CT-3

1(a) What is switching? Classify automatic switching system. 5

(b) What is switching matrix? mention the types of connections in telecommunica network. 5

(c) Explain message switching briefly. 4

2.(a) What is space division switching? write some advantages and disadvantages of space division switching. 5

(b) What is Crossbar switch? write the features of Crossbar switching.

(c) What is dialing? mention some advantages of automatic switching system. 4

3.(a) What is pulse dialing? Which is used in a rotary dialphone. 5

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(b) Describe the signaling tones briefly. 5

(c) Explain time division switching briefly. 5

4.(a) What is optical switch? write all the features of optical switches. 5

(b) Why we use fiber switching? 4

(c) what is trunk port? How does multi stage switch fabrics work? 5

5 (a) what is time slot interchange? How does time slot interchanger work? 4

(b) Describe the Characterization of telephone ~~trap~~ traffic. 5

(c) what is traffic volume? How does the erlang unit Correspond to ccs? 5

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6(a) what is time multiplexed space switch? How does a time multiplexed space switch work? 5

(b) write the different types of blocking models. 4

(c) Explain the Binomial distribution model. 5

7.(a) what is telephone system and describe it briefly. 4

(b) What is time space time switching? How does a time space time switching work? 5

(c) Describe Traffic offered Carried and traffic Cost briefly. 5

8.(a) Explain the Engset distribution model. 5

(b) Describe the 2 wire to 4 wire Conversion 5

(c) what is network Congestion? write the effects of network Congestion. 4

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CT-3

Answer to the question no: 01 (a)

Switching: Switching is the method that is used to establish Connections between nodes within a network. Once a Connection has been made, information Can be sent.

The autometic switching systems are Classified as the following

→ Electromechanical switching systems:

The electromechanical switching systems are a Combination of mechanical and electrical switching types

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The electrical circuits and the mechanical relays are deployed in them. The electromechanical switching systems are further classified into two types.

① step by step

② Crossbar.

→ Electronic switching systems:

The electronic switching systems are operated with the help of a processor or a computer which control the switching timings. The instructions are programmed and stored on a processor or computer that control the operations.

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Answer to the question no: 01 (b)

Switching matrix: The hardware used to establish Connection between inlets and outlets is called the switching matrix. This switching network is the group of Connections formed in the process of Connecting inlets and outlets.

types of Connections:

→ local Call Connections between two subscribers in the system.

→ Outgoing Call connection between a subscriber and an outgoing trunk.

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→ Incoming Call Connection between an incoming trunk and a local subscriber.

→ Transit Call Connection between an incoming trunk and an outgoing trunk.

Answer to the question no: 01 (c)

Message switching: Message switching is a switching technique in which a message is transferred as a complete unit and routed through intermediate nodes at which it is stored and forwarded. In message switching technique,

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there is no establishment of a dedicated path between the sender and receiver.

The destination address is appended to the message. Message switching provides a dynamic routing as the message is routed through the intermediate nodes based on the information available in the message.

message switches are programmed in such a way so that they can provide the most efficient routes. Message switching treats each message as an independent entity.

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Answer to the question no: 02(a)

The switching system where any channel of one of its incoming PCM highway is connected to any channel of an outgoing PCM highway, where both of them are spatially separated is called the space division switching. The crosspoint matrix connects the incoming and outgoing PCM highways, where different channels of an incoming PCM frame may need to be switched by different crosspoints in order to reach

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differents.

Advantages:

→ space division switching is instantaneou

Disadvantages:

→ Number of Crosspoints required to make space division switching are acceptable in terms of blocking.

→ Slow and bulky.

Answer to the question no: 02(b)

Crossbar switch : In electronics, a Cross-bar switch is a Collection of switches arranged in a matrix Configuration. A crossbar switch has multiple unit

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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 features of crossbar switches:

→ while processing a call, the common control system helps in the sharing of resources.

→ The specific route functions of call processing are hardwired because of the wire logic computers.

→ Fewer moving parts ease the maintenance of crossbar switching systems.

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Answer to the question no: 02(c)

Dialing: Dialing is the action of initialing a telephone call by operating the rotary dial or the telephone keypad of a telephone. This mechanism should be present in the telephone set, in order to connect the call automatically to the required subscriber.

The automatic switching system come with the following advantages

→ Language barriers will not affect the request for connection.

→ Higher degree of privacy is

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maintained.

→ faster establishment and release of calls is done.

→ Number of calls made in a given period can be increased.

→ Calls can be made irrespective of the load on the system or the time of the day.

Answer to the question no: 03 (a)

Pulse dialing: pulse dialing is a signaling technology in telecommunications in which a direct current local loop circuit is interrupted according to a

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defined Coding system for each signal transmitted, usually digit.

A rotary dial phone uses the following for implementing pulse dialing:

- Finger plate and spring.
- Shaft, gear and pinion wheel.
- pawl and ratchet mechanism.
- Impulsing Cam and suppressor Cam or actrigger mechanism.
- Impulsing Contact.
- Centrifugal governor and worm gear.
- Transmitter, Receiver, and bell bypass circuits.

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Answer to the question no: 03(b)

Signalling tones: As the manual exchanges were replaced, the operator who used to communicate the calling subscribers regarding the situation of the called subscribers, needed to be replaced with different tones indicating different situations.

— Respond to the calling subscriber that system is ready to receive the identification of the called party.

— Inform the calling subscriber that the call is being established.

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- Ring the bell of the called party.
- Inform the calling subscriber, if the called party is busy.
- Inform the calling subscriber, if the called party line is unobtainable for some reason.

Answer to the question no: 03(c)

Time division switching: In digital TDM systems, channels are divided by time slot, but switching is still possible. Switching is by a time slot interchanger and is accomplished

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by rearranging the order in which data is read out of the buffer. Incoming data enters a speech store while the outgoing channels indicate to the speech address memory which incoming timeslot it is assigned to. During each time slot, the outgoing circuit reads the speech store slot corresponding to the SAM. The digitized speech information is sliced into a sequence of time intervals or slots.

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Answer to the question no: 04(a)

Optical switch: An optical switch is a multiport network bridge which connects multiple optic fibers to each other and controls data packets routing between inputs and outputs. Some optical switches convert light to electrical data before forwarding it and converting it into a light signal again.

Features of optical switch:

→ All optical switch is a circuit switch with no packet routing.

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→ Does not selectively route Ip packets.

→ switches data on the fiber without Conversion.

→ All optical switch uses OOO switching.

→ Switches the entire light signal from one fiber to another.

→ Has no timing jitter, latency or data Corruption.

Answer to the question no: 04(b)

We use fiber switching because using a fiber switches has many benefits over Conventional copper switches. The

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fiber layer which is used in optical switches is mostly static. This means that optic switch cabling needs to be done only once and can be reconfigured remotely without the need for patching or manual intervention. optical switches reduce cost, power usage, and electrical conversion delays which create transparent paths with near zero latency. In addition because fiber optic switching uses management

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software, it maintains an inventory of cross connects routing.

Ans to the question no: 04(c)

Trunk port: A trunk port is a specific type of port on a network switch that allows data to flow accross a network node for multiple virtual local area networks or VLANS. The trunk port relies on the basic idea of trunking that a single point to point connection can handle two different kinds of traffic.

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Multi stage switch fabrics works:

→ Divide the 100 inlets into groups of 10.

— 1st outlet of each stage 1 block is Connected to an inlet of the 1st stage 2 block.

— 2nd outlet of each stage 1 block is Connected to an inlet of the 2nd stage 2 block.

— 3rd outlet of each stage 1 block is Connected to an inlet of the 3rd stage 2 block.

— i^{th} outlet of each stage 1 block is Connected to an inlet of the ith stage 2 block.

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Answer to the question no: 05 (a)

Time slot interchanger : A time slot interchanger is a time switch that switches one time slot channel in a single physical input to another time slot channel on a single physical output.

Time slot interchanger work:

— Data is written to the speech store cyclically as it comes in.

— path setup control signalling tells the SAM to store the name of the input time slot in the appropriate location

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Corresponding to the output time slot it must be switched to.

— Data is read a cyclically from the speech store in the order of the output time slots as stored in the SAM.

Answer to the question no: 05(b)

Calling Rate: Calling rate is also called arrival rate, or attempts rate, etc.

— Average number of calls initiated per unit time.

— Each call arrival is independent of other calls.

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- Call attempt arrivals are random in time.
- Until otherwise, we assume a large calling group or source pool.

If receive α calls from a terminal in time T: $\gamma = \frac{\alpha}{T}$

If receive α calls from m terminals in time T

$$\gamma_g = \frac{\alpha}{T}$$

Per terminal calling rate $\gamma = \frac{\alpha}{m.T}$

Calling rate assumption:

Number of calls in time T is poisson distributed: $P(x) = \frac{e^{-\lambda} . \lambda^x}{x!}$ $[x = 0, 1, 2, 3 \ldots$

In our case $\lambda = \gamma T$.

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Answer to the question no: 05 (c)

Traffic Volume:

$$V = \alpha . h$$

here α = # Calls in time period T

h = mean holding time.

V = Volume of calls in time T.

1 ccs is volume of traffic equal to
- One circuit busy for 100 seconds.
- two circuits busy for 50 seconds.
- 100 circuits busy for one second.

The Erlang unit Correspond to ccs.

$$1 \text{ ccs/hour} = \frac{100 \text{ Call. seconds}}{1 \text{ hour} \times 60 \text{ min/hr} \times 60 \text{ sec/min}} = 0.027 E$$

$$36 \text{ ccs/hour} = \frac{3600 \text{ call. seconds}}{1 \text{ hour} \times 60 \text{ min/hr} \times 60 \text{ sec/min}} = 1 E$$

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percentage of time a terminal is busy is equivalent to the traffic generated by that terminal in Erlangs

Answer to the question: 06(a)

Time multiplexed space switch: A time multiplexed space switch that is potentially reconfigured entirely in every time slot of each frame.

Time multiplexed space switch work:

- A memory structure called Cross point address memory (XAM) is used to control switching.

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XAM is a RAM with capacity to store the ~~name~~ "word" for each time slot, each word being a number identifying a specific physical input to connect to during each time slot.

— Control signalling tells the XAM to store the name of the physical input in the appropriate time slot location.

— The space switch is rapidly reconfigured at each time slot to affect the proper connections.

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Answer to the question no: 06(b)

There are 3 types of blocking models

(i) Blocked Calls Cleared

— Blocked Calls leave system and do not return.

— Good approximation for Calls in 1st Choice trunk group.

(ii) Blocked Calls held

— Blocked Calls remain in the system for the amount of time it would have normally stayed for.

— If a server frees up, the Call picks up in the middle and Continuous

— Not a good model of real world behaviour.

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- Tries to approximate Call reattempt efforts.

(iii) Blocked Calls wait:

- Blocked calls enter a queue until a server is available.
- When a server becomes available, the calls holding time begin.

Answer to the question no: 06(c)

Assumptions:

- m sources.
- A Erlangs of offered traffic
  - per source: $T_0 = A/m$
  - probability that a specific source is busy: $P(B) = A/m$

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Can use Binomial distribution to give the probability that a certain number (K) of those m sources is busy:

$$P(K) = \binom{m}{K}\left(\frac{A}{m}\right)^K\left(1-\frac{A}{m}\right)^{m-K} = \left(\frac{m!}{K!(m-K)!}\right)\left(\frac{A}{m}\right)^K\left(1-\frac{A}{m}\right)^{m-K}.$$

~~P(B) = P~~

We can have at most N busy sources at a time.

$$P(B) = P(K \geq N) = P(K=N) + P(K=N+1) + \dots + P(K=m)$$

$$= \sum_{K=N}^{m} \binom{m}{K}\left(\frac{A}{m}\right)^K\left(1-\frac{A}{m}\right)^{m-K}$$

$$= 1 - \sum_{K=0}^{N-1} \binom{m}{K}\left(\frac{A}{m}\right)^K\left(1-\frac{A}{m}\right)^{m-K}$$

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Answer to the question no: 07(a)

① Early telephone system:

— powered by self contained local battery.

— Ringing created by cranking generator

② Today's telephone system:

— powered through the line by battary at the central office.

— Circuit is closed when handset is lifted from the cradle.

③ Transmitter

— Carbon granule microphone

— Air pressure of sound waves

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impact on diaphragm, varying pressure on Carbon granules.

④ Receiver

— varying electrical Current passing through windings on magnet, moves a diaphragm. Same as in a music loud speaker.

Answer to the question no: 07(b)

Time space time switching: Time space time switching is when data is switched across time slots and physical Connections.

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Time space time switch work:

— first, we find a time slot that is free from the input TSI to the TMSS and from the TMSS to the output TSI we wish to connect to.

— Next, switch the input channels time slot in question to the free time slot.

— Then at the TMSS, connect the proper input line to the proper output line during free time slot.

— finally, at the output lines. TSI, switch the free time slot to the time slot we wish to switch to.

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Answer to the question no: 07 (c)

Offered traffic (T_0) equivalent to traffic intensity. It takes into account all attempted calls, whether blocked or not, and uses their expected holding times. Consider a group of 150 terminals, each with 10% utilization and dedicated service

$T_0 = A = 150 \times 0.1E = 15.0E$

$T_C = 150 \times 0.1E = 15.0E$

$T_L = 0E$

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$A = T_0 = T_C + T_L$

Here T_0 = offered traffic

T_C = Carried traffic

T_L = Lost traffic

$T_L = T_0 \times$ prob. blocking

$= P(B) \times T_0 = P(B) \times A$.

Answer to the question no: 08(a)

BCC model with small number of sources $(m > n)$

μ = mean departure rate per call.

λ = mean arrival rate of a single source.

γ_K = arrival rate if in the system is state K.

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$\gamma_K = \lambda(m-K)$

Balance equations give:

$$P_K = P_0 \left(\frac{\lambda}{\mu}\right)^K \frac{m!}{K!(m-K)!} \quad \text{and} \quad P_0 = \frac{1}{\sum_{i=0}^{N} \left(\frac{\lambda}{\mu}\right)^i \binom{m}{i}}$$

therefore:

$$P_K = \frac{\left(\frac{\lambda}{\mu}\right)^K \binom{m}{K}}{\sum_{i=0}^{N} \left(\frac{\lambda}{\mu}\right)^i \binom{m}{i}}$$

but we can show that: $\frac{\lambda}{\mu} = \frac{A}{m-A}$

$$P(B) = P(K=N) = E(m,N,A) = \frac{\left(\frac{A}{m-A}\right)^N \binom{m}{N}}{\sum_{i=0}^{N} \left(\frac{A}{m-A}\right)^i \binom{m}{i}}$$

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Answer to the question no: 08(b)

2W to 4W Conversion: for short distances, two way Communication is possible on a single pair of wires. problems occour however when amplificati or digital regeneration is needed. Amplifiers or regenerators in the network are uni directional.

Any telephone Call undergoes 2W-4W Conversions:

- from the phone (4W) to the subscriber line (2W).
- from the subscriber line (2W) to the network interface (4W).

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Balance network has a balance impedance of Z_B. If $Z_B = Z_{line}$ then half the signal goes to the line and half goes to the balance network with little or no Coupling to the local receiver.

Ans to the question no: 08(C)

Network Congestion: Network Congestion in data networking and queueing theory is the reduced quality of service that occours when a network node or link is carrying more data then it can handle.

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Effects of network Congestion:

① Delay: Delay also known as latency. delay is the time it takes for a destination to receive the packet sent by the sender.

② packet loss: while packets may take a while to get to their destination, packet loss is an even more negative effect of network Congestion.

③ Timeouts: Network Congestion can also result in timeouts in various applications.

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