

# **Mawlana Bhashani Science and Technology University**

## **Assignment**

Assignment No: 01

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Course Title: Telecommunication Engineering  
Course Code: ICT-4101

CT Assignment #01

1.
  - (a) What do you mean by switching system. Classify switching system. 6
  - (b) Draw the block diagram of a switching system showing each of its elements. 5
  - (c) In a 100 line folded networks how many switching elements are required for non-blocking operation. 3
2.
  - (a) What are the fundamental features of a common control switching system? 4
  - (b) Draw the block diagram of a common control switching system. 5
  - (c) Categorize the control function in a switching system write a list of functions that the initial translator determines. 5

3.

(a) What is crossbar Switching System? what are the features of crossbar switches? 5

(b) Describe how to configure switching. 5

(c) What is challenges for the crosspoint Technology  
Describe the different categories of the crosspoint technology. 4

4.

(a) What do you mean by stored Program control? 4

(b) Describe the software Architecture of Telecommunication Switching System. 6

(c) Difference between circuit switching, message switching and packet switching. 4

5.

(a) What do you mean by Network traffic? 4

(b) In a particular exchange, during busy hour 1200 calls were offered to a group of trunks, during this time 6 calls were lost. The average call duration being 3 minutes, calculate 3

(i) Traffic offered in Erlangs

(ii) Traffic lost

(iii) Grade of Service

(iv) Period of congestion

3

③ In what ways stored Program control is superior to hard-wire control? 3

④ Explain briefly the operation of a basic time division Space switching. 4

6. ~~Explain how a telephone system works.~~ 6

⑤ What is ISDN? Write down advantages of ISDN. 4

⑥ Describe switching mechanisms. 6

⑦ Classifying signaling techniques. 4

7.

⑧ Draw the TCP/IP model in a single diagram Explain briefly. 4

⑨ If Prefix size is /25. Network mask is 255.255.255.128. Find out the available subnet & usable host per Subnet, total usable hosts. If the IP address 192.128.10.3. Write down Network ID, Host ID and class. 4

⑩ Why TCP is a connection oriented protocol? Explain it with a figure. 3

⑪ What is mask in IPv4 addressing? What is a default mask in IPv4 addressing? 3

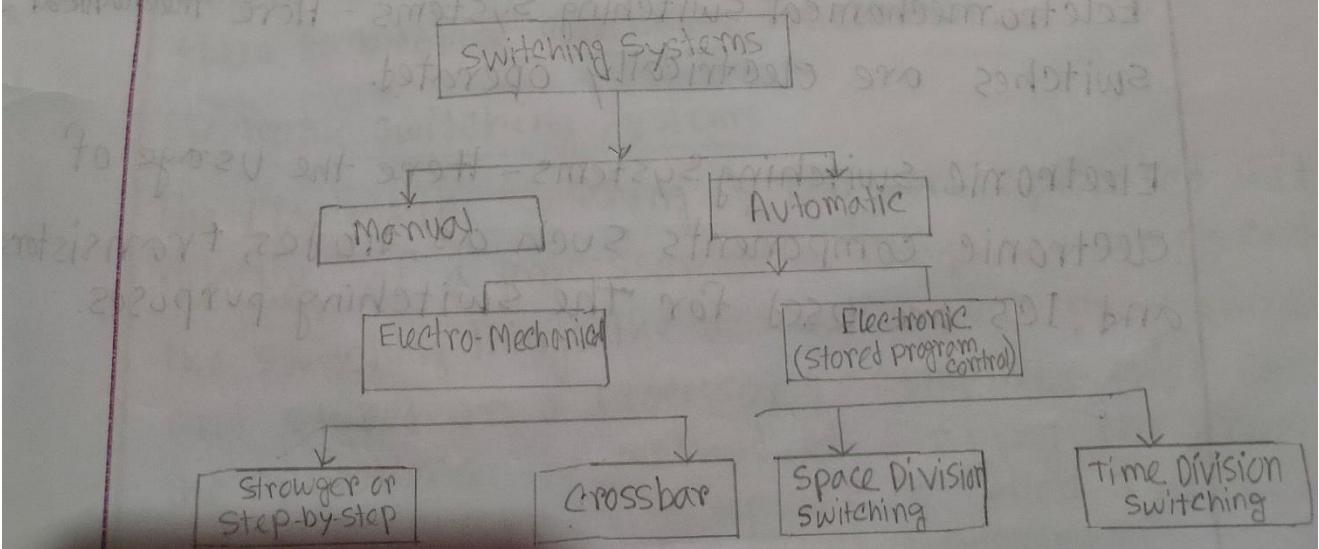
- Q. What is data network? What is the application of data network? 4
- (a) Classify the data networks. 3
- (b) Describe data rates in PSTNs. 3
- (c) Describe Link to Link Layer networks. 4

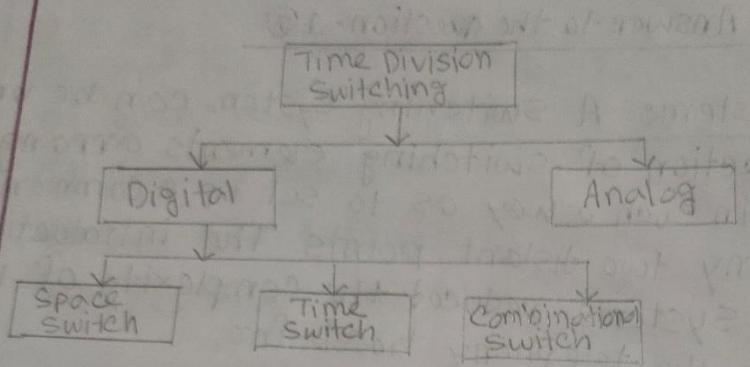
### Answer to the question - 1 ①

Switching System: A switching system can be understood as a collection of switching elements arranged and controlled in such a way as to set up a common path between any two distant points. The introduction of switching systems reduced the complexity of wiring and made the telephony hassle-free.

### Classification of switching System

In the early stages of telecommunication systems, the process and stages of switching, played an important role to make or break connections. At the initial stages, the switch systems were operated manually. These systems were later automated. The following flowchart shows how the switching systems were classified.





The switching systems in the early stages were operated manually. The connections were made by the operators at the telephone exchanges in order to establish a connection. To minimize the disadvantages of manual operation, automatic switching systems were introduced.

The Automatic switching systems are classified as the following -

**Electromechanical switching systems** - Here mechanical switches are electrically operated.

**Electronic switching systems** - Here the usage of electronic components such as diodes, transistors and ICs are used for the switching purposes.

### Electromechanical switching Systems

The Electromechanical switching systems are a combination of mechanical and electrical switching types. The electrical circuits and the mechanical relays are deployed in them. The Electromechanical switching systems are further classified into the following.

#### Step-by-step

The Step-by-step switching system is also called the Strowger Switching System after its inventor A B Strowger. The control functions in a Strowger system are performed by circuits associated with switching elements in the system.

#### Crossbar

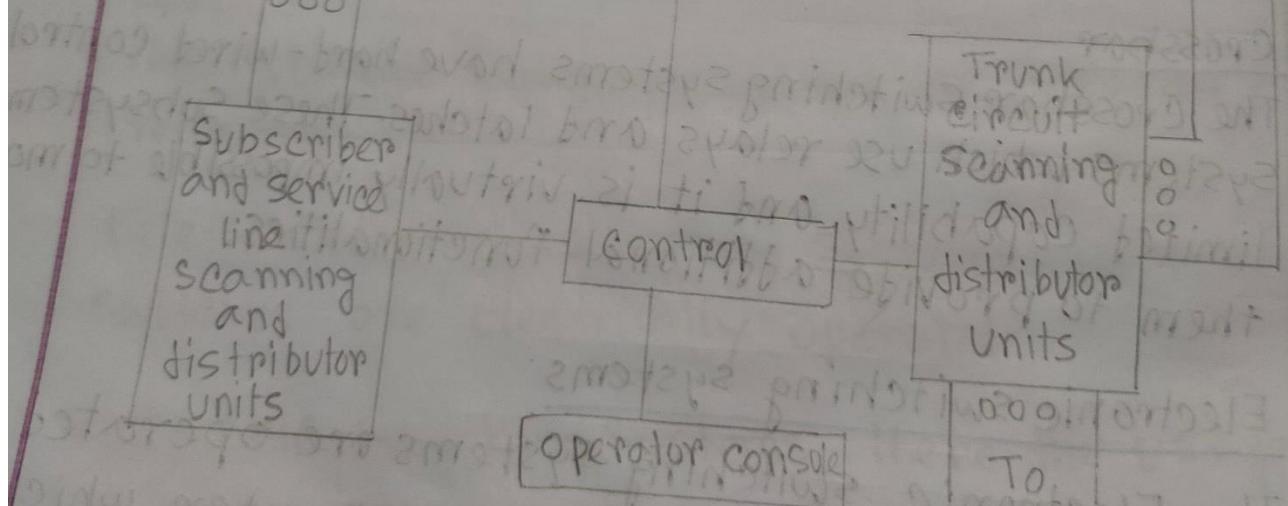
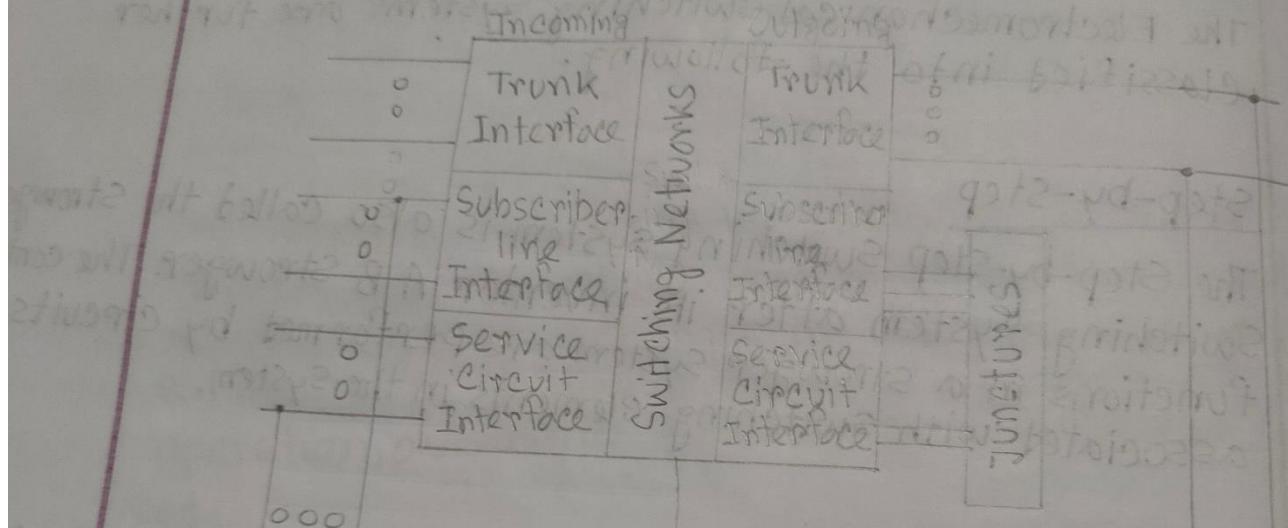
The Crossbar switching systems have hard-wired control subsystems which use relays and latches. These subsystems have limited capability and it is virtually impossible to modify them to provide additional functionalities.

#### Electronic switching systems

The Electronic switching systems are operated with the help of a processor or a computer which control the switching things. The instructions are programmed and stored on a processor or computer that control the operations. The method of storing the programs on a processor or computer is called the stored program control (SPC) technology.

Answer to the question no-1⑥

The block diagram of the switching system given below show the essential elements of a switching systems.



Switching Network - It provides the switching paths between the called subscribers and the calling subscribers.

Trunk Interface - The trunk lines used for connections between the switching systems, are terminated at this port. The Trunk interface is the point where the trunk lines are connected to the system.

Subscriber Line Interface - The subscriber lines used for connections between the subscribers and the switching systems are terminated at this port. The subscriber line interface is the point where the lines from the subscribers are connected to the system.

Line Scanning unit - The line scanning unit senses and obtains the signaling information from the respective lines. The information obtained from these lines are given to the control sub system to identify the inlets and outlets.

Distributor Units - The distributor units are used for distributing or sending out the signaling information on the respective lines. The distribution of information through the trunk lines, is done through the distribution units.

Operator Console - The operator console permits interaction with the switching system for maintenance and administrative purposes.

Service Circuit Interface - The service circuit interface provides interaction between circuits for maintenance and testing purposes.

Junctures - The junctures is a junction that provides a folded connection for the local subscribers and the service circuits. If the calling subscriber both are local, then the folded connection helps in making the connection to a local call, whereas the trunk lines will not be used.

#### Answer to the question NO-1 ©

We know that the number of switching elements required for a nonblocking operation is  $n/2$ .

$$n=100, \text{ therefore we need } n/2 = 100/2 = 50$$

50 switching elements.

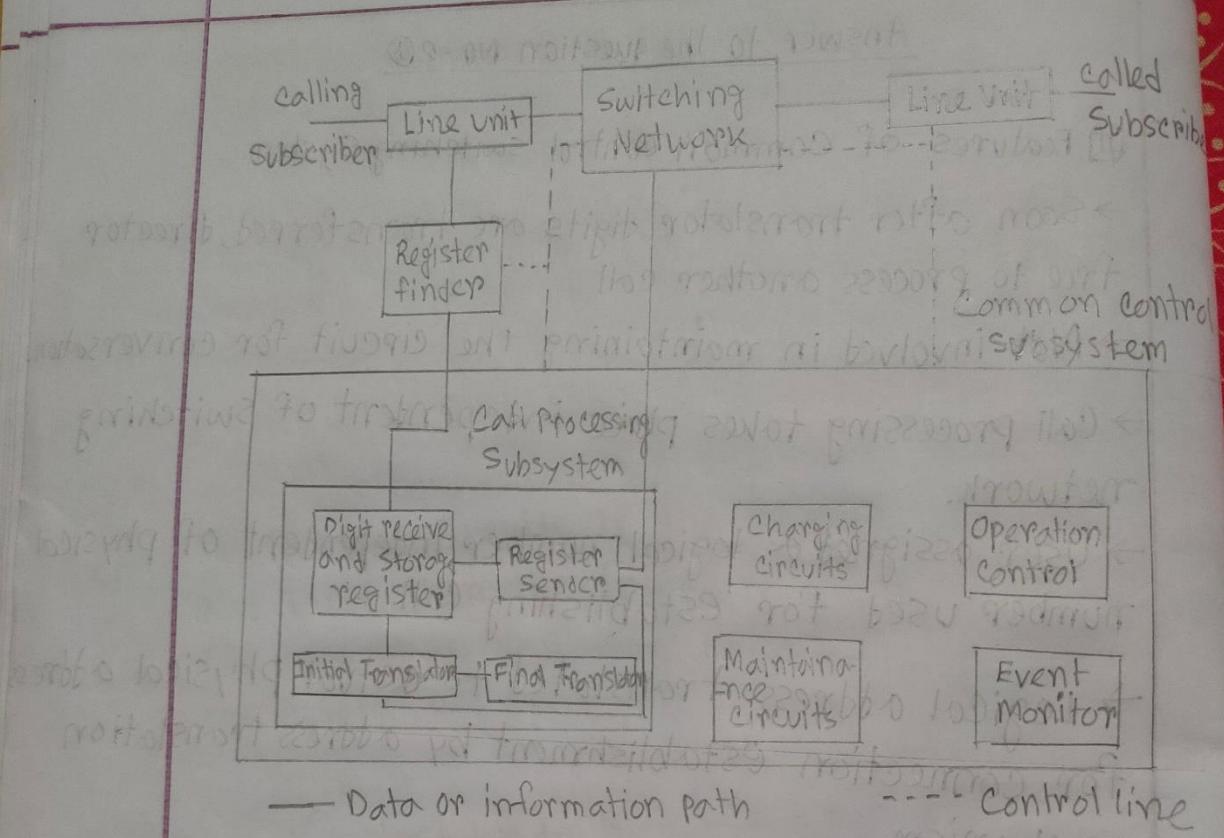
Answer to the question No-2⑧

■ Features of common control switching system.

- Soon after translator digits are transferred, director free to process another call
- Not involved in maintaining the circuit for conversation
- Call processing takes place independent of switching network.
- User assigned a logical number independent of physical number used for establishing call.
- Logical address translated to actual physical address for connection establishment by address translation mechanism.

Answer to the question No-2⑩

■ The following figure shows the diagram of the Common control subsystem, which contains Call processing subsystem, charging circuits, operation control, maintenance control, and Event monitor.



The above block diagram is a simple indication of the Common Control switching system. The control function in a switching system can be categorized as the following.

Answer to the question NO-2@

Event Monitoring: Event Monitoring section of the common control subsystem monitors the events occurring outside exchange at the line units, trunk junctures and inter exchange signaling and sender/receiver units. The events at the line units are call request or call release.

Call processing: The call processing units contain digit receiver and storage register, which receive and store the dialog number from the calling party. The units also contain the initial and final translators. The initial translator is the office code translator that determines the route for the call through the network or charging method or rate. The final translator is the subscriber code translator which determines is the line unit to which a call must be connected and category of the called line.

Charging: This is related to the charges levied on the calls made. It depends upon the type of subscriber and the service of the subscriber.

Operation and Maintenance The control and operation of the switching network with two main techniques known as a map-in-memory and map-in-network.

Answer to the question NO-3@

Crossbar Switch: A crossbar switch is a collection of switches arranged in a matrix configuration. A crossbar switch has multiple input and output lines that form a crossed pattern of interconnecting lines between which a connection may be established by closing a switch located at each intersection, the elements of the matrix.

A crossbar switch is an assembly of individual switches between a set of inputs and a set of outputs. The switches are arranged in a matrix. If the crossbar switch has M inputs and N outputs, then a crossbar has a matrix with  $M \times N$  cross-points or places where the connection cross. A crossbar switching system is also called a coordinate switching system.

The Features of Crossbar Switches

1. While processing a call, the common control system helps in the sharing of resources.
2. The specific route functions of call processing are hardwired because of the wire logic computers.
3. The flexible system design helps in the appropriate ratio selection is allowed for a specific switch.

4. Fewer moving parts ease the maintenance of crossbar switching system.

Answer to the question No-3@

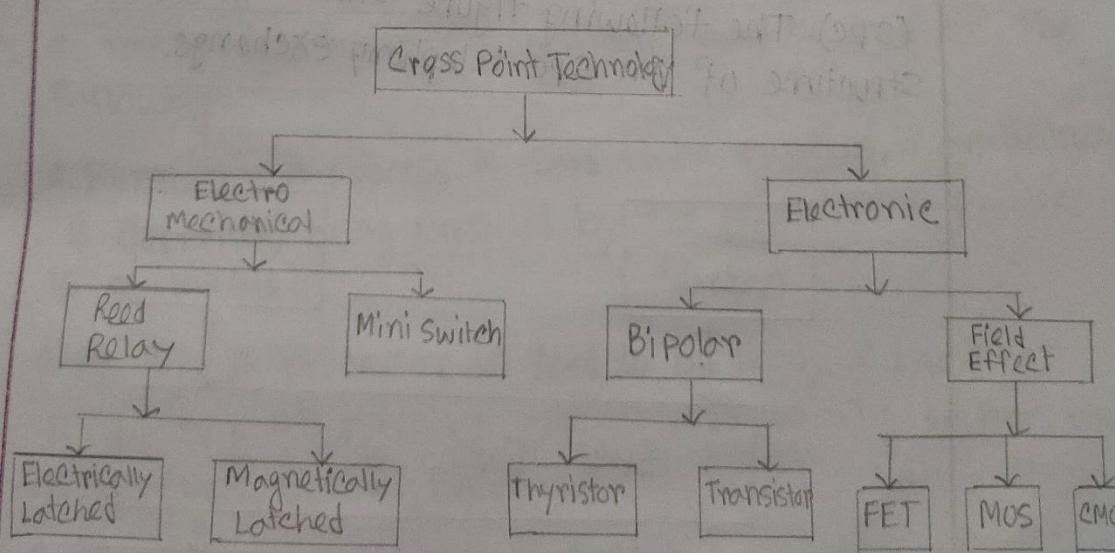
challenges for the Crosspoint Technology

The challenges are described below-

1. Reduction in the size of a crosspoint
2. Reduction in the cost of a crosspoint
3. Improvisation of the switching time

In the process of finding solution to the existing challenges, the cross point technology evolved.

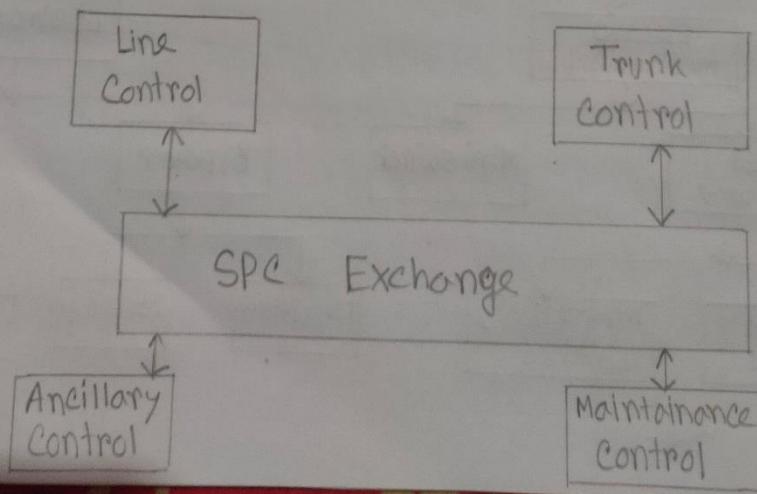
The flowchart given below show the different categories of the Crosspoint technology-



Answer to the question NO-9 ①

Stored Program Control: The Stored Program Control, in short SPC is the concept of electronics that ringed in a change in telecommunication. It permits the features like abbreviated dialing, call forwarding, call waiting, etc. The stored program control concept is where a program or a set of instructions to the computer is stored in its memory and the instructions are executed automatically one by one by the processor.

As the exchange control functions are carried out through programs stored in the memory of a computer, it is called the stored program control (SPC). The following figure shows the basic control structure of an SPC telephony exchange.



The processors used by SPC are designed based on the requirements of the exchange. The processors are duplicated; and, using more than one processor makes the process reliable. A separate processor is used for the maintenance of the switching system.

There are two types of SPCs -

1. Centralized SPC

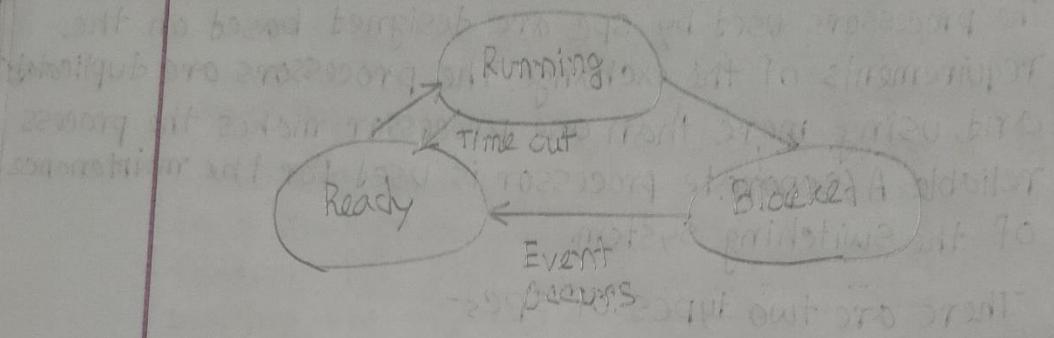
2. Distributed SPC

Answer to the question No-4(b)

### Software Architecture

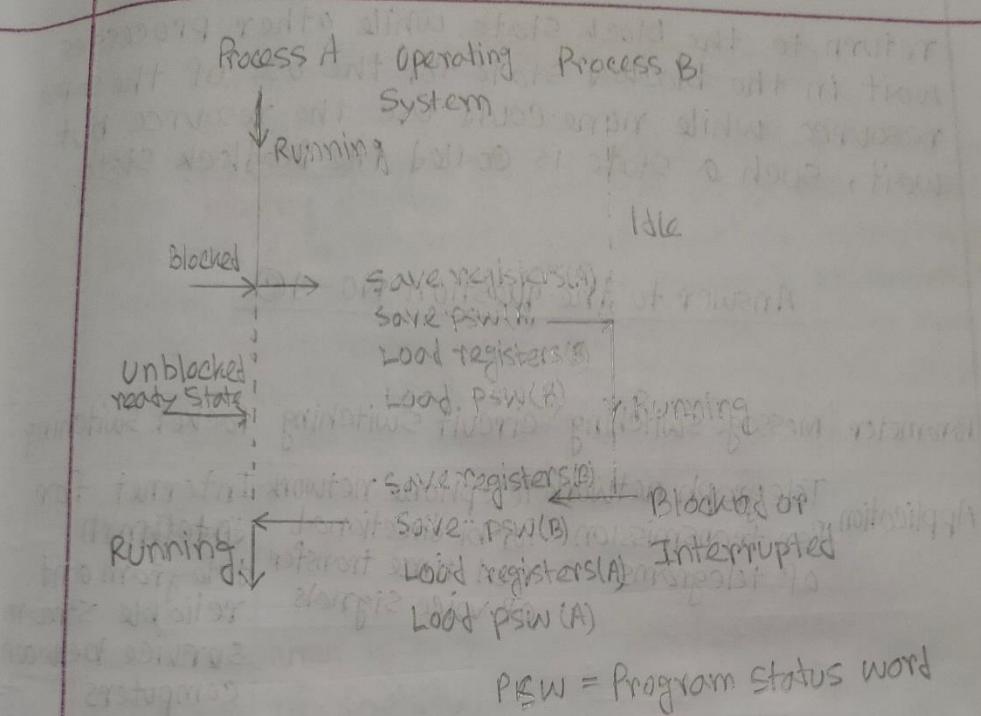
Process in a Multiprogramming Environment: A process in a multiprogramming environment may be one of the following -

1. Running - A process is said to be running, if an instruction is currently being executed by the processor. A process is said to be
2. Ready - A processor is said to be ready if the next instruction of running a process is waiting or has an instruction that is timed out.
3. Blocked - A processor is said to be blocked, if it is waiting for some event to occur before it can proceed

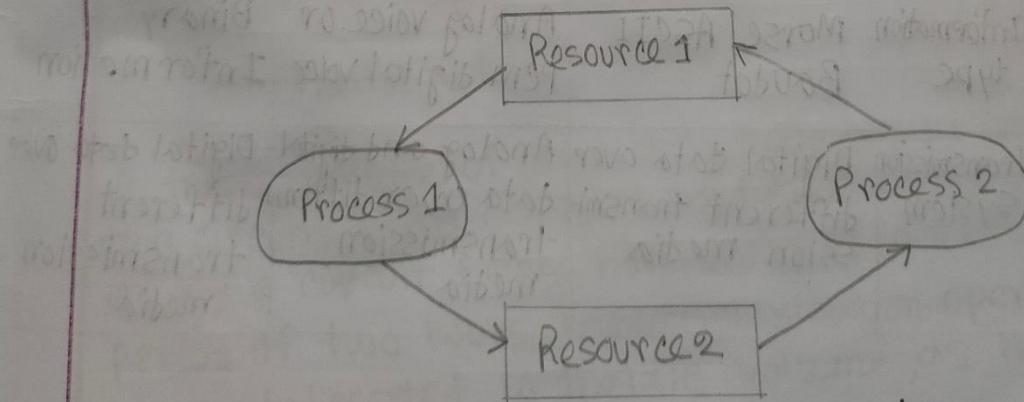


**Process Control Block:** The process control block represents each process in the operating system. PCB is a data structure containing the following information about the process.

- Current running state of the process
- Process Priority which are in the ready state
- CPU scheduling parameter.
- Saves the content of CPU, when a process gets interrupted.
- Memory allocation to the process
- The details of process like its number, CPU usage etc. are present.
- Status of event and I/O resources that are associated with the process.



### Sharing Resources



If two or more processes in a semaphore wait indefinitely for a resource and does not get zero

return to the block state, while other processes wait in the blocked state for the use of the same resource while none could use the resource but wait, such a state is called the Deadlock State.

### Answer to the question NO-4@

Parameter	Message switching	Circuit switching	Packet switching
Application	Telegraph network for transmission of telegrams	Telephone network for bi-directional real time transfer of voice signals	Internet for <del>data</del> <del>graph</del> datagram and reliable stream service between computers
End terminal	Telegraph, teletype	Telephone, modem	Computer
Information type	Morse, ASCII Baudot	Analog voice or PCM digital voice	Binary Information
Transmission System	Digital data over different transmission media	Analog and digital data over different transmission media	Digital data over different transmission media.

Q5) How deadlock can be removed from no out if  
for the above two sensor a lot of things will

Answer to the question No-5

Network Traffic: Network traffic refers to the amount of data moving across a network at a given point of time. Network data is mostly encapsulated in network packets, which provide the load in the network. Network traffic is the main component for network traffic measurement, network traffic control and simulation. The proper organization of network traffic helps in ensuring the quality of service in a given network. Network traffic is also known as data traffic.

Traffic volume is a measure of the total work done by a resource of facility, normally over 24 hours, and is measured in units of erlang-hours. It is defined as the product of the average traffic intensity and the time period of the study.

$$\text{Traffic volume} = \text{Traffic intensity} \times \text{time}$$

A traffic volume of one erlang-hour can be caused by two circuits being occupied continuously for half an hour or by a circuit being half occupied (0.5 erlang) for a period of two hours. Telecommunication operators are vitally interested in traffic volume, as it directly dictates their revenue.

Answer to the question NO-5 (1)

i) Traffic offered in erlangs

is traffic sent or created with different priority levels  
unit to carry traffic  $A = \frac{C}{T} = \frac{1200 \times 3}{60} = 60 \text{ E}$

ii) Traffic lost or discarded when call is rejected  
 $1194 \times \frac{3}{60} = 54.7 \text{ E}$

iii) Grade of service =  $\frac{6 \times 3}{60} = 0.3 \text{ E}$

iv) Period of congestion

in this period the number of calls in queue is zero  
 $B = \frac{6}{1200} = 0.005 \text{ second}$

$0.005 \times 3600 = 18 \text{ seconds}$

and  $18 \times 3600 = 64800 \text{ calls}$

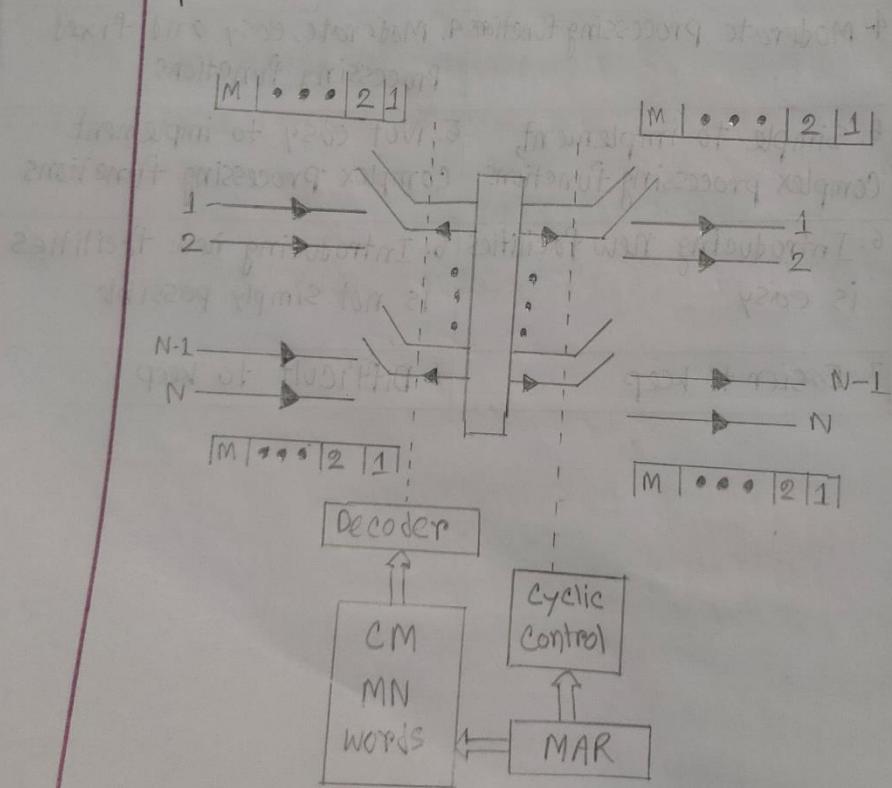
Answer to the question No-5@

The SPC gains superiority over hard wired because of following points:

Stored Program Control	Hard-Wired Control
1. It is flexible	1. It is not flexible
2. It is slower	2. It is faster
3. More costly for	3. Less costly for
4. Moderate processing functions	4. Moderate, easy and fixed processing functions.
5. Simple to implement, Complex processing functions	5. Not easy to implement. complex processing functions
6. Introducing new facilities is easy	6. Introducing new facilities is not simply possible.
7. Easier to keep	7. Difficult to keep

Answer to the question No-58)

A Time division space switch takes outputs of several time division switches (say, TSI switches) which are then given as inputs to space division switches. This means that one of the two similar outputs produced by a TDM switch, can be selected by space switch to deliver to another output path which reduces the number of crosspoints. The model of time division space switch is as shown in the following figure.



A time multiplexed Time Division Space switch can be configured around a Space array, which has  $M$  input horizontals and  $N$  output verticals. If both inputs and outputs are equal,  $M=N$  the switch lead to non-blocking. If inputs are greater than outputs; for concentrating switch we have  $M>N$  and if the output are higher the switch expands gathering one more connection. In every time slot one logic gate per vertical if  $M>N$  or one logic per horizontal if  $M\leq N$  is enabled for one-to-one connections.

In every time slot, up to  $N$  or  $M$  samples are switched simultaneously. Because of the parallel transfer of  $N$  or  $M$  data samples in each time slot, a large number of channels can be multiplexed per input line. If along with multiplexing for control memory modules, full availability has to be achieved, one should opt for time division time multiplexing technique.

Answer to the question NO-6@

ISDN: ISDN was the first defined in the CCITT red book in 1988. The Integrated Services of Digital Networking, in short ISDN is a telephone network based infrastructure that allows the transmission of voice and data simultaneously at a high speed with greater efficiency. This is a circuit switched telephone network system, which also provides access to packet switched networks.

- Advantages of ISDN: ISDN is a telephone network based infrastructure, which enables the transmission of both voice and data simultaneously. There are many advantages of ISDN such as -
1. As the services are digital, there is less chance for errors.
  2. The connection is faster.
  3. The bandwidth is higher
  4. voice, data and video - all of these can be sent over a single ISDN line.

Answer to the question No-6(B)

Switching Mechanisms: The Switching system at the exchange should be able to connect the line automatically to the called subscriber. In the stronger switching system, there are two types of Selectors; these selectors from the building blocks for the the switching systems.

- Uni-Selector
- Two-motion selector

Both of these selectors are constructed using electro-mechanical rotary switches. The Uni-Selector has a single selector pole and multiple throws to reach the bank of contacts for each number dialed. The two-motion selector has two rotary switches for vertical and horizontal stepping movement, to reach the bank of contacts.

Uni-selector Switching: The Uni-selector switching mechanism consists of an Electromagnet, an Armature with springs, a pawl, a ratchet wheel with wiper attached and a detent. The wiper is made to move on the bank contacts in clock wise direction. As the wiper moves in one direction, the process is called Uni-Selector switching.

The contacts onto which the wiper moves are called Bank contacts as a number of contacts are placed in this shape of an arc.

Two-motion Selectors: Unlike in Uni-selector, the motion in these selectors is two-way, vertical and horizontal. An upward movement is made in vertical and horizontal directions; there are no contacts made in the vertical movement. However, bank contacts are made in the horizontal movement. If the two motion selector has 10 levels, each having 10 contacts, then 100 contacts are accessible, by the vertical and horizontal movement of the two-motion selector switching system.

#### Answer to the question NO-6@

④ The signaling techniques are categorized into two, the In-channel Signaling and Common Channel Signaling. However, these are further divided into few types depending upon the frequencies and frequency techniques used.

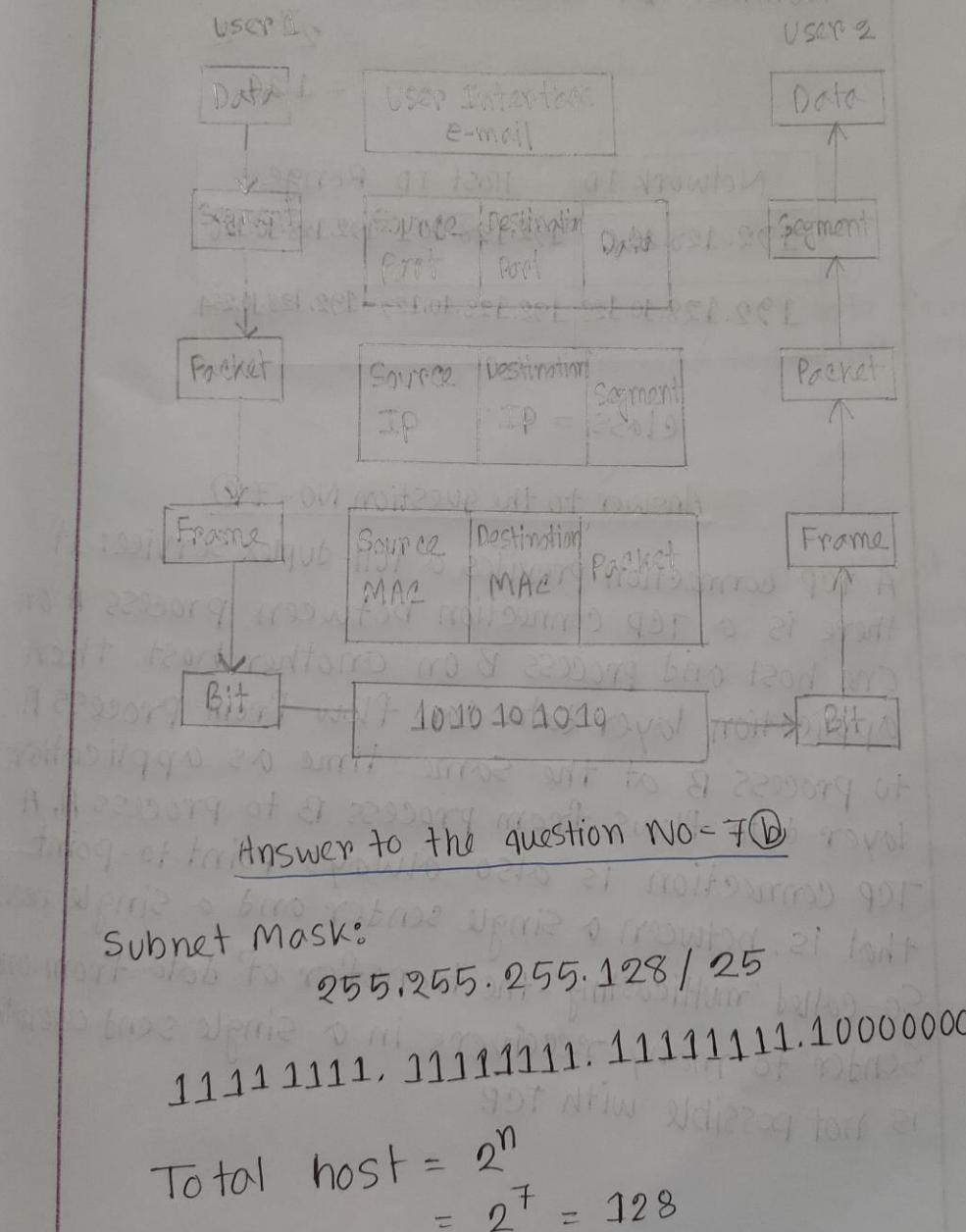


Answer to the question No-7@

TCP/IP Model: TCP/IP stands for Transmission control Protocol / Internet Protocol. TCP/IP is a set of layered protocols used for communication over the internet. The communication model of this suite is client-server model. A computer that sends a request is the client and a computer to which the request is sent is the server.

- **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:** Internet Protocol (IP) works on this layer. This layer facilitates host addressing and recognition. This layer defines routing.
- **Link Layer:** This layer provides mechanism of sending and receiving actual data. Unlike its OSI model counterpart this layer independent of underlying

network architecture and hardware.



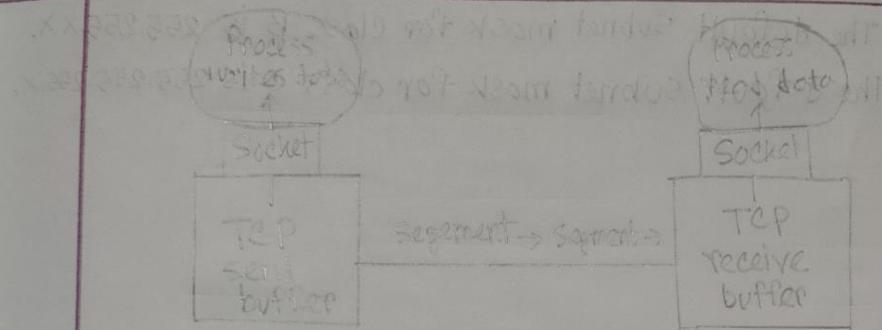
$$\begin{aligned}\text{Number of usable hosts} &= 2^n - 2 \\ &= 2^7 - 2 \\ &= 126\end{aligned}$$

Network ID	Host ID Range
192.128.10.0	192.128.10.1-192.128.10.126
192.128.10.128	192.128.10.129-192.128.10.254

Class = C

### Answer to the question No-7 @

A TCP connection provides a full-duplex service: If there is a TCP connection between process A on one host and process B on another host, then application layer data can flow from process A to process B at the same time as application layer data flows from process B to process A. A TCP connection is also always point-to-point, that is, between a single sender and a single receiver. So-called "multicasting"-the transfer of data from one sender to many receivers in a single send operation-is not possible with TCP.



From time to time, TCP will grab chunks of data from the send buffer and pass the data to the network layer.

#### Answer to the question No-7④

Subnet Mask: A subnet mask is a number that defines a range of IP addresses available within a network. A single subnet mask limits the number of valid IPs for a specific network. Multiple subnet masks can organize a single network into smaller networks (called sub-networks or subnets). Systems within the same subnet can communicate directly with each other, while systems must be on different subnets must communicate through a router.

The default subnet mask for Class A IP address is  
255.0.0.0

The default subnet mask for class B is 255.255.x.x.  
The default subnet mask for class C is 255.255.255.x.