Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

4th Year 1st Semester, B.Sc. (Engg.) in ICT

Course Title: Telecommunication Engineering

Course Code: ICT-4101

Name: Zaber All Khaled ID: IT-17057

Assignment Name: Question and Answer on Lecture 3,4,5.

Assignment No: 03

Zaben Ali Khaled ID: IT-17057

1. a) Write down the different type of frequency bands for satellite communication? 5

b) Describe kepler's laws?

c) Calculate the diameter of a circular orbit for which period is 1 day? 4

2. a) Define Radar? Write the working principle of radar with appropriate block diagram? 5

d) Derive the maximum radar range equation and describe the effects of each parameter? 6

e) Why are capture area and effective area selected as optimal in radar range equation? 3

3. a) Define Apogee and perigee Heights? 4

b) What is the Quality of Service? What are the QoS parameters? Explain in details? 6

c) Draw block diagram of Block calls wait? 4

4. a) What is Nyquist theorem? Write some application of Nyquist theorem? 5

b) Why it is necenary to modulate the picture and sound signals before tranmimi? Why TV tranmimiim carried out in the UHF and VHF bands? 5

c) What is the composite video signal? Enumerate the basic requirment that must be satisfied by the pulse train added after each field? 4

5. a) Define time slot interchange? How TSI work? 6

b) Draw time slot interchange? 8

c) Define Link blocking? Define Estimating blocking 2

6. a) Define time Space-Time Switching with diagram?

b) Draw block diagram of time-Space Time switching?

c) What are the benefits of multiplexi in TSI ?

7. a) Define traffic Engineering? Why we need traffic in telecommunication? 5

b) What is grade of service? What are the related terms of it? 5

c) Describ blocking Models of call? 4

8. a) Draw a telephone network architechure

b) Establishing a call using appropriate diagram? 5

c) Describ Network for planning? 4

Answer to the Question No-1(a)

Satellite communication: A communication satellite is an artificial satellite that relays and amplifies radio telecommunications signals via a transponder, it create a communication channel between a source transmitter and a receivers at different location on Earth.

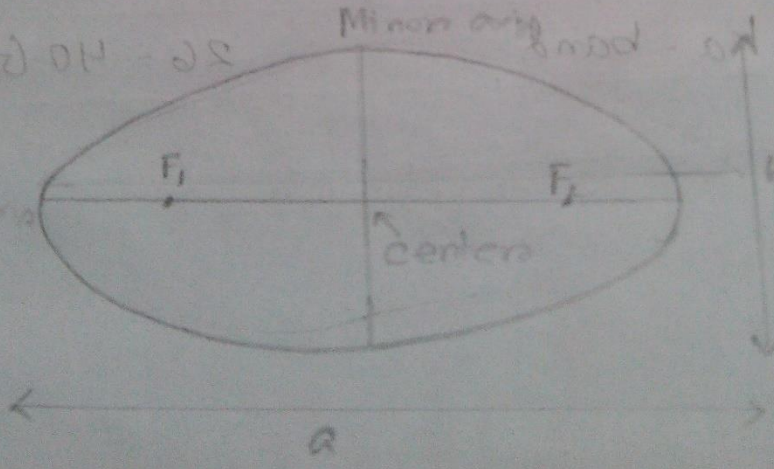
Satellite frequency bands

Band Name	Frequency Range
L-band	1-2 GHz
C-band	4-8 GHz
X-band	8-12 GHz
Ku-band	12-18 GHz
Ka-band	26-40 GHz

Answers to the Question No-1(b)

We know that satellite revolves around the earth which is similar to the earth revolves around the sun. So the principal whic are applied to earth and it's movement around the sun are also applicable to satellite and it's movement around the earth.

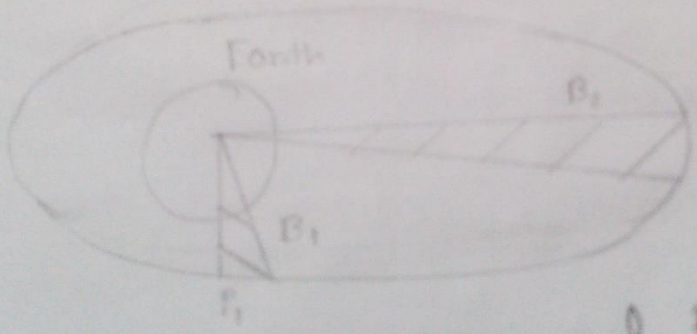
Kepler's First Law: Kepler's first law states that the path followed by a satellite around it's primary will be an ellipse. This ellips has two focal point. Center of mass of the earth will always present at one of the two foci of the ellipse.



If the distance from the center of the object to a point on its elliptical path is considered, then the farthest point of an ellipse from the center is called as apogee and the shortest point of an ellipse from the center is called as perigee.

$$\text{Eccentricity } e = \frac{\sqrt{a^2 - b^2}}{a}$$

Keplers Second Law: Keplers second law states that for equal intervals of time the area covered by the satellite will be same with respect to center of mass of the earth.



The satellite covers P_1 and P_2 distances in the same time interval. Then the areas B_1 and B_2 covered by the satellite instances are equal.

Kepler's third law: Kepler's third law state that the square of the periodic time of a elliptical orbit is proportional to the cube of it's semi major-axis length.

$$T^2 \propto a^3$$

$$\Rightarrow T^2 = \left(\frac{4\pi^2}{\mu}\right) a^3$$

Where, $\frac{4\pi^2}{\mu}$ is the proportionality constant.

A satellite, when it resolves around the earth, undergoes a pulling force from the earth which is gravitational force.

Answer to the Question No. 1(c)

Time is given one day means 24 hr.

we knows $V = \frac{2\pi R}{T}$ [R is radius]

$$\Rightarrow R = \frac{VT}{2\pi}$$

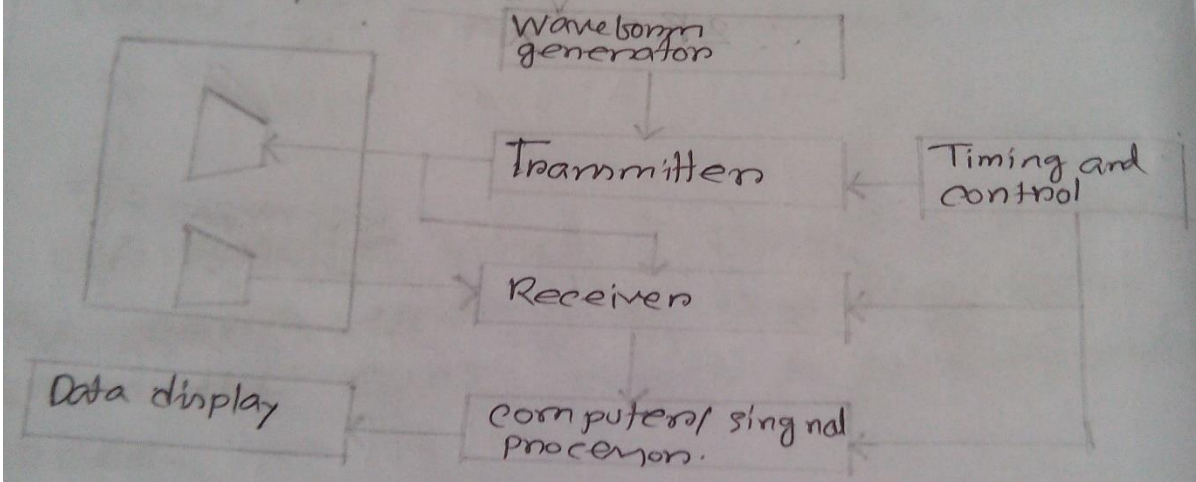
$$\Rightarrow 2R = \frac{VT}{\pi}$$

$$\therefore 2R = \frac{V * 24}{\pi}$$

Answer to the Question No- 2 (a)

Radar: A radar is an electromagnetic sensor used for detecting, location tracking and recognizing objects of various kind at considerable distances.

Antenna System



Answer to the Question No. 2(b)

The standard form of Radar range equation is also called as simple form of Radar range equation.

We know that power density is nothing but the ratio of power and area. So the power density P_{di} at a distance R from the Radar can be mathematically represented as.

$$P_{di} = \frac{P_t}{4\pi R^2} \quad \text{--- (1)}$$

[P_t is the amount of power transmitted by the Radar]

The above power density is valid for an isotropic Antenna. Radious use directional Antennas. Therefore power density P_{dd} due to directional Antenna.

$$P_{dd} = \frac{P_t G_t}{4\pi R^2} \quad \text{--- (11)}$$

Target radiates the power in different from the received input power. The amount of power, which is reflected back towards the Radar depends on its cross section. So the power density P_{de} of echo signal.

$$P_{de} = P_{dd}\left(\frac{G}{4\pi R^2}\right) \quad \text{---} \quad (iii)$$

$$\therefore P_{de} = \left(\frac{P_T G_1}{4\pi R^2}\right)\left(\frac{G}{4\pi R^2}\right) \quad \text{---} \quad (iv)$$

The amount of power P_R received by the Radar depends on the effective aperture A_e of the receving Antenna.

$$P_R = P_{de} A_e \quad \text{---} \quad (v)$$

$$P_R = \left(\frac{P_T G_1}{4\pi R^2}\right)\left(\frac{G}{4\pi R^2}\right) A_e$$

$$\Rightarrow P_R = \frac{P_T G_1 G A_e}{(4\pi)^2 R^4}$$

$$\Rightarrow R^4 = \frac{P_T G_1 G A_e}{(4\pi)^2 P_R}$$

$$\therefore R = \left[\frac{P_T G_1 G A_e}{(4\pi)^2 P_R}\right]^{1/4} \quad \text{---} \quad (vi)$$

Therefore we can say that the range of the target is said to be maximum range when the received echo signal is having the power equal to that of minimum detectable signal. We will get the following equation $R = R_{max}$ and $P_{ro} = S_{min}$ then.

$$R_{max} = \left[\frac{P_t G_1 G A_e}{(4\pi)^2 S_{min}}\right]^{1/4}$$

The maximum range of radar range limited by a number of factor.

* Line of sight.
* The maximum non-ambiguous range.
* Radar sensitivity and the power of the return signal as computer in the radar equation.

Answer to the Question No 2(c)

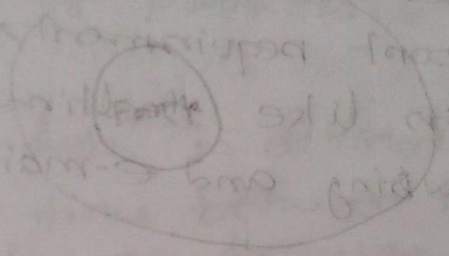
The selected area is called optimal area in radar range equation, because a range of experimental trials was undertaken to highlight a selection of those of those areas that were deemed to be important with respect to the testing of theoretical ideas discussed.

Then the selected area is call optimal are in radar range equation.

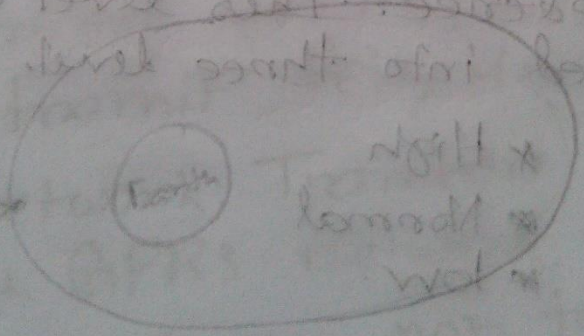
Equation: $$R = \left[\frac{P_T G_1 G \lambda^2 \sigma}{4\pi \lambda^2 S} \right]^{1/4}.$$

Answers to the Question-No-3 (a)

Apogee: The point in the orbit of an object orbiting the earth that is at the greatest distance from the center of the earth.



Perigee: The point in the orbit of an object obiting the earth that is at the closest distance from the center of the earth.



Answer to the Question No-3(b)

Quality of Service: Quality of Service requirements of conventional mobile packet data applications are in assorted forms. The QoS is a vital feature of GPRS services as there are different QoS support requirments for assorted applications like realtime multimedia. web browsing and e-mail transfer.

Paramiters of Quality of service.

Service Precedence: The preference given to a service when compared to another service is known as service Precedence. This level of priority is classified into three level.

* High
* Normal
* low.

, when there is network congestion the packets of low priority are discarded as compared to high or normal.

Reliability: This parameter signifies the transmission characteristics required by an application. The reliabity classes are defined which guarantee certain maximum values for the probability of lost, duplication, missequening and corruption of packets.

Delay: The delay is defined as the end-to-end transfer time between two communication mobile station or between a mobile station and the GI interface to an external packet data network.

This includes all delays within the GPRS network, the delay for request and assignment of radio resource. and the transit delay in the GPRS backbone network. Transfer delays outside the GPRS network in external transit network are not taken into account.

Throughput: The throughput specifies the maximum bit rate and mean bit rate.

Using these dimen Q.S profiles can be negotiated between the mobile user and the network for each session depending on the Q.S demand and available resource.

The billing of the service is then based on the transmitted data volum the type of service and the Chosen Q.S profile.

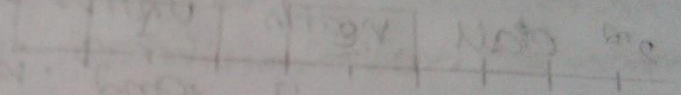
Answer to the Question No - 3 (a)

Blocked Calls Wait

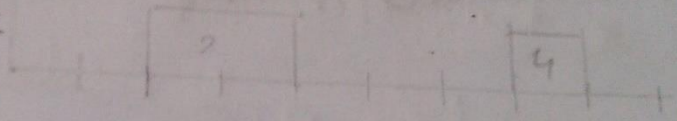
2 Source

10 minute

Source 1
observed traffic

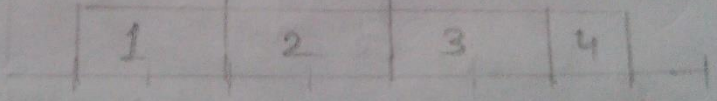


Source 2
observed traffic



Only one Server.

Traffic
carried



Total traffic carried

$T_c = 0.7E$

Total traffic obtained:

$T_c = 0.4E + 0.3E$

$T_c = 0.7E$

1st call arrives and is served

2nd call arrives but served busy

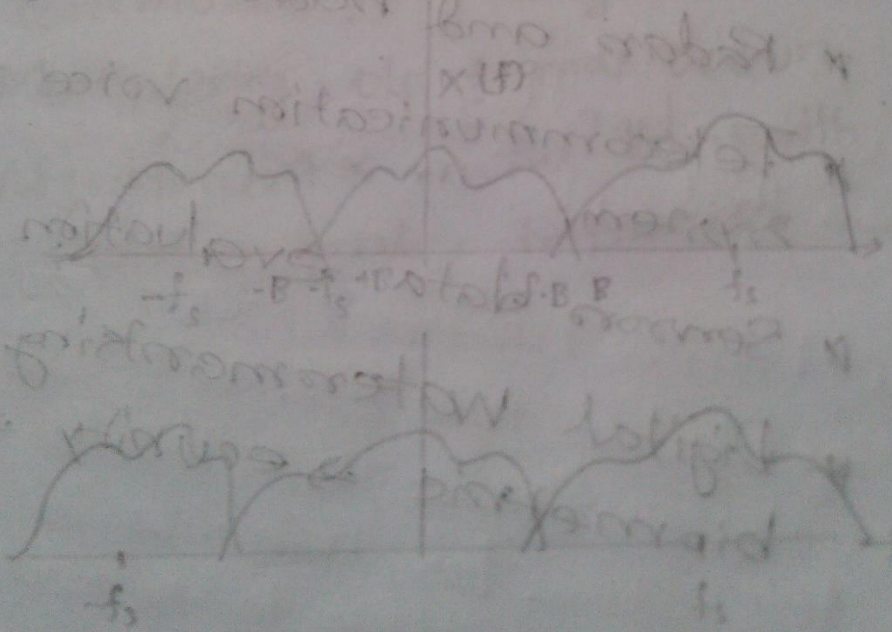
2nd call waits until server free.

3rd call wait and is served.

4th call wait and served.

Answers to the Question No-4(a)

Nyquist-Theorem: The nyquist-theorem in the field of digital signal processing which serves as a fundamental bridge between continuous-time signal and discrete-time signal. It establishes a sufficient condition for a sample rate that permits a discrete sequence of samples to capture all the information from a continuous time signal of finite bandwidth.



Application of Nyquist's theorem

* Analog to digital conversion.
* Digitize analog signal.
* Most application involve music or voice recording and it is applied to maitain sound quality
* Siggnal modulation demodulation
* Speech recognition system.
* Pattern recognition system.
* Radar and radio navigation.
* Telecommunication voice transmission system.
* Sensor data evaluation system.
* Digital watermarking and biometric → security system.

Answer to the Question No- 4(b)

Modulation : Modulation is the process of converting data into radio waves by adding information to an electronic or optical carrier signal. A carrier signal is one with a steady wave form constant height or amplitude and frequency.

We need modulation to.

* Reduce antenna size
* No signal mixing occurs.
* Communication rang increase.
* Multiplexing of signal occur.
* Adjustments in the bandwidth is allowed.
* Reception quality improves

TV transmision is carried out in the UHF and VHF bands; because the main advantage of UHF and VHF transmision is the physically short wave that is produced by the high frequency. The size of transmision and reception antennas is related to the size and short. Smaller and less conspicous antennas can be used with highers frequency bands.

we can also say.

A television tramiminon required a wide bandwidth very much wider than that of an audio tranmmision.

The bands resered for audio broad casting both m.f and h.f are much narrower than the bands allocated for television. too narrow to accommodate even a single station to operate satisfactor

Answer to the Question No- 4 (c)

Composite video signal: Composite video signal is an analog video signal format that carries standard definition video as a single channel.

video information is encoded on one channel, unlike the higher quality S-video and the even higher quality component video. In all of these formats audio is carried on a separate connection.

Pulse train with period T_0 consists of rectangular pulses of duration T. The duty cycle of a periodic pulse train is defined by T/T_0. An application of the periodic pulse train is in the practical sampling process. An even periodic pulse train should be analytical expressed.

Answer to the Question No-5(a)

Time Slot Interchange: Time slot interchange is switched to another. That performed through use of two memory store.

Working principle of TSI:

- Data is written to the speech store cyclically as it comes in sequentially one time slot at a time.

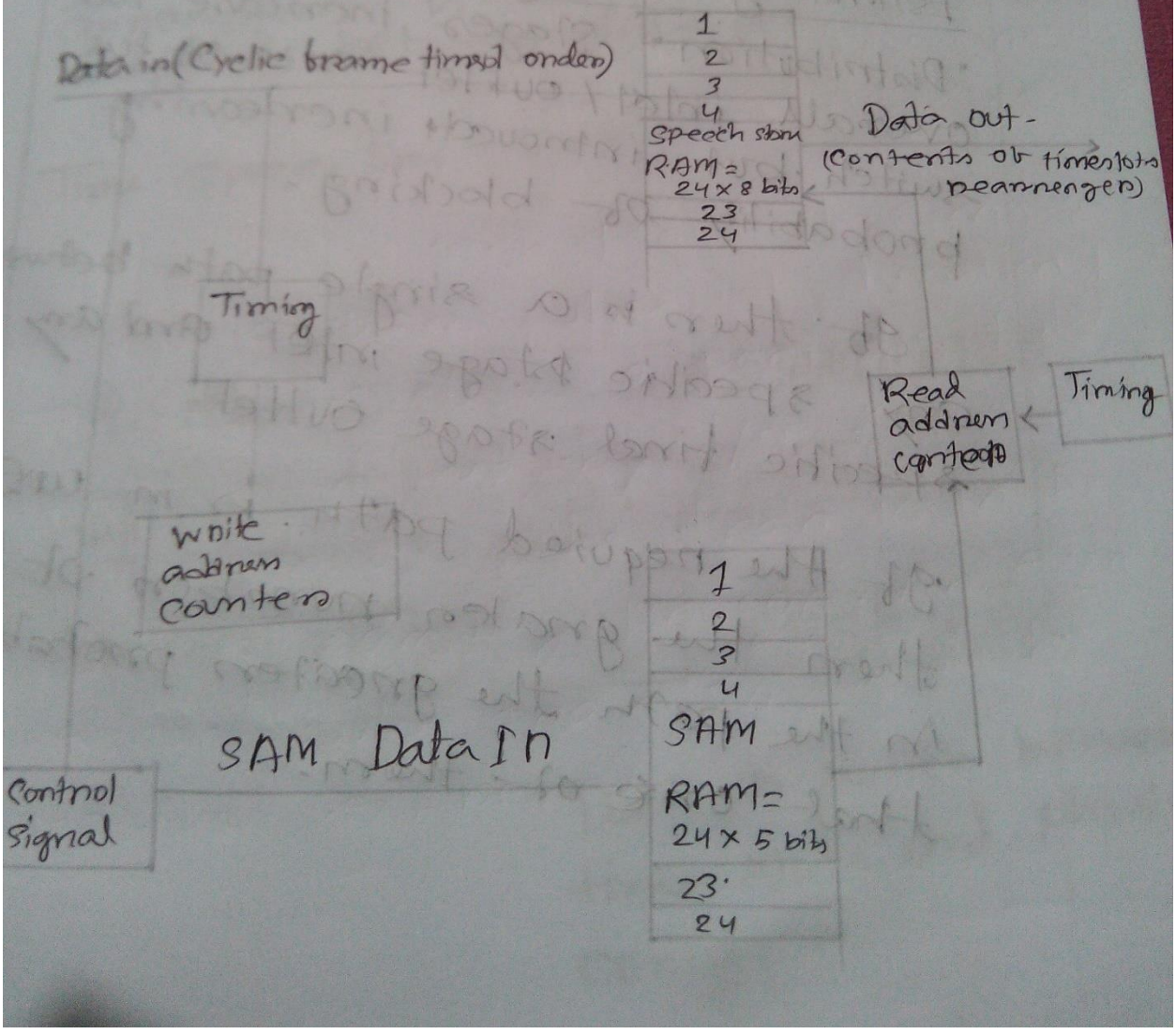
- Path set-up control signalling tells the SAM to store the name of the input time slot in the appropite location corresponding to the output time slot it must be switch to.

* For example, if input time slot 7 is to be switched to output time slot 15, then location 15 of the SAM will store the number "7".

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

So that this means there could be a delay of up to nearly a full frame.

Answer to the Question No-3(b)



Answer to the Question No- 5(c)

Link blocking: In telecommunication when a circuit group is fully occupied and unable to accept further call then the link is block.

Estimating Blocking:

"Distribution" stages increase the overall inlet/outlet size of the switch but introduce increasing probability of blocking.

If there is a single path between any specific stage inlet and any specific final stage outlet.

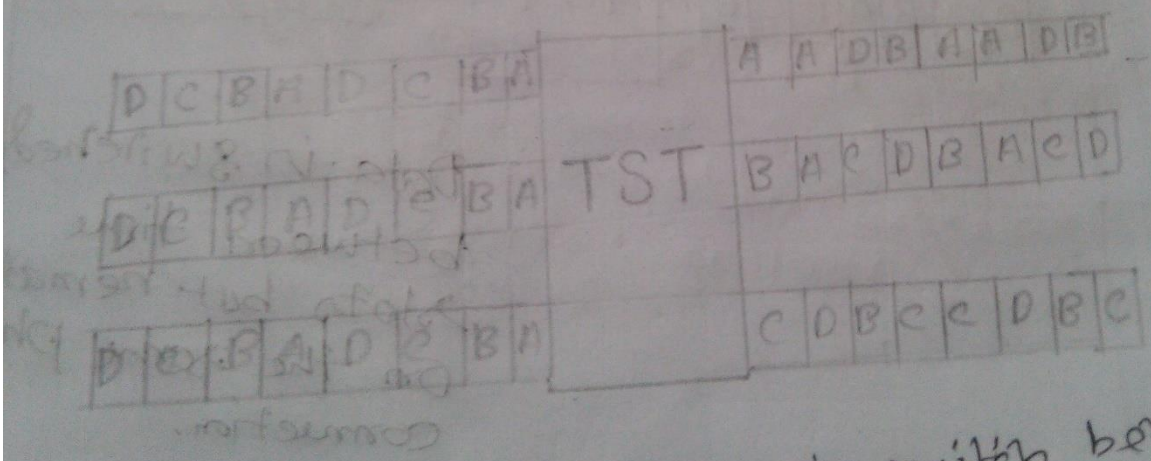
If the required path is in use. then the greater number of link in the path the greater probability that one of them.

Answer to the Question No-6 (a)

Time space time switing: A time space switch takes the outputs of several time division switches.

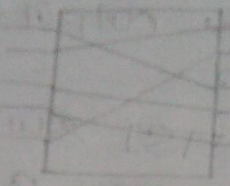
For example: TSI switches and connects them as inputs as a space divison switch. The effect of this paired arrangment is that packets can be swapped between different output lines.

Time - Space - Time - Switch



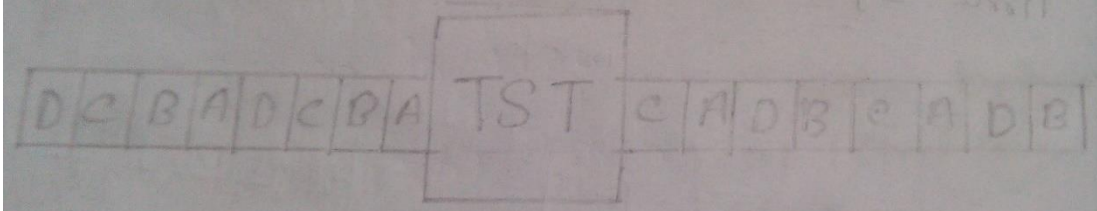
Data is switch betwee
time slots and physi
connection.

Space switch:



Physical inputs are connected to physical outputs but data does not cross time slots.

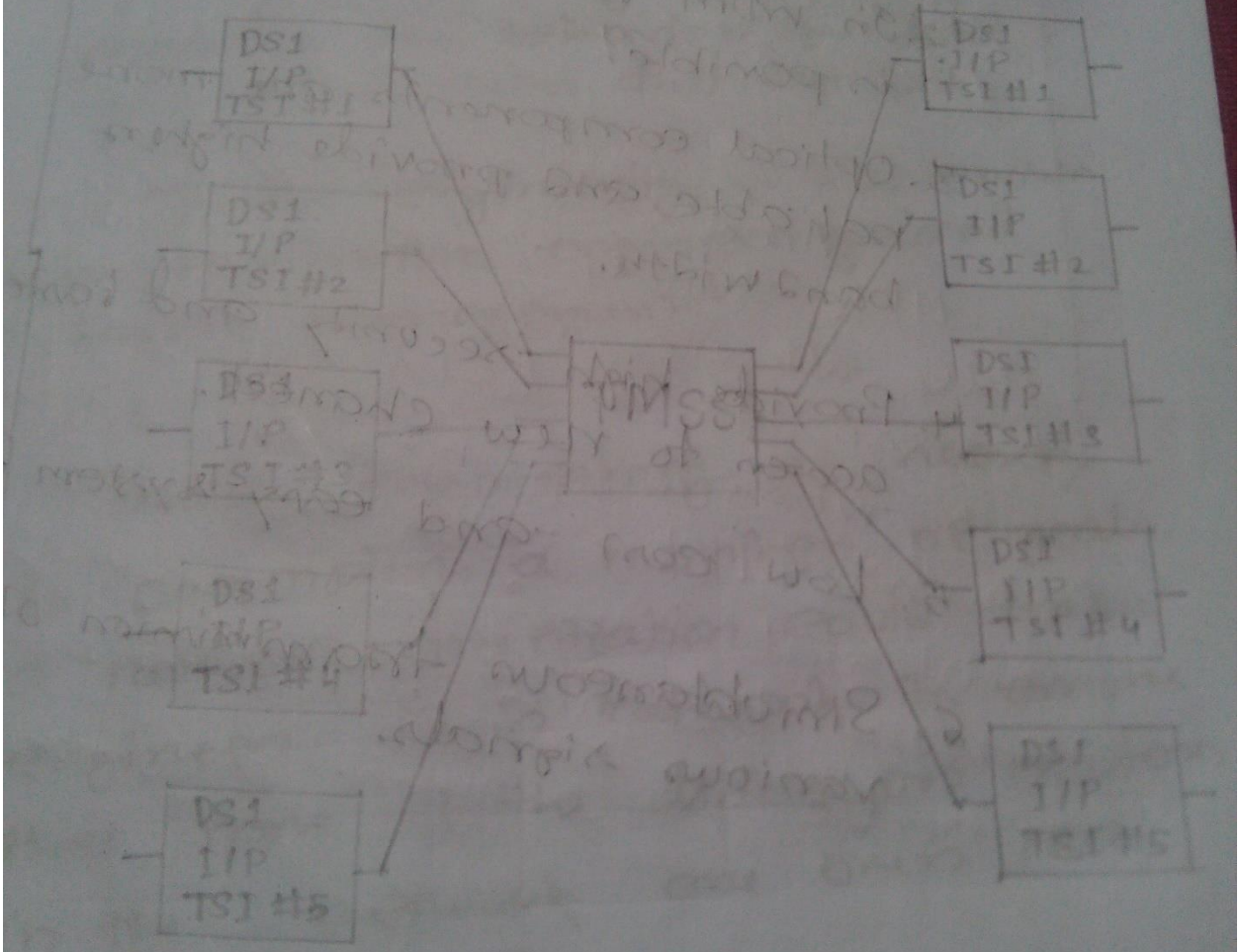
Time switch:



Data is switched between time slots but remains on the same physical connection.

Answer to the Question No- 6(b)

Time-Space-Time Switching is when data is switched across time slots and physical connection.



Answers to the Question No- 6 (c)

Benefits of Multiplexing JSI

1. It is easiers to reconbigre.
2. In WDM full-duplex trammimion is poniible.
3. Optical eomponents are more reliable and provide higher bandwidth.
4. Provide high security and faster accen to new chaneel.
5. Low cost and eary system exper
6. Simultaneous trammimion of various signals.

Answer to the Question No-7(a)

Traffic Engineering: Traffic engineering is a method of optimizing the performance of a telecommunications network by dynamically analyzing, predicting and regulating the behavior of data transmitted over that network.

Traffic engineering is also known as teletraffic engineering and traffic management.

Traffic engineering is necessary to accomplish a number of goals. A network organization could traffic engineer their network to ensure that none of the links or routers in the network are over or under utilized.

Alternatively, a network organization could use traffic engineering to control the path taken by voice packets in order to ensure appropriate levels of delay, jitter and packet loss.

~~Answer to the Ques~~

MPL supports traffic engineering thus allowing network organizations to associate a labeled switched path with whatever physical path they choose. MPLS also supports constraint based routing which ensure that an LSP can meet specific performance requirements.

Answer to the Question No-7(b)

Grade of Service: Grade of service in telecommunication and in particular teletraffic engineering grade of service is the probability of a call in a circuit group being blocked or delayed for more than a specified interval expressed as a vulgar fraction or decimal fraction.

Parameters of Grade of Service.

Busy Hour: One hour period during which traffic volume or call attempts is the highest overall during any given time period.

Peak Busy Hour: Busy hour for each day usually varies from day to day.

Busy season: 3 months with highest average daily busy hour.

High Day Busy Hours: Open hour period during busy season with the higher load.

Answer to the Question-7(c)

There are three types of Block model

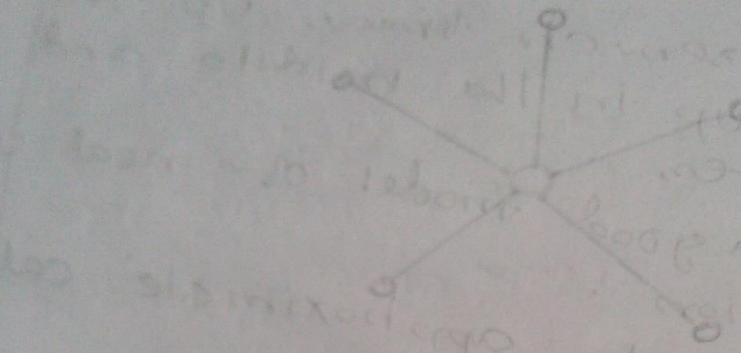
1. Blocked Calls cleared
   - Blocked call level system and do not return.
   - Good approximation for calls in 1st choice trunk group.

2. 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 continues.
- Not a good model of real world behavior.
- Tries to approximate call reattempt efforts.

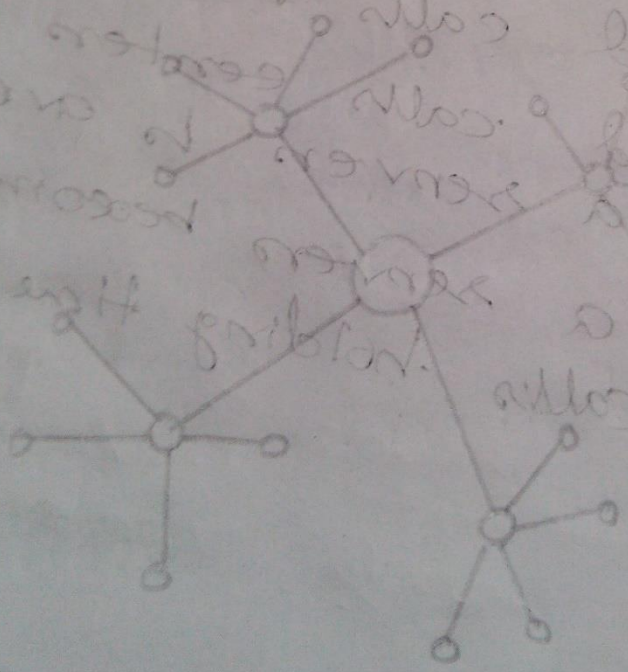
3. Blocked calls wait.
- Blocked calls enter a queue until a server is available.
- When a server becomes available the calls holding time begin.

Answers the Question No-8(a)

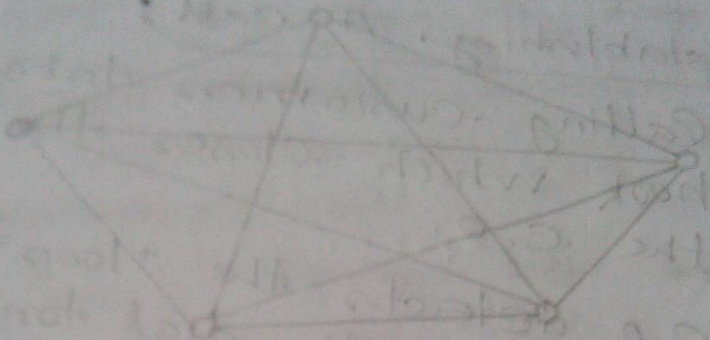
Telephone Network Architecture.



a) Ans: Star



b) Double Star



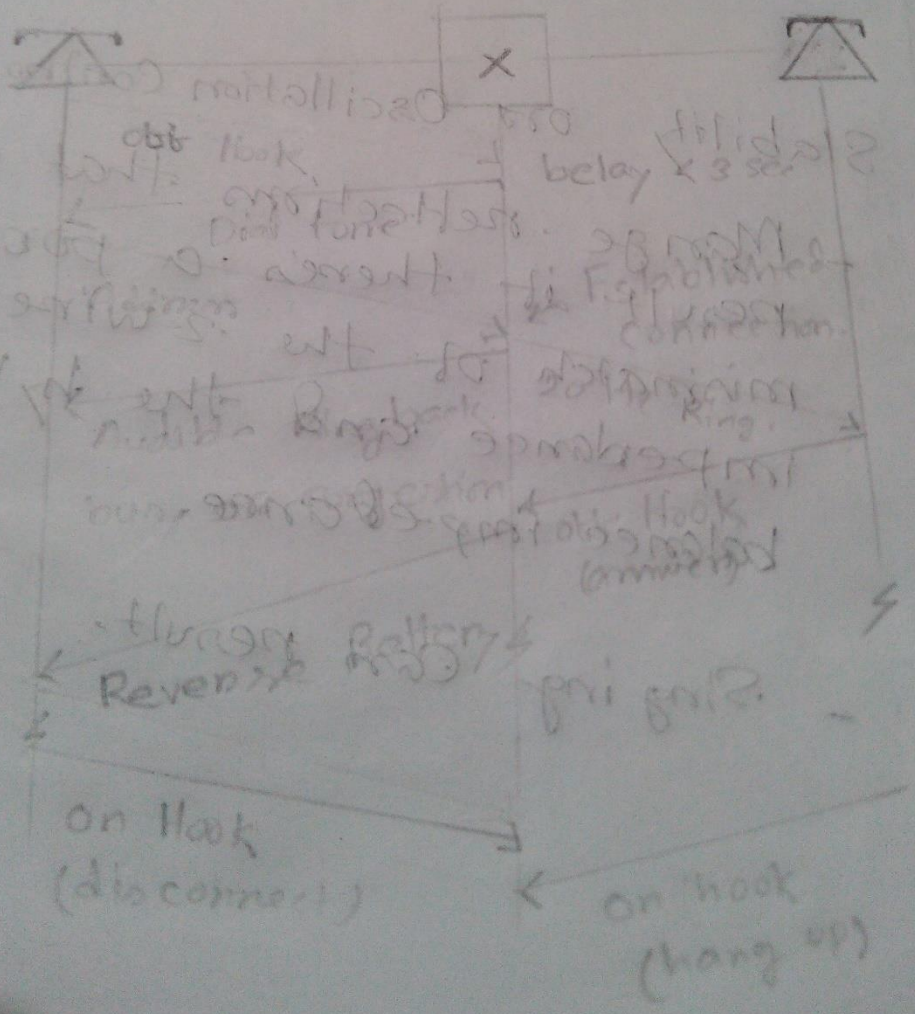
- Full MESH

Answers to the Question No-8(b)

Establishing A call :

1. Calling customer takes phone off hook which closes the circuit to the C.O.
2. C.O. detects the "loop" and indicates readiness with dial tone.
3. Calling customer hears dial tone and dials tone and number.
4. The network checks on the called party status and decides on a routing for the connection.
5. If connection possible. the called party is alerted.
6. 'Ring tone' is returned to the caller.

7. The called party picks up the handset and closes the loop.
8. Exchange detects second loop and "trips" on ringing then establishes call.
9. One party opens loop by hanging up and exchange clears connection



Answer to the Question No- 8(c)

Network loss planning

Received Volume Control.

- Subscribers must have a received signal level within an appropriate.
- Not too loud and control: Singing

Stability or Oscillation Control: "Singing"

- Manage reflections that can result if there's a poor mismatch of the 2-wire line impedance and the hybrid balance impedance.
- Singing can result.

Talker Echo.

- Talker should not hears his/hers own voice reflected back (with a significat enough delay).

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