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Internal Assesment Test – II

Sub:	Digital switching system							Code:	15EC654
Date:	20/4/2019	Duration:	90 mins	Max Marks:	50	Sem:	VI	Branch/Section	ECE A section

Answer Any FIVE FULL Questions

		Marks	OBE CO	OBE RBT
1 .(a)	Differentiate between circuit switching and message switching.	[05]	CO2	L2
(b)	With neat diagram explain the marker control of cross bar switch	[05]	C02	L2
2.	Explain in detail basic call processing of a digital switching system with neat diagram	[10]	C02	L1
3.	List and Explain the function of switching systems	[10]	C02	L2
4.	With the help of neat diagram explain the working of distribution frame in strowger exchange	[10]	C02	L2
5.	Define the following (i)Busy hour (ii)Grading (iii)Congestion(iv)Statistical Equilibrium(v)Holding time	[5]	CO3	L1
5b)	With the neat block diagram of subscriber line interface circuit ,mention the functions implemented by it..	[5]	C02	L2
6	Design a two stage switching network for connecting 200 incoming trunks to 200 outgoing trunks	[10]	CO4	L3
7	Design a progressive grading system connecting 20 outgoing trunks to switches having 10 outlets	[10]	C04	L3
8	With neat diagram explain the progressive,skipped and homogeneous grading	[10]	C04	L2

1 .(a)	Differentiate between circuit switching and message switching.	[05]
	5 points - 5 marks	

Message switching	Cirtuit switching
The source and destination do not interact in real time	The source and destination are connected temporarily during data transfer.
Message delivery is on delayed basis if destination node is busy or otherwise unable to accept traffic.	Before path setup delay, may be there due to busy destination node. Once the connection is made, the data transfer takes place with negligible propagation time.
Destination node status is not required before sending message.	Destination node status is necessary before setting up a path for data transfer.
Message switching network normally accepts all traffic but provides longer delivery time because of increased queue length.	A circuit switching network rejects excess traffic, if all the lines are busy.
In message switching network, the transmission links are never idle.	In circuit switching, after path setup, if the users denied service, the line will be idle. Thus, the transmission capacity will be less, if the lines are idle.

1(b)	Draw and explain the cross bar switch and function of marker in a crossbar switch	[5]
	Diagram of crossbar switch – 1 mark Explantion -2 mark Diagram of marker -1 mark Expanation-1 mark	

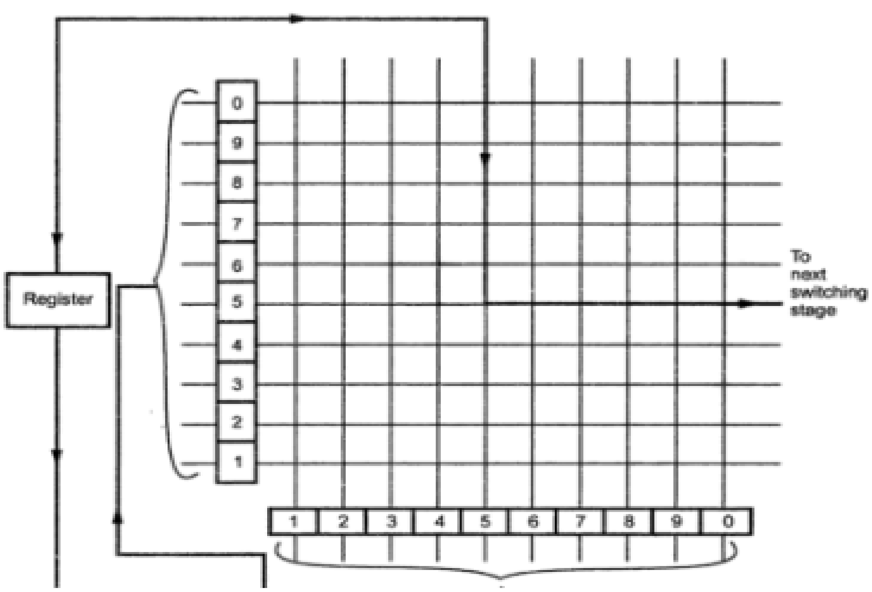
- Strowger switches require regular maintenance. The banks need cleaning, mechanisms need lubrication and adjustments and wiper and cards wearout. This disadvantage led to the development of several other forms of switch. One idea was to replace the manually operated switch by a matrix of telephone relays with their contacts multiplied together horizontally and vertically as shown in Fig. 1.5.1.
- The crossbar switch retains a set of contacts at each crosspoint, but these are operated through horizontal and vertical bar magnets at the sides of the switch. Thus, a switch with N inlets and N outlets only needs 2N operating magnets.
- In case of Strowger system various function performed by the group selectors while in crossbar system various functions are performed by the marker.

Working

- Let us consider 3×3 crossbar schematic shown in Fig. 1.5.1 The schematic shows 3 subscribers with the horizontal bars representing the inlets and the vertical bar the outlets.

- Now consider the establishment of the following sequence A to C and C to B. First the horizontal bar A is energised, than the vertical bar C is energised. The crosspoint AC is latched and conversation between A and C can now proceed.
- Suppose we now energise the horizontal bar of C to establish the connection CB.
- Thus the procedure for establishing a connection in a crossbar switch may be summarised as

1. Energise horizontal bar
2. Energise vertical bar
3. De-energise horizontal bar



	4. Energise vertical bar 5. Energise horizontal bar 6. De-energise vertical bar **Functions of marker** a) It decides which magnet to move. b) It also controls many switches and has many registers in it. c) It can make more than one connection at a time. d) For a larger switching system marker makes use of linked frame switching system.

2.	Explain in detail basic call processing of a switching system with neat diagram Intra LM call diagram and explanation -2.5 mark Inter LM call diagram and explanation -2.5 mark Incoming calls-2.5 mark Outgoing calls-2.5 mark	[5]
	Intra-LM Calls. ➢ When a customer dials from a telephone that is connected to a specific line module and calls another customer who is also connected to the same line module, this type of call is classified as an intra-LM call. ➢ A call path for this type of call is shown in Fig. 1.6a. The off-hook (line origination request) condition is detected by the line module, and service circuits are attached to supply a dial tone to the calling customer. ➢ Many other functions are performed before a dial tone is given to a calling customer; The line module's request for a path through the switching fabric is processed by the interface controller, which in turn works with the network control processor to make a path assignment.	

- Consequently, a path is established through the switching fabric for the called line, and a service circuit is attached to ring the line. Again, many other functions are performed before ringing is applied to the called customer; Since this is an intra LM call, the same line module will be involved in controlling the origination and termination of a call.

- This very simplified explanation is offered here for introductory purposes only. Later chapters go into far greater detail in explaining various functions such as digit reception, digit translation, and tests that are performed before a call is completed.

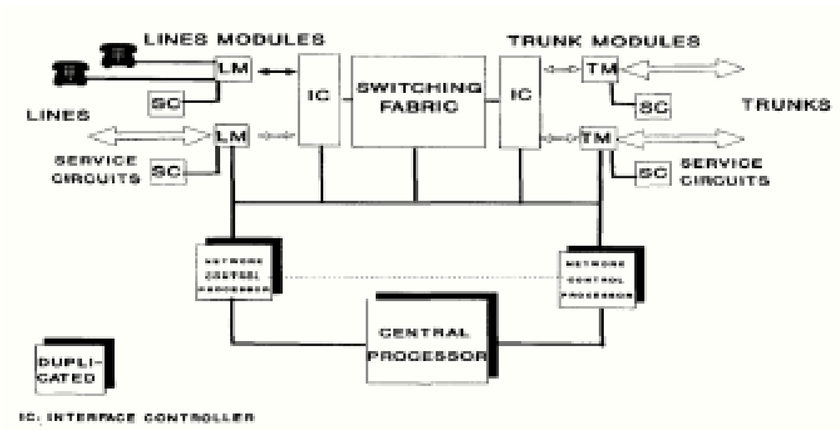


Figure 2.6a. Calls within a line module

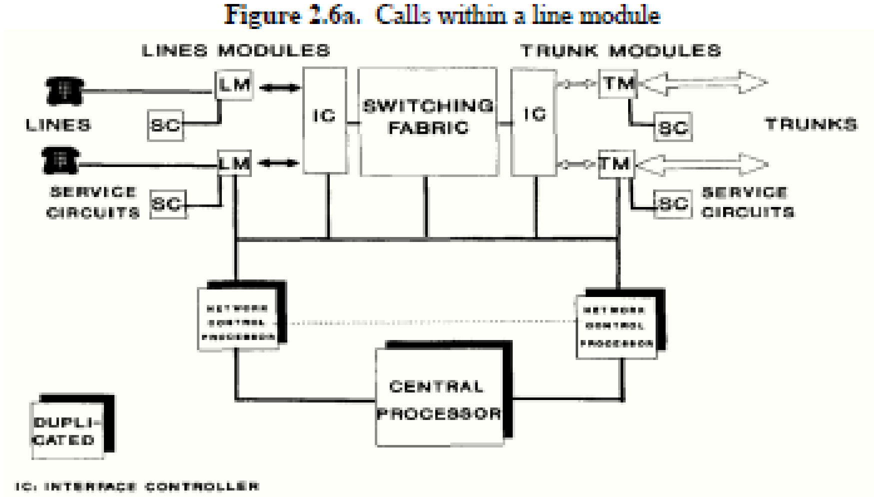


Figure 2.6b. Calls outside a line module

Inter-LM Calls. The workings of an inter-LM call are similar to those of an intra-LM call, except that the terminating line equipment is located in another line module. Figure 1.6 & shows interconnections for such a call. There are some subtle differences in how an inter-LM call is handled versus an intra-LM call, which are discussed in later chapters.

	Outgoing calls: When a line module processes a call which has terminating equipment outside the central office (CO), the LM requests for the path through the switching matrix to a trunk module via the interface controller (IC). IC works with the NCP to establish a path to an outgoing trunk. Once a path is established through the switching matrix, the trunk module (TM) connects a service circuit for the controlling the call to the called CO. The special functions such as DTMF and out pulsing are provided trunk service circuits. An outgoing call from an originating office is an incoming call to a terminating office. The paths for the incoming and outgoing calls are shown in figure 2.18c. Incoming calls: when a TM detects a incoming call, the trunk module requests for a path through the switching matrix from the interface controller and the NCP. Once the path is detected the switching matrix to LM that has the terminating line, the service circuit provides the ring to the called telephone equipment.	

3.	List and describe the functions of Switching Systems.	[5]
	Eight points description – 10 marks The basic functions that all switching systems must perform are as follows, **1.Attending**: The system must be continuously monitoring all lines to detect call requests. The calling signal is sometimes known as a ‗seize' signal because it obtains a resource from the exchange. **2.Information receiving**: In addition to receiving calls and clearing signals, the system must receive information from the caller as to the called line (or other service) required. This is called the address signal. **3.Information processing**: The system must process the information received in order to determine the actions to be performed and to control these actions. Since both originating and terminating calls are handled differently for different customers, class of service information must be processed in addition to the address information. **4.Busy testing**: Having processed the received information to determine the required outgoing circuit, the system must make a busy test to determine whether it is free or already engaged on an other call. If a call is to a customer with a group of lines to PBX(private branch exchanges), or to an outgoing junction route, each line in the group is tested until a free one is found. In an automatic system, busy testing is also required on trunks between switches in the exchange. **5.Interconnection**: For a call between two customers, three connections are made in the following sequence; A connection to the calling terminal A connection to the called terminal A connection between the two terminals In the manual system connections, a and b are made at the two ends of the cord circuit and connection c merely joins them in the cord circuit. Many automatic systems also complete connection c by joining a and b at the transmission bridge. However some modern systems release the initial connections a and b and establish connection c over a separate path through the switching network. This is known as *call-back* or *crank-back*. The calling line is called back and the	

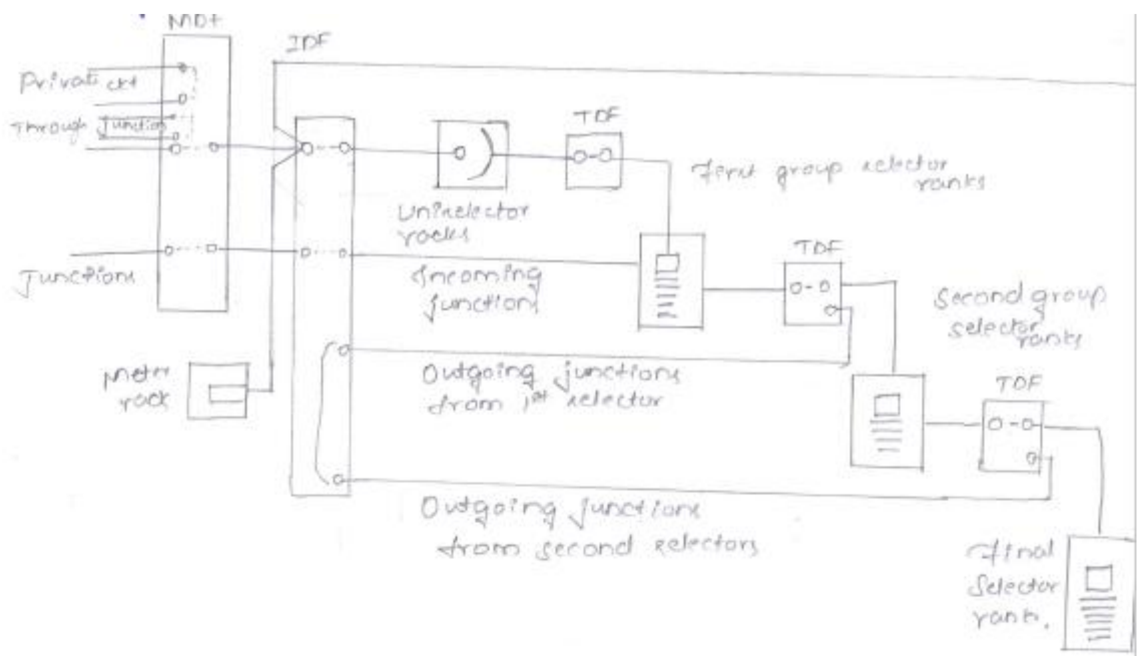
connection to the called line is cranked back.

6.Alerting: Having made the connection, the system sends a signal to alert the called subscriber. E.g. by sending ringing current to a customers telephone.

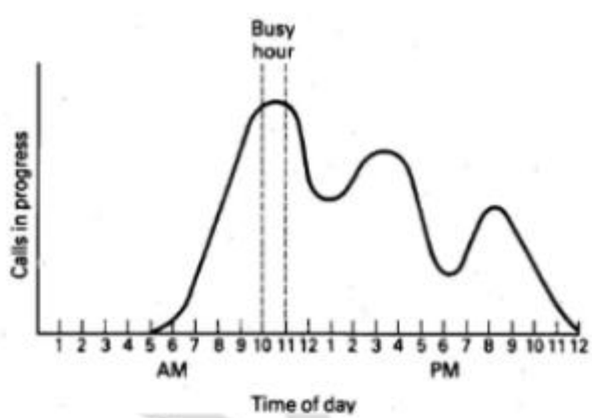
7.Supervision: After the called terminal has answered, the system continues to monitor the connection in order to be able to clear it down when the call has ended. When a charge forthe call is made by metering, the supervising circuit sends pulses over the private wire to operate a meter in the line circuit of the calling customer. When automatic ticketing is employed, the system must send the number of the caller to the supervisory circuit when the connection is setup. This process is called *calling line identification (CLI)* or *automatic numbe identification (ANI).* In SPC system, the data for call charging can be generated by a central processor as it sets up and clears down connections.

8.Information sending: If the called customer‘s line is located on another exchange, the additional function of information sending is required. The originating exchange must signal the required address to the terminating exchange (and possibly to intermediate exchanges if the call is to be routed through them).

4	With the help of neat diagram explain the distribution frame in strowger exchange	[5]
	Diagram – 5 marks Explanation- 5 marks	



	→ Many changes occur during the life of telephone exchange. New customers join and old ones leave. Customers move from one part of exchange area to another and those with PBXs may increase their no of exchange lines. The total no of lines may increase over the years, say from an initialization of 2000 lines to an ultimate 10,000 lines. Growth of traffic → may require additional switches in the exchange and more junction to other exchanges. Great flexibility is therefore required in the permanent exchange cooling. → MDF corresponds to the street cabling so reflects the geography of the area. The no of a line is changed by moving its jumper, protectors and fuses are mounted on the MDF also provides a convenient point of access for testing lines. → The intermediate distribution frame (IDF) is used to distribute incoming traffic evenly over the groups of first selectors. → The terminals on this side of the IDF can be said to correspond to equipment no (EN) of the lines.	

5.a).	Define the following(i)Busy hour (ii)Grade of service (iii) Pure chance traffic (iv)Statistical Equilibrium (v)Holding time with necessary examples and diagrams.	[10]
	Each definition with an example or diagram -2mark each (i)**Busy hour**: It is a period of one hour, which corresponds to the peak traffic load. In figure below .Busy hour is from 10 am to 11 am.  Traffic variations during a day	

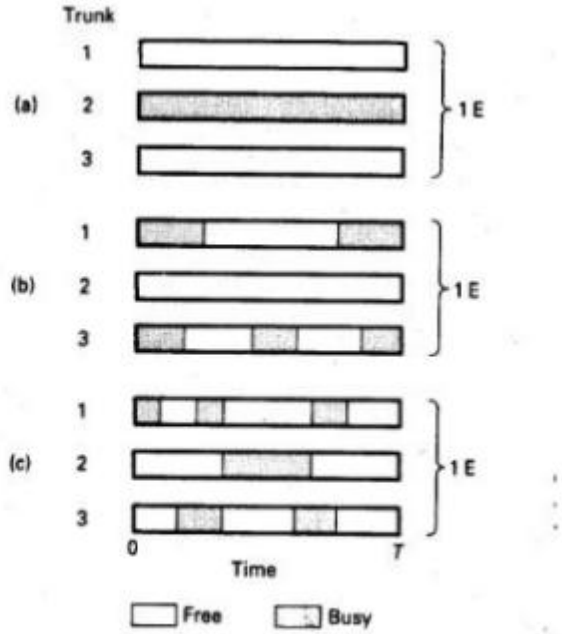
(ii)**Grade of service**: The proportion of calls that is lost or delayed due to congestion is a measure of the service provided. It is called as grade of service (B). For a lost call system, the grade of service, B can be defined as:

B = Number of calls lost/Number of calls offered
Hence, also:
B= Traffic lost/Traffic offered
= Proportion of the time which congestion exists
= Probability of congestion
=Probability that a call will be lost due to congestion

(iii) **Pure chance traffic**: traffic: The assumption of pure chance traffic means that call arrivals and call terminations are independent random events. Sometimes it is also called as Poissonian traffic. If call arrivals are independent random events, their occurrence is not affected by previous calls. Sometimes traffic is called as memoryless traffic.

(iv)**Statistical Equilibrium**: The assumption of Statistical equilibrium means that the generation of traffic is a stationary random process i.e., probabilities do not change during the period being considered. Consequently the mean number of calls in progress remains constant. Statistical equilibrium is not obtained immediately before the busy hour, when the calling rate is increasing nor at the end of the busy hour, when calling rate is falling.

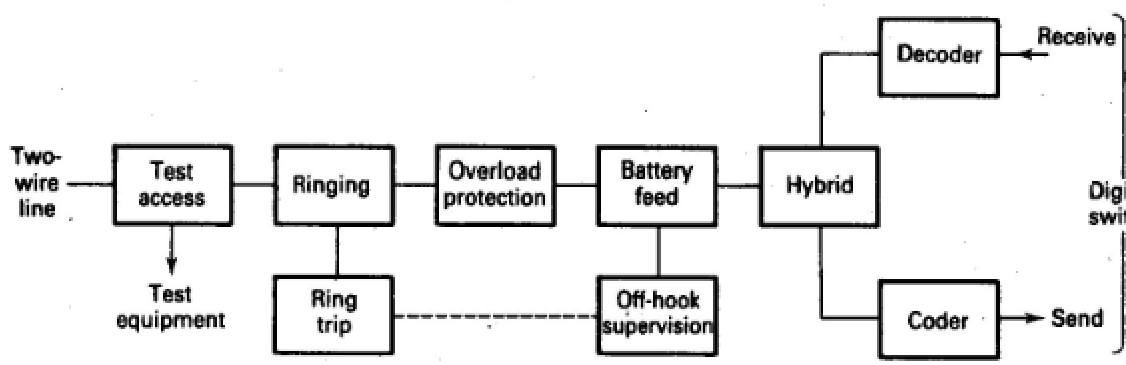
(v)**Holding time**: Duration of call is often called its holding time, because its holds a trunk for that time. The example in figure below shows how one Erlang of traffic can result from one trunk being busy all of the time, for each of two trunks being busy for half of time or from each of three trunks being busy for one third of the time as in figure a, b and c.



Examples of 1 Erlang of traffic carried on three trunks

5.b)	With the neat block diagram of subscriber line interface circuit ,mention the functions implemented by it..

Diagram :2.5 mark :
Explanation:2.5 mark



The function can be summarized by the acronym BORSCHT as follows

- Battery feed
- Over-voltage protection
- Ringing
- Supervisory signaling
- Coding

	□ Hybrid □ Testing

6.	Design a two stage switching network for connecting 200 incoming trunks to 200 outgoing trunks	[10]
	Design:5 marks Diagram:5 marks	

Now, $\sqrt{200} = 14.14$.

However, n must be a factor of 200, so the nearest practicable values are $n = 10$ and $n = 20$.

Two possible networks are shown in Figure 2.12.

No of Crosspoints $= 2\ N^{3/2}$

$= 2 \times (200)^{3/2}$

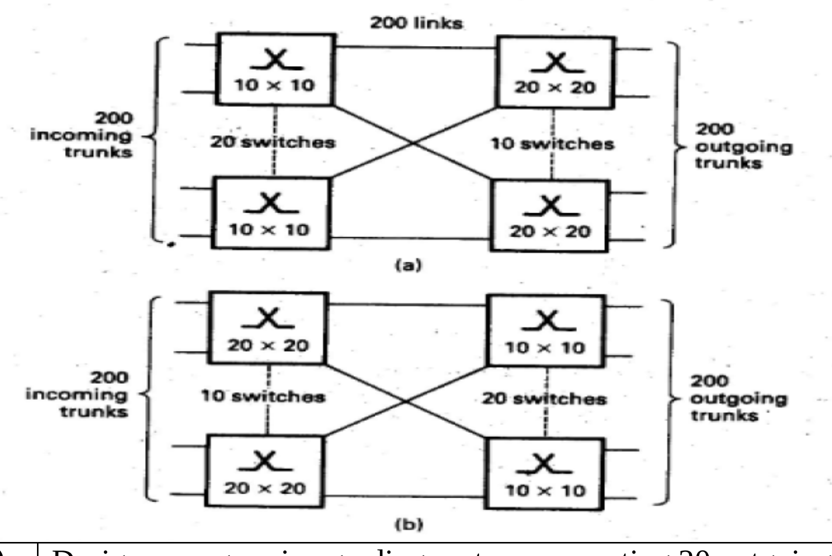
$= 2 \times 2.828 \times 10^3$

= 5656 crosspoints

= almost it contains 6000 crosspoints.

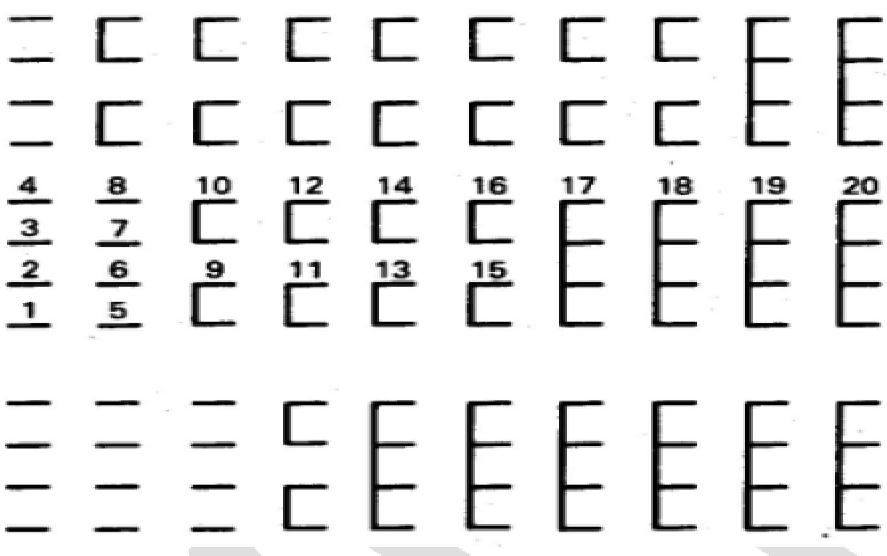
The network of Figure 3.22(a) is suitable for 20 outgoing routes, each having 10 trunks, and that of Figure 3.22(b) is suitable for 10 outgoing routes, each having 20 trunks.

The network in Figure 3.21 has the same number of outgoing trunks as incoming trunks. However, a concentrator has more incoming than outgoing trunks and an expander has more outgoing than incoming trunks



7)	Design a progressive grading system connecting 20 outgoing trunks to switches having 10 outlets	[5]
	Design :7 marks Diagram:3 marks g = 2*N/k= 40/ 10 = 4, and the factors of *g* are 1, 2 and 4. Let the number of choices having singles = *s* the number of choices having doubles = *d*	

	the number of choices having quadruples = q substituting in equations (2.4) $\Sigma r_{iqi=1}=k$ $s + d + q$ = 10 -------(1) $4s + 2d + q$ = 20------------(2) ------------------------------------ From (2) - (1) = $3s + d$ = 10 Substituting in equations $\Sigma r_i g f_{iqi=1}=k$ s = 1: d = 7 and q = 10 - 8 = 2 s = 2: d = 4 and q = 10 - 6 = 4 s = 3: d = 1 and q = 10 - 4 = 6 s= 4: d < 0, so this is not possible . There are thus three possible gradings, which are shown in Figure 3.16. The sums of the successive differences for these gradings are respectively given by : D = | $r_1 - r_2$ | + | $r_2 - r_3$|+…………………+| $r_{q-1}-r_q$| *Case1)* D_1= |7-1|+|2-7| D_1 = 6 + 5 = 1 1 D_2 = |4 – 2|+|4-4| = 2 + 0 = 2 D_3 = |1-3| + |6 - 1| = 2 + 5 = 7 The second grading is therefore the best.	



8.	With neat diagram explain the progressive,skipped and homogeneous grading.	[10]
	Progressive grading:4mark Skipped grading:3 mark Homogenous grading:3 mark	

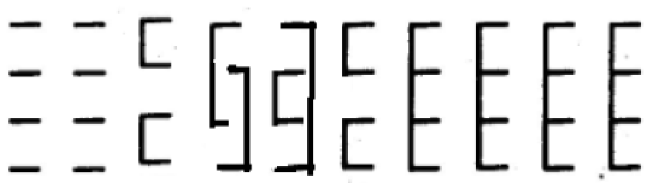
Skipped Grading

In an O'Dell grading, the partial commons are arranged as separate groups, so each is available to only some of the incoming trunks.

For example, in Figure 3.16(b) the upper of pairs serves only the first two groups. However, the principle of grading is based on the sharing of outgoing trunks between different sets of incoming trunks. Efficiency can be improved if this principle can be applied to the whole of a grading instead of only to parts of it.

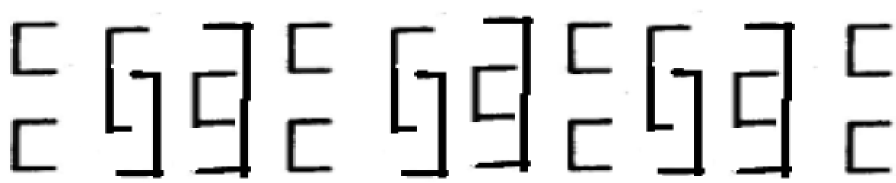
This can be done by connecting non-adjacent groups, in addition to adjacent groups, as shown in Figure 3.18. This is known as skipping.

In this grading in addition to communing adjacent groups, non-adjacent groups also are commonly connected. This avoids upper half and lower half of the group to be separated. Traffic is evenly distributed in both the halves.



Homogeneous Grading

Progressive gradings are intended to be used with switches that hunt sequentially from a fixed home position. However if switches do not hunt from a single position, or they select outlets at random, there is no advantage in connecting some outlets to singles and others to partial or full commons. The grading should then be designed to share each trunk between an equal numbers of groups, as shown in figure 3.18b. this is known as Homogeneous Grading.



Progressive Grading

In order to form a grading, the switches having access to the outgoing route are multiplied into a number of separate groups, known as *graded groups.*

On early choices each group has access to individual trunks and on late choices trunks are common, as shown in Figure 3.15. This diagram shows a small grading for only two groups -of switches. For larger numbers of outgoing trunks, gradings may contain four or more groups.

Figure 2.5 shows four-group gradings. Since the traffic decreases with later choices of outlet, the number of groups connected together increases from individual connections on the early choices through partial commons (doubles) to full commons on the late choices.

Switches hunt over the outlets sequentially from a home position.

In designing a grading to provide access to N outgoing trunks from switches having availability ***k,*** the first step is to decide on the number of graded groups ***g.***

If all the choices were individual trunks, we would have

$N = gk$.

If all the choices were full commons,

$N = k$.

Since the grading contains a mixture of individuals, partial commons and full commons, then $k < N < gk$.

A reasonable choice for N is $N = \frac{1}{2}gk$ and traffic simulations have shown that the efficiency of such gradings is near the optimum.

The number of groups is thus chosen to be: $N=\frac{1}{2}gk$

$$2N=gk$$