CT-03

Question no ; 01

1. (a) What is Trunk switch?

(b) Explain circuit switching, message switching and packet switching.

(c) Describe technique of seperating circuits.

Question no; 02

2. (a) What is access switch?

(b) How does a time-space-time switch work?

(c) Explain time slot interchanger (TSI).

Question no: 03

3. a) What is traffic offered?

b) Describe Traffic engineering Trade offs.

c) Explain types of blocking model.

Question no: 04

4. a) What is Poisson Traffic model?

b) Differentiate time congestions and call congestion.

c) Calculate probability of blocking.

Question no ; 05

5. a) What are the failure of the poisson model as valid for situations with high blocking?

b) Explain Erlang B Model.

c) Explain B Birth-Death process

An Question no : 06

6. a) Define Receiver

b) What is transmitter? Differentiate between early telephone system and todays telephone system.

c) Show PSTN circuit model.

Question no: 7

7. a) What is DTMF signalling?

b) What are the procedures of establishing a call?

c) Describe pulse dialling.

Question no: 08

8. a) Define SRL.

b) Describe Subscriber Loop.

c) How do you determine the target resistance?

Ans to the question no; 1(a)

Trunk switch:

Trunk switch also called traffic switch. Trunk switch is defined as one to one connection which has one specific intel that is must connect to one specific outlet

Ans to the question no; 1(b)

- Circuit switching
  - A path is established between the caller and destination.
  - Real time connection formed.
  - Example:- PSTN
- Message switching
  - Aso called store and forward.
  - A message is first stored in a buffer and then sent on in its entirely.
  - No real time connection (i.e connectionless)

- Packet switching

  - A message is broken down into parts and each part is sent separately (possibly via different routes)

  - Example: Internet UDP protocol.

<u>Ans to the question no: 1(c)</u>

Separating circuits

- Four technologies for separating circuits;

  (i) Space

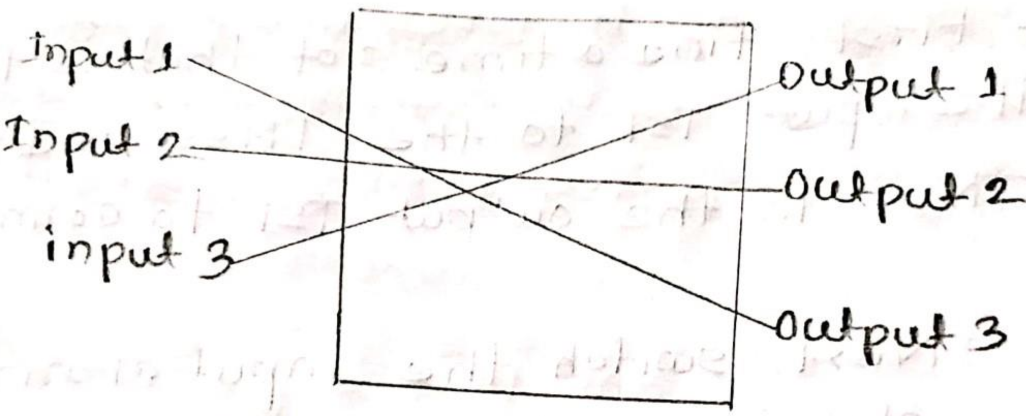
  (ii) RF frequency

  (iii) Time

  (iv) optical wavelength.

- There is logically connect circuits coming into a switch with circuits at the output.

• Example " space division" equivalent inter-connection pattern.



Ans to the question no: 2(a)

~~Access switch~~:

Access switch is considered as one to any connection which has one specific inlet must connect to any free outlet.

Ans to the question no: 2(b)

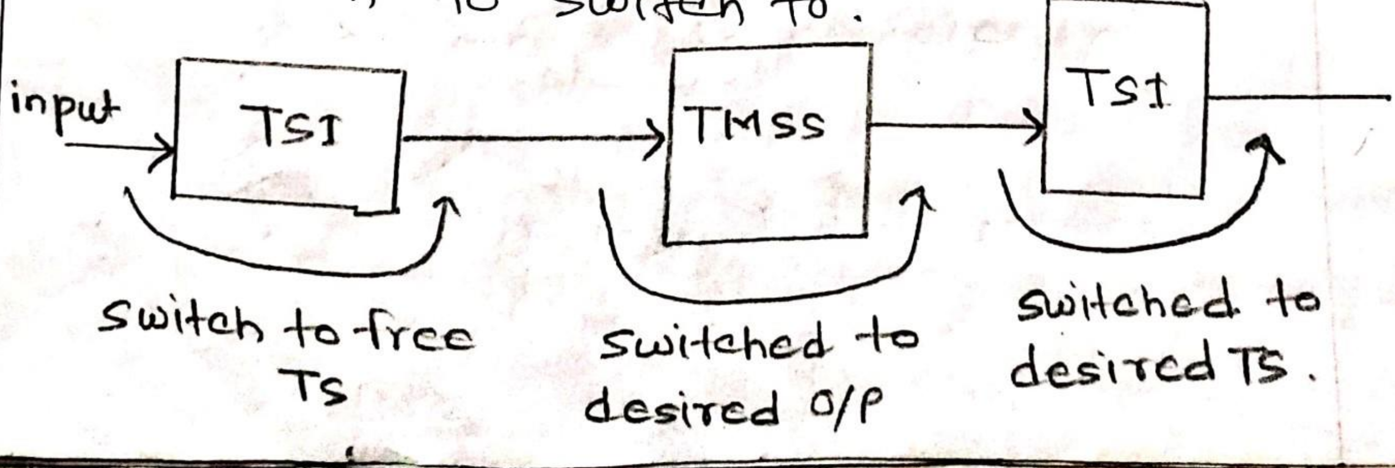
Time-Space-Time switching working process:

- First, find a time slot that is free from the input TSI to the TMSS and from the TMSS to the output TSI 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 line's TSI, switch the free time slot to the time slot we wish to switch to.



Ans to the question no: 2(c)

Time slot interchanger:

- In a TSI, one time slot is switched to another.
- Performed through use of two memory stores:

- Speech store is RAM with to store one full frame of data.

  - For DS1 (1.544 Mbps) with 24 channels of 8 bits, the speech store is 24 bytes long.

- Speech address memory or Time switch connection store is RAM with capacity to store a word for each time slot, each word being a number identifying a specific time slot.

  - For DS1, the SAM has capacity to store 24 words of 5 bits per word (need 5 bits to store a number between 1 and 24)

Ans to the question no: 3(a)

Offered traffic (To) equivalent to traffic intensity (A). It takes into account all attempted calls, whether blocked or not and uses their expected holding times.

Ans to the question no: 3(b)

Traffic Engineering Trade offs

- Designs number of transmission paths or channels.
  - How many required normally
  - What if there is an overload.

- Design switching and routing mechanisms.
  - How do we route efficiently?
  - E.g.
    - High usage trunk groups.
    - Overflow trunk groups.
    - Where should traffic flows be combined

- Design network topology
  - Number and sizing of switching nodes and Locations.
  - Number and sizing of transmission systems and locations.
  - Survivability

Ans to the question no: 3(c)

Three types of blocking models.

- Blocked calls cleared (BCC)
  - Blocked calls leave system and do not return.
  - Good approximation for calls in 1st choice trunk group
- Blocked calls Held (BCH)
  - Blocked calls remain in the system for the amount of time it would have normally stayed for,
  - If a server feeds up, the call picks up in the middle and continues.

- Not a good model of real world behaviour
- Tries to approximate call attempts efforts.

- Blocked calls Wait (BCW)
  - Blocked calls enter a queue until a server is available.
  - When a server becomes available, the calls holding time begins

Ans to the question no: 4(a)

Poisson Traffic model:

- Poisson approximates Binomial with large m and small A/m

$$P_K = \frac{e^{-\lambda} \lambda^k}{k!}$$

Where λ = mean # of Busy sources.

and Possion = $\lim_{m \to \infty}$ (Binomial)

Ans to the question no: 4(b)

Time congestions vs. Call congestion

- Time Congestion
  - Proportion of time a system is congested (all servers busy)
  - Probability of blocking from point of views of servers.

- Call Congestion
  - Probability that an arriving call is blocked
  - Probability of blocking from point of view of calls.

for call, $P(B) = P(K > N)$

probability that there are more sources wanting service than there are servers.

For time,

$P(B) = P(K \geq N)$

Probability that all servers are busy.

Ans to the question no: 4(c)

Probability of blocking:

$$P(B) = P(K \geq N) = P(N) + P(N+1) + \cdots + P(\infty)$$

$$= \sum_{K=N}^{\infty} \frac{e^{-A} A^K}{K!} = \sum_{K=N} \frac{A^K}{K!} e^{-A}$$

[where $P(K) = \frac{e^{-A} A^K}{K!}$

$$= 1 - \sum_{K=0}^{N-1} \frac{A^K}{K!} e^{-A}$$

$P(B) = P(N, A)$ ← Offered traffic

Poisson N = #servers

Example,

$P(7, 10)$

↑

Poisson $P(B)$ with 10 E
offered to 7 servers

Ans to the question no; 5(a)

Failure of the Poisson model,

(i) Poisson only good approximation when
low blocking

(ii) Use Erlang B if high blocking.

Above are the failure of Poisson model as
valid for situations with high blocking.

Ans to the question no: 5(b)

Erlang B Model,

- More sophisticated model than Binomial or poisson.
- Blocked calls cleared (BCC)
- Good for calls that can reroute to alternate route if blocked.
- No approximation for reattempts if alternate route blocked too.
- Derived using birth-death process

Ans to the question no: 5(c)

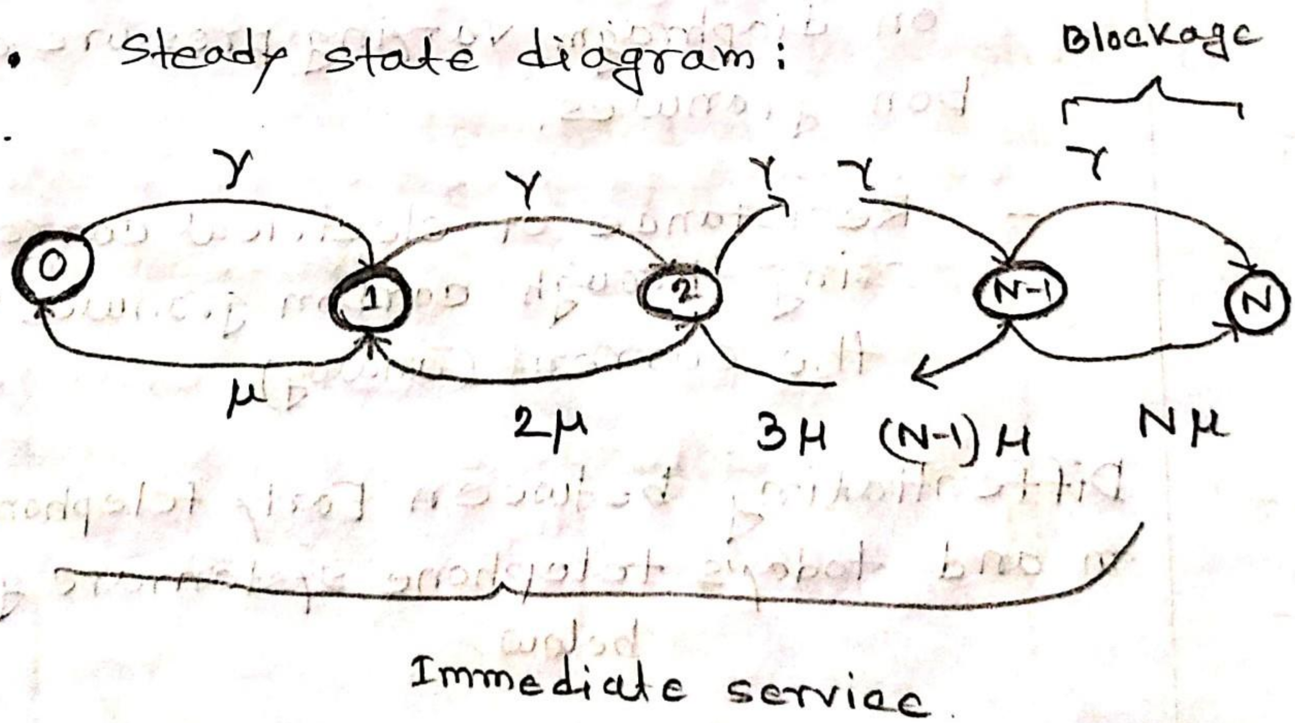
Erlang B Birth- Death process,

- consider infinitesimally small time δt during which only one arrival or departure (or none) may occur.

- Let γ be the arrival rate from an infinite pool or sources.

- Let $\mu = 1/h$ be the departure rate per call
  - if k calls in system, departure rate is $k\mu$

- Steady state diagram:



Ans to the question no: 6(a)

Receiver:

Varifying electrical current passing through windings on magnet, moves a diaphragm. Same as in a music loudspeaker.

Ans to the question no: 6(b)

Transmitter: (carbon granule microphone)

- Air pressure of sound waves impact on diaphragm, varying pressure on carbon granules.
- Resistance of electrical current passing through carbon granules varies the current (analog)

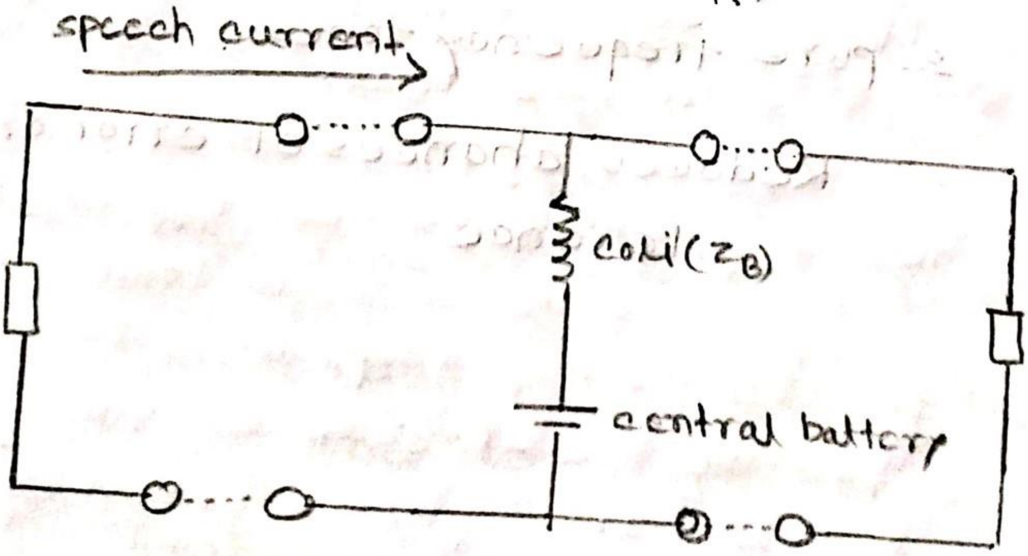
Diffentiating between Early telephone system and today's telephone system are given below.

- Early telephone system
  - Powered by self-contained Local battery
  - Ringing created by cranking generator.

- Today's telephone system
  - Powered through the line by battery at the central office (-48v)
  - Circuit is closed when handset is lifted from the cradle.

Ans to the question no: 6(c)

PSTN or POTS simplified circuit model of any connection:



"The coil is a 'transmission bridge coil' with a high impedance (Z_B) preventing out the speech current from shorting out at the central battery."

Ans to the question no: 7(a)

DTMF signalling

- Faster than pulse dialling (1-2 seconds for ten digit numbers)
  - reduces call set up time

- Each digit produced by combination of 2 pure frequency tones.
  - Reduces chances of error or interference

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Ans to the question no: 7 (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 customers hears dial tone and dials 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 his/her loop.

8. Exchange detects second loop and trips or stop ringing then establishes call.

9. One party opens loop by hanging up and exchange clear connection.

Ans to the question no; 7(c)

Pulse dialling:

- Line is rapidly disconnected and reconnected in sequence with one pulse for digit value "1", two pulses for digit value "2"

- Each pulse Lasts 0.1 second.

- Inter-digit pause (IDP) must be >0.5 second.
  - If not, current digit may combine with previous digit.

- Ten digit phone number typically takes 6-15 seconds total.

- This is the kind of signalling old "rotary dial" phones produced.

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Ans to the question no: 8(a)

SRL defines as singing return loss which has minimum attenuation to reflected power at any frequency coming back from the 2W-4W interface

Ans to the question no: 8(b)

Subscriber Loop

- Wire network from the central office to the station sets.
- Largest portion of capital capabilities (50%?) and workforce requirements (30%-40%)
- Prime candidate for replacement by optical fibre but costs often prohibitive.
- Main goal is to design and work with length limits.
  - Limited by resistance and attenuation along the line.

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Ans to the question no: 8(c)

Target resistance determination,

- We need a high enough current at the customer premises to operate the station set (20mA minimum in North America)

- Use $V = IR$, with a known battery voltage of $-48V$.

- $48V \geq 20mA \times R \rightarrow R \leq 2400\Omega$ total.

- Budget $\approx 400\Omega$ for the battery feed bridge at the C.O

- Budget $\approx 300\Omega$ for other miscellaneous wire resistance (e.g. subset wiring, etc).

- $\therefore$ The subscriber loops wire resistance must not exceed 1700Ω.

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