home network of a care-of address to which all packets for the user's device should be sent.

Mobile IP is most often found in wireless WAN environments where users need to carry their mobile devices across multiple LANs with different IP addresses.

A common analogy to explain Mobile IP is when someone moves his residence from one location to another. Person moves from Boston to New York. Person drops off new mailing address to New York post office. New York post office notifies Boston post office of new mailing address. When Boston post office receives mail for person it knows to forward mail to person's New York address.

ii) DNS server: A DNS server is a computer server that contains a database of public IP addresses and their associated host-names, and in most cases serves to resolve, or translate, those names to IP addresses as requested. DNS servers run special software and communicate with each other using special protocols.

The Purpose of DNS Servers is that it is easier to remember a domain or hostname like bbc.com than it is to remember the site's IP address numbers 38.160.150.31.

iii) **Proxy Server:**