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CT-03

1. a) What are the problems & advantages of space Division Switching? 6

b) Describe Space Division Switching. 4

c) Define Strowger Switching. 4

2. a) What is network traffic load? What are the types of network traffic? 4

b) An exchange serves 2000 Subscriber If the avg. BHCA is 1000 & the CCR is 60%, calculate the busy hour calling rate. 6

Proof,

$$P(T \geq T_1 + t \mid T \geq T_1) = P(T \geq t)$$

c) What is holding time? What are traffic volume & traffic identity?

3. a) What are the application of Wireless Mash Network? 3

b) Determine the limits of visibility for an earth station situated at mean sea level, at latitude 48.42° north and longitude 89.26 degrees west. Assume a minimum angle of elevation of 5°. 6

c) What is Nyquist Theorem? Write down few applications of Nyquist Theorem. 5

4. a) What is link blocking? 4

b) Estimate blocking for a pure distribution switch. 5

c) How to solve the mixing stage? 3

5. a) Define call packing Analyze. How blocking in a network occurs? 5

b) Write down the differences between TSI & TMSS. 5

c) How does a TSI system work? 4

6. a) Describe Time multiplexed space switch (TMSS). 4

b) What is TSI & its role in a time division switching? 5

c) Describe Optical switching? 4

7. a) Define LAN with examples. 3

b) Write down the advantages and disadvantages of LAN. 4

c) Write down the difference between LAN and MAN. 4

d) Define fibre optic networks with its characteristics. 3

8. a) How does a cell get established? 3

b) What is pulse dialing? 3

c) Determine the cutoff frequency of 26 gauge cable loaded with 22 mH inductor at 3000 spacing $R = 440\ \Omega/\text{mile}$, $C = 83\ nF$, $L = 1\ mH$, $G = 0.2\ \mu S$. 8

Ans to the Q. No-1(a)

The advantage of space Division Switching is -

It is instantaneous.

Disadvantages are -

i) Number of crosspoint required to make space division switching are acceptable in terms of blocking.

ii) It's slow.

iii) It's bulky with lots of interconnect wiring.

iv) Subject to cross talk.

v) It's specific route functions of call processing are better than others.

Ans to the Q. No-1(b)

Connecting two channels that are separated in space.
Can be mechanical and/or electronic
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.

Space Division Switch: Any switching mechanism that is based on the through connection of a set of input lines selectively to a set of output lines. They are implemen

either by electromechanical or electronic means.

Ans to the Q. No - 1(c)

The strowger switch is the first commercially successful electromecanical stepping switch telephone exchange system. It was developed by the Strowger Automatic Telephone Exchange Company. Because of its operational characteristics it is also known as a step by step switch.

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Ans to the S. No - 2 (a)

Network traffic or data traffic is the amount of data moving across a network at a given point of time. Network data in computer networks is mostly encapsulated in packets which provide the load in the network. operators often distinguish three bread types of of network traffic sensitive, Best-Effort, and undesireed.

Ans to the Q. No-2(b)

Solution:

Average busy hour calls = BHCA × CCA

= 10000 × 60 %

= 6000 calls

Busy hour calling rate.

$$= \frac{\text{average busy hour calls}}{\text{total number of subscribers}}$$

$$= \frac{6000}{2000}$$

$$= 3$$

∴ The busy hour calling rate is 3. (Ans)

Proof of. $P(T \geq T_1 + t \mid T \geq T_1) = P(T \geq t)$

$$P(T \geq T_1 + t \mid T \geq T_1) = \frac{P(T \geq T_1 + t \cap T \geq T_1)}{P(T \geq T_1)}$$

$$= \frac{P(T \geq T_1 + t)}{P(T \geq T_1)}$$

$$= \frac{e^{-(T_1 + t)/h}}{e^{-T_1/h}}$$

$$= \frac{e^{-T_1/h}\, e^{-t/h}}{e^{-T_1/h}}$$

$$= e^{-t/h}$$

$$= P(T \geq t)$$

$\therefore P(T \geq T_1 + t \mid T \geq T_1) = P(T \geq t)$

[Proved]

Ans to the Q.NO-2(c)

Holding Time: The length of time that a resource is being held (e.g the duration of a phone call)

Traffic volume for an interval is the sum of all the ~~traffic~~ holding times for that interval.

Traffic intensity = Traffic volume/time interval which is a measure of demand.

In generally, signaling may occur either within the subscriber loop - that is within the circuit between the individual telephone instrument & the local office or in circuits between offices

Frequency: The frequency is the number of oscillation per unit time. It is used for defining the cyclic process like rotation, oscilation wave etc.

The completion of the cyclic process at particular interval of time is known as the frequency.

Ans To The Q: No - 3 (a)

Wireless Mesh networks are communic networks which comprise radio nodes in which nodes are arranged in a mesh topology. Mesh topology is an interconnection of all nodes connected with all other nodes in the network. Some of the applications of mesh networks which deserve common are:

↳ Battlefield surveillance.

↳ Tunnels

↳ Mobile video applications.

↳ Emergency situations.

↳ Real time car racing etc.

Voice over Internal Protocol (VoIP) is the main application of wireless mess networks. In order to provide quality of service (Q.S). wireless mess network is used in telecommunication for voice communication. Military forces in the USA are using wireless mesh network to connect their devices for feild operations

Switching system.

↳ Electromechanical switching systems are electrically operated

↳ The usage of electronic components such as diodes, transistors and ICs are used for the switching purposes.

↳ The switching systems in the early stages are operated manually.

Ans to the Q. No - 3(b)

Given data,

$\lambda_E = 48.42^\circ$; $\phi_E = -89.26^\circ$; El=

$a_{GSO} = 42164$ km ; $R = 6371$ km

$\sigma_{min} = 90^\circ + El_{min}$

We know,

$$S = \text{arc sin}\left(\frac{R}{a_{GSO}} \sin \sigma_{min}\right)$$

$$= \text{arc sin}\left(\frac{6371}{42164} \sin(90^\circ + 5^\circ)\right)$$

$$= 8.66^\circ$$

$$b = 180^\circ - \sigma_{min} - S$$

$$= 180^\circ - (90^\circ + 5^\circ) - 8.66^\circ$$

$$= 76.34^\circ$$

$$B = \text{arc Cos}\left(\frac{\text{Cos } b}{\text{Cos } \lambda_E}\right)$$

$$= \text{arc Cos}\left(\frac{\text{Cos } 76.34^\circ}{\text{Cos } 48.42^\circ}\right)$$

$$= 69.15^\circ$$

The satellite limit east of the earth station is at,

$\phi_E + B = -20^\circ$ approx.

and west of the earth station at

$\phi_E - B = -158^\circ$ approx.

Ans

Ans to the q. No- 3(c)

The Nyquist theorem states that an analog signal waveform may be uniquely and precisely reconstructed from samples taken of the waveform at equal time intervals, provided the sampling rate is equal to or greater than twice the highest significant frequency in the analog signal.

$$f_s \geq 2 f_{max}$$

To have high quality standards the following guidelines were put forward by the CCITT:

i) The maximum number of circuits to be used in international call is 12.

ii) No more than four international circuits be used in tandem between the originating & the terminating international switching others.

iii) In exception cases & for a low number of calls, the total number of circuits may be 14, but even in this case, the international circuits are limited to a maximu of four.

Applications:

The Nyquist theorem also known as the sampling theorem. There are few applications of ~~A~~ Nyquist Theorem are listed below!

↳ To maintain sound quality in music recordings.

↳ Sampling process applicable in the conversion of analog to distorte from.

↳ Speech recognition systems and pattern recognition systems.

Ans To The Q. No-4(a)

The NANP divides the territories of it's numbers into numbering plan areas which are encoded numerically with a three-digit telephone number prefix commonly called area code. Each telephone number unique only within its respective plan area.

A national number consists of three parts. They are;

i) The area-code or the trunk code

ii) Exchange code.

iii) Subscriber line number.

Ans To The Q. No 4 (b)

In telecommunications, in band signaling is the sending of control information within the same band or channel used for data such as voice or video. This is in contrast to out of band signaling which is sent over a signaticast channel or even over a separate network.

A major component of any telephone system is signaling in which electric pulses or double tones are used for all alerting,

In generally, signaling may occur either within the subscriber loop - that is within the circuit between the individual telephone instrument & the local office or in circuits between offices

Frequency: The frequency is the number of oscillation per unit time. It is used for defining the cyclic process like rotation oscilation wave etc.

The completion of the cyclic process at particular interval of time is known as the frequency.

The advantages of in-band signaling are:

i) The control signals can be sent to every part where a speech signal.

ii) The control signals will be independent of the transmission signals as they are carried along with the signal.

iii) Analog to digital & digital to analog conversion processes will not affect them.

Ans To The Q: NO-4(c)

Flat Fading:

→ Derivation of fading based on electromagnetic field.

→ Several paths arrive at the receiver at nearly the same instant.

→ Each paths has been shifted in frequency due to the relative motion of mobile.

→ The maximum Doppler shift is geiven by $f_m = v/\lambda$ where v is the mobile velocity & λ is the carrier wavelength.

→ The paths interfere constructively & destructively causing the received power at the mobile to vary with time.

→ The coherence time is the time over which the received power does not change significantly.

A reasonable "ball park" estimate is:

$$T_c \approx \frac{9}{16\pi f_m} \approx \frac{9c}{16\pi v f_c}$$

Ans to the Q. No-5(a)

In a network, the blocking occurs -

↳ There are generally free links in each stage.

↳ problem is that they are mismatched from stage to stage.

Call Packing:

Call packing is a strategy of organizing new calls so that they use free links corresponding to other busy links in the next stage if possible.

Ans To The Q. No-5(b)

Difference between TSI & TMSS -

TSI:

↳ TSI stands for time slot interchange.

↳ A TSI is a time switch.

↳ Switches one time slot channel in a single physical input to another time slot.

TMSS:

↳ TMSS stands for Time Multiplexed space switch.

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

↳ Data is switched such that for each time slot.

↳ Data doesn't switch time slot.

↳ A TSI is a time switch.

↳ Switches one time slot channel in a single physical input to another time slot.

TMSS:

↳ TMSS stands for Time Multiplexed space switch.

↳ A space switch that is potentially reconfigureed entirely in every time slot of each frame.

↳ Data is switched such that for each time slot.

↳ Data doesn't switch time slot.

Ans To The Q. NO - 5(c)

A TSI System works:

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

↳ path set-up control signalling tells the SAM to store the name of the input time slot in the appropriate location 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.

Ans To The Q. NO-6(a)

TSI: A time-slot interchange (TSI) switch is a network switch that stores data in RAM in one sequence & reads it out in a different sequence. It uses RAM, a small routing memory and a counter. Like any switch it has input & output ports. The RAM stores the packets or other data that arrive via its input terminal.

Ans To The Q. No- 6(b)

Optical Switching:

Optical switching refers to a phenomenon in which transmission of an optical field through a device is switched among two or more possible states by optical means.

Applications: Optical switching technology is driven by the need to provide flexibility in optical network connectivity

Prime applications are optical protection, test systems

remotely re configurable add-drop multiplexers & sensing. Possible provisioning & restoration

Working Process:

Traditional switches that connect optical fiber lines are electro-optic. They convert photons from the input side to electrons internally in order to do the switching & the then convert back to photon on the output side. These may separate signals at different wavelength

and direct them to different ports.

Ans To The Q. No-6(c)

TSI (Time Slot Interchanger):

→ A TSI is a time switch.

→ Switches one time slot channel in a single physical input to another time slot channel on a single physical output

→ Functionally equivalent to an nxn space divided switch where n is the

remotely re configurable add-drop multiplexers & sensing. Possible provisioning & restoration

Working Process:

Traditional switches that connect optical fiber lines are electro-optic: They convert photons from the input side to electrons internally in order to do the switching & the then convert back to photon on the output side. These may separate signals at different wavelength

Ans to the Q. No-7(a)

System: A system is one or more autonomous computers & their associated software, peripherals & users.

Sub-system: A logically independent smaller unit of a system.

Ans to the Q. No-7(b)

Difference between Layer & Entity:

Layer	Entity
1. A layer is composed of subsystems of the same rank of all the interconnection systems.	1. The functions in a layer are performed by hard-wave sub-systems.
2. The layers are numbered starting with one at the	2. Entities are communicate with peer

Layer	Entity
3. Layering is a natural choice for communication architecture.	3. There is no communication with entities in the intermediate systems.
4. A layer obtains services from its intermediate lower layer.	4. Entity obtains services from its intermediate higher layer.

Ans to the Q. No - 7 (c)

The layering principle are given below:

↳ Create layers to handle functions which are manifestly different in the process performed.

↳ Collect similar function into the same layer & create a boundary at a point where the number of instructions across the boundary are minimised.

↳ Create a layer of easily localised functions so that the layer could be ~~found~~ totally redesigned & its protocals change.

Ans to the Q. No - 7(a)

⊞ Describe various types of Layers:

According to OSI model there are seven types of layer in network. They are -

i) Physical Layer

ii) Data Link "

iii) Network Layer

iv) Transmission "

v) Session "

vi) presentation "

vii) Application "

Physical Layer:

This is the most lowest layer of the OSI model.

It permits the usages of a realistic variety of physical media & control procedures.

Data Link Layer:

The data link layer deals with error detection & automatic recover procedures required. when a message is lost or corrupted

Network Layer:

The highest link-to-link layer in the OSI model is the network layer. It transmits the packets from

number of time slots per frame.

Ans To The Q.No-8(a)

Process of Establishing a call:

1. calling customer takes phone off hook.
2. C.O detects the loop & indicates readiness with dial tone.
3. calling customer hears dial tone & dials number.
4. The network checks on the called party is alerted.
5. Ring tone is returned to the

caller.

6. The called party picks up the handset & closer his/her loop.
7. Exchange detects second loop and trips or stop ringing.
8. Connected.

Ans. To The Q. No - 8 (b)

Pulse dialing is rapidly disconnected and reconnected in sequence with one pulse for digit value "1", two pulse for digit value "2". Each pulse lasts 0.1 seconds.

Ans To The Q. No- 8(c)

We know,

$$L' = l\Delta x + L_c$$

$$= 1mH\,(3000/5280) + 22mH$$

$$= 22.57mH.$$

$$C'' = C\Delta x$$

$$= 83nF$$

$$= (38000/5280)$$

$$= 42.2nF.$$

$$\omega_c = \frac{2}{\sqrt{L'C''}} = 61.3 \times 10^3 \text{ rad/s}$$

$$f_c = \frac{\omega_c}{2\pi} = 9.76 \text{ kHz}$$ Ans.

xxx