Q.2a. Explain the functions of a switching system.

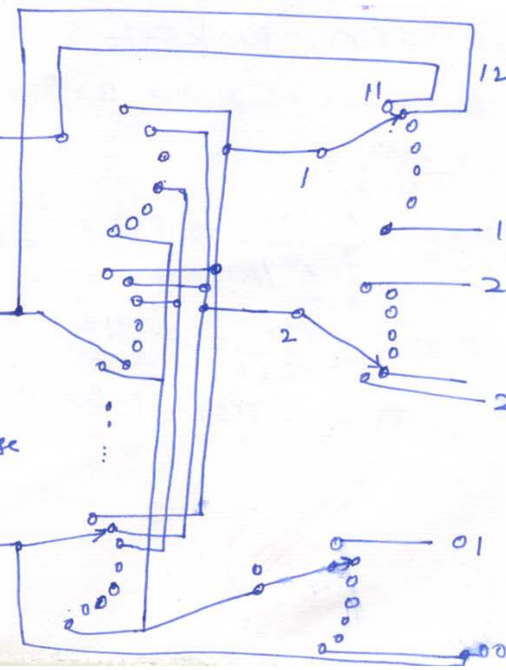
Q.2(a) The functions of all switching system are as follows.

(i) Attending
(ii) Information receiving
(iii) Information processing
(iv) Busy Testing
(v) Interconnection
(vi) Alerting
(vii) Supervision
(viii) Information Sending.

b. What are design parameters of a switching system? Explain 100 line step by step switching system.

b. The design parameters of a switching system are
(i) No. of subscriber lines
(ii) Total no of switching elements
(iii) Cost of switching system
(iv) Switching capacity
(v) Traffic Handling capacity
(vi) Equipment utilization factor
vii) No of switching stages
viii) Average switching time
ix) Call setup time
x) Cost capacity Index

A 100 line Switching System:-
A 100 line switching system can serve upto 100 subscribers. A 100 line strowger switching system can be configured in a variety of ways. This design has two stages.
In the first stage, there are 100 uniselectors one for each subscriber. The second stage has 10 or more uniselectors. The second stage outlets are folded back to the corresponding inlets via suitable control circuitary.



Q.3 a. Explain the mathematical model of the traffic offered to telecommunication system.

Q.3(a) The mathematical model of traffic offered to telecommunication systems are necessary to obtain analytical solutions to teletraffic problems. It is based on following assumptions

- Pure chance traffic means call arrival and terminations are independent random events.
- Statistical equilibrium: means the generation of traffic is a stationary process.

The random call arrivals and terminations leads to

i. The no of call arrivals in a given time has a poission distribution ie

$P(x) = \frac{\mu^x}{x!} e^{-\mu}$ where $x \to$ no of call arrivals in time T and $\mu \to$ mean no of calls in time T

ii) The internals between the calls are intervals between independent random events and it has a negative exponent distribution

$P(T \geq t) = e^{-t/\bar{T}}$ where $\bar{T} \to$ mean interval between call arrivals.

iii) The interval between two random events have a negative exponents distribution

$P(T \geq t) = e^{-t/h}$ where $h \to$ mean call duration (holding time)

For statistical equilibrium the probabilities donot change and the process is said to be a regular Markov chain. The probability of a call arriving during δt is

$P_{jk} = P(a) = A\delta t/h$ $k \to$ no of calls in progress

The probability of call ending during δt is

$P_{kj} = P(e) = k\delta t/h$

If the probability of j calls in progress at time t is P(j), then probability of a transition from j to k busy trunks during δt is

$P(j \to k) = P(j)P(a) = P(j)A\delta t/h$

The probability of a transition from k to j busy trunks during δt is

$P(k \to j) = P(k)P(e) = P(k)k\delta t/h$

b. **A group of five trunks is offered 2E of traffic. Find :**

(i) Grade of service

(ii) Probability that only one trunk is busy

(iii) Probability that only only one trunk in free

(iv) Probability that at least one trunk is free

2. (i) The grade of service $B = E_{1,N}(A) = \dfrac{A^N/N!}{\sum_{k=0}^{N} A^k/k!} = \dfrac{2^5 \times 5!}{1+\frac{2}{1}+\frac{4}{2}+\frac{8}{6}+\frac{16}{24}+\frac{32}{120}}$

$B = \dfrac{0.2667}{7.2667} = 0.037$

(ii) $P(x) = \dfrac{A^x/x!}{\sum_{k=0}^{N} A^k/k!} \Rightarrow P(1) = \dfrac{2}{7.2667} = 0.275$

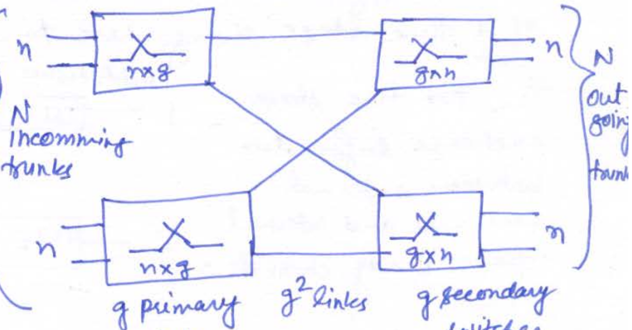
(iii) $P(4) = \dfrac{16/24}{7.2667} = 0.0917$

(iv) $P(x<5) = 1 - P(5) = 1 - B = 1 - 0.037 = 0.963$

Q4 a. What is meant by link systems? Explain two stage networks in detail.

b. Design a three stage Network for 100 incoming trunks and 400 outgoing trunks.

Q.4 a. The connection from a calling line to a called by choosing a horizontal link and inserting pegs at the crosspoints with coordinates is known as link system. A two stage link system is as under. (4)



It has N incomming and N outgoing trunks and contains primary switches having n intels and secondary switches having n outlets, then no. of primary switches (g) = no. of secondary switches = no. of outlets per primary switch = no. of inlets per secondary switch

where $g = N/n$

The no of crosspoints per primary switch = no of crosspoints per secondary switch $= gn = N$

The total no. of crosspoints (C_2) in the network = no of switches × crosspoints per switch

$C_2 = 2gN = 2N^2/n$

Since there is one link from each primary switch to each secondary switch, the no of links is equal to no. of primary switches × no. of secondary switches i.e

No. of links $= g^2 = (N/n)^2$

Let occupancy of the links be a and the occupancy of outgoing trunks be b.

The probability of loss using a particular link is = 1 − Probability that both links and trunks are free. $= 1-(1-a)(1-b)$

If there are g paths available. The probability of simultaneously blocking for all g paths is $B_2 = [1-(1-a)(1-b)]^g = [a+(1-a)b]^g$

b. The total no of Primary switch n $= N/\sqrt{N+M}$, Secondary switch $m = M/\sqrt{N+M}$.

$\therefore 100/\sqrt{100+400} = 4.47$ or $400/\sqrt{100+400} = 17.89$.

$\therefore m = 4$ or 5, $n = 16$ or 20

1. If $m=5$, $n=20$,
20 primary switch of size 5×5
5 secondary switche of size 20×20
20 tertiary switches of size 5×20

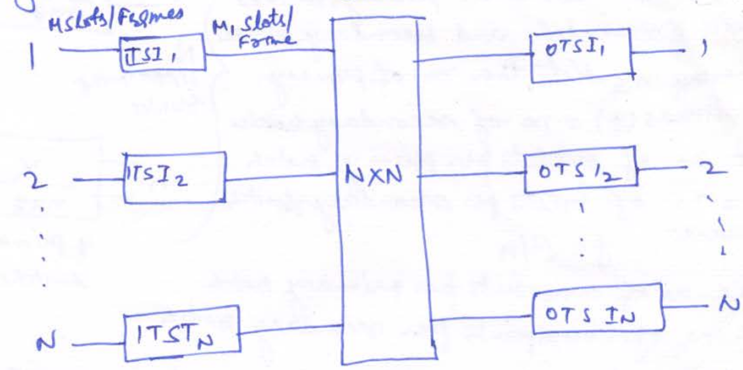
2. If $m=4$, $n=16$
25 primary switches of size 4×4
4 secondary switches of size 25×25
25 tertiary switches of size 4×16

Q.5 a. Explain three-stage combination switching and give the expression for blocking probability of a TST switch.

b. Calculate the maximum access time that can be permitted for the data and control memories in a TSI switch with a single input and single output trunk multiplexing 2500 channels. Also estimate the cost of the switch and compare it with that of a single stage space division switch.

Q.5a. The most common three stage configurations are (i) those which place time stages on either side of a space stage giving rise to TST configuration (ii) those which place space stages on either side of a time stage giving rise to STS configuration

The two time stage exchange information between external channels and internal space array channels.



The expression for blocking probability of a TST switch is given by

$$P_B = \left[1-(1-\alpha/L)^2\right]^{M_1}$$

Where $M_1 \rightarrow$ no. of time slots on the opp side of the TSI switch

$L \rightarrow$ expansion or contraction factor $= M_1/M$

$\alpha \rightarrow$ traffic intensity on the intel

b. The time slot duration $t_{TS} = \frac{125}{M}$ $M \rightarrow$ No of channels multiplexed

$= \frac{125 \times 10^3}{2500 \times 2} = 25\,ns$

$C = 2M = 2 \times 2500 = 5000$ units, Single stage space switch uses $= 2500 \times 2500 = 6.25 \times 10^6$

Cost of switch $= \frac{6.25 \times 10^6}{5000} = 1250$

. Refer Example 6.2 of P. No - 209 Text Books II

Q.6a. Give the characteristics of micro programmed and hand wired control schemes.

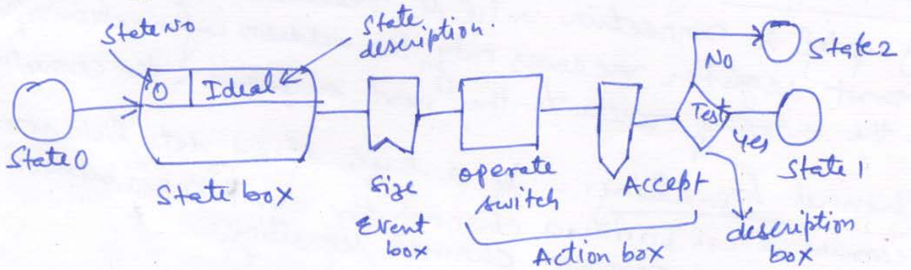
b. Explain the basic symbols defined for use in state transition diagram.

c. Explain signal exchange diagram for local call.

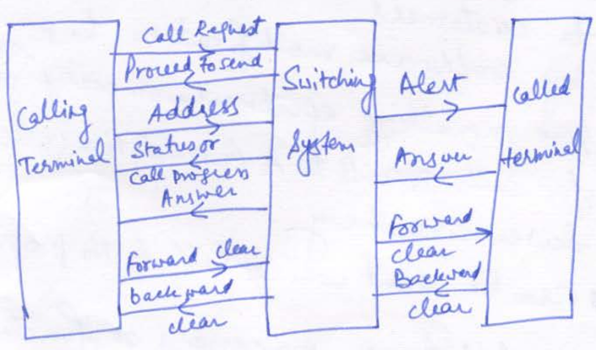
Q.6 a. Characteristics of Microprogrammed control & Hard wire control (5)

Microprogrammed Control	Hard wire control
1. Flexible	1. Not flexible
2. Slower	2. Faster
3. Expensive for moderate processing function	3. less expensive for moderate simple and fixed processing
4. Easier to implement complex processing functions	4. Difficult to implement complex functions
5. Introducing new service is easy	5. Not easily possible
6. Easier to maintain	6. Difficult to maintain

b. Basic symbols used in state transition diagrams.



c. Signal exchange diagram for local call



1. The call request is answered by the proceed to send signal
2. The address signal is answered by a call status signal
3. The answer signal is a response to the alerting signal.
4. The caller response to the answer signal by commensing the conversation
5. The backward clear signal is a response to the forward clear signal or vice-versa.

Q.7 a. Explain the meaning of following terms applied to inter register signalling:
(i) En-block signalling
(ii) overlap signalling
(iii) link by link signalling
(iv) end to end signalling

b. What is common channel signalling? Give its advantages.

Q.7 a. (i) En-block signalling:- In this signalling, the complete address information is transferred from one register to the next as a single string of digits. No signal is sent out until the complete address information has been received.

(ii) Overlap Signalling:- In this signalling digits are sent out as soon as possible. Thus, some digit may be sent before the complete address has been received and signalling may take place simultaneously on two links. This enables subsequent registers to start digit analysis earlier ~~than is possible~~ and reduces post-dialling delay.

(iii) Link by Link signalling:- In this signalling, information is exchanged only between adjacent registers in a multilink connection.

(iv) End to End Signalling: In this signalling, the original register controls the setting up of a connection until it reaches its final destination. Each transit register receives only the address information required to select the outgoing route to the next exchange in the connection.

b. Common channel Signalling:- If a high speed data link is employed between processors, it can provide a channel for all signals between exchanges A and B. This is known as common channel signalling.

Advantages:
1. Information can be exchanged between the processors much more rapidly.
2. It gives more service to customers.
3. Signal can be changed by software modification to provide new service.
4. There is no need for line signalling equipments on every junction.
5. Junctions can be used for calls from B to A in addition calls from A to B. It requires fewer circuitry.
6. Signal relating to calls can be sent while call is in progress.
7. Signals can be exchanged between processors or functions other than call processing.

Q.8 a. Explain the difference between a circuit switched and a packet switched network and discuss their relative merits.

b. A pure ALOHA system uses a 56 kbit/s channel. On average each terminal originates a 1024 bit packet every seconds. How many terminals can the system accommodate?

c. Explain the basic functions of an ATM switch

Q.8 a. Page No. 231 : Telecommunication Switching, Traffic and Networks by J E Flood, Pearson Education-2006 (6)

b. Duration of Packet = 1024/56 = 18.3 ms

$\therefore$ Traffic per terminal = $18.3 \times 10^{-3}/30 = 6.1 \times 10^{-4}$ E

Total traffic = $6.1 n \times 10^{-4}$ E   n → no of stations

Max. throughput of system = $\frac{1}{2e}$ E

$\therefore n = 10^{4}/6.1 \times 2e = 301$.

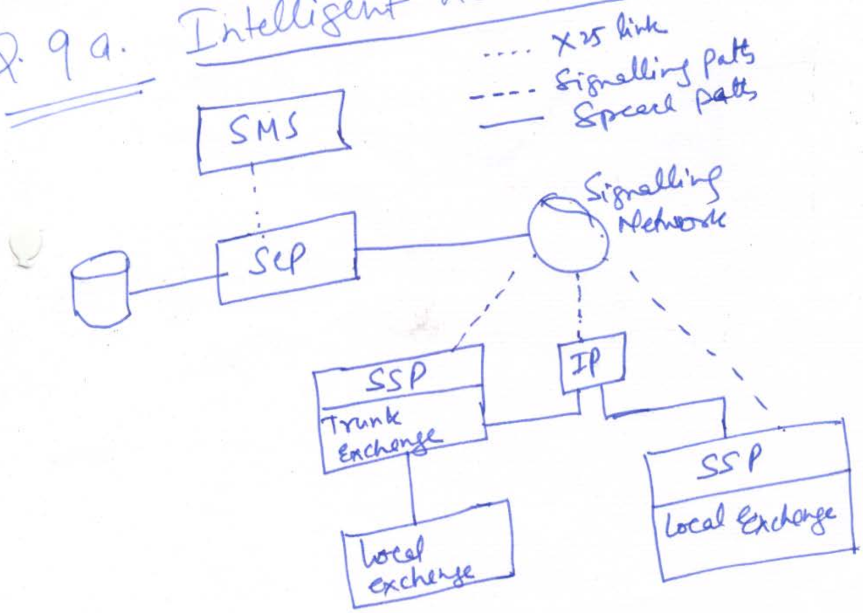
c. The basic functions of ATM switches

1. call routing by space switching
2. Header translation
3. queuing

Q.9a. Explain the intelligent network architecture.

b.Explain the principles determining a national numbering plan. How is this influenced by the need for an international number plan?

Q. 9a. Intelligent Network Architecture



The SSP may be at any level in network hierarchy. It software is modified so that a no. of events can trigger it to suspend normal call processing and request the intervention of SCP. These events may be the caller's class of service. The SCP software is organized in three levels.

1. Node software
2. Service logic program
3. Service logic execution environment.

Q b. Page No. 273 : Telecommunications Switching, Traffic & Networks by JE- Flood : Textbook-1

Text books

1. Telecommunications Switching, Traffic and Networks, J.E.Flood, Pearson Education-2006
2. Telecommunication Switching Systems and Networks, Thiagarajan Viswanathan, Prentice Hall of India Pvt. Ltd, 2007