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Internal Assessment Test 2 – May 2017

Sub:	Digital Switching Systems					Code:	10EC82
Date:	08/ 05/ 17	Duration:	90 mins	Max Marks: 50	Sem: 8	Branch:	ECE

Answer any five full questions. Sketch neat figures wherever necessary.

1	Derive the minimum number of crosspoints for three stage network with incoming trunks greater than outgoing trunks. Design a three stage network for 100 incoming and 400 outgoing trunks.	10	C4
2	A grading is required to connect 20 outgoing trunk to switches of availability 10.Design a progressive grading. Draw the grading diagram.	10	C4
3a)	Explain about space switch for K incoming PCM highways and m outgoing PCM highways.	5	C3
b)	Explain STS and TST switching network in detail.	5	C4
4	Explain about synchronization networks and its types.	10	C4
5	Explain Basic software architecture with level 1 control, level 2 control and level 3 control of a typical digital switching system.	10	C3
6a)	Explain software linkages during a call.	5	C3
b)	Explain Feature Flow Diagrams for activation, operation and Deactivation of a feature in a digital switching system and write a note on Feature interaction.	5	C3
7	Design a 3-stage network with 100 incoming line and 400 outgoing line .Specify assumptions and draw the 3 stage network.	10	C4
8	Explain and derive grade of service for three stage networks	10	C4

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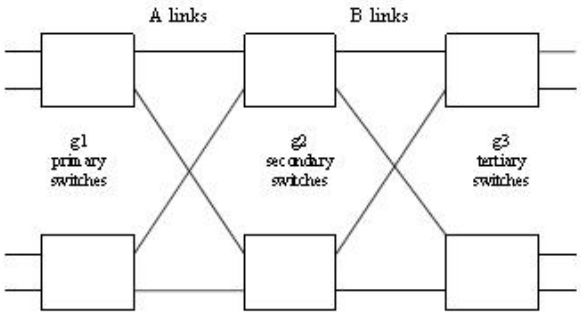
3.5 Three stage networks:



There are total of N/n primary and tertiary switches. There is one link from each primary to each secondary switch and so is the case between secondary and tertiary switches. Any inlet on a primary switch has g_2 alternate paths (secondary switches to reach tertiary switches).

If the three stages have N incoming trunks and N outgoing trunks and has primary switches with n inlets and tertiary switches with n outlets, then:

Number of primary switches (g_1) = number of tertiary switches(g_3) = N/n

Therefore, secondary switches have N/n inlets and outlets.

If the no. of primary-secondary links (A links) and secondary-tertiary (B links) are each N, then the number of secondary switches is

$g_2 = N \div (N/n) = n$ = no. of outlets per primary switch = no. of inlets per tertiary switch

No. of cross points in primary stage = $n^2(N/n) = nN$

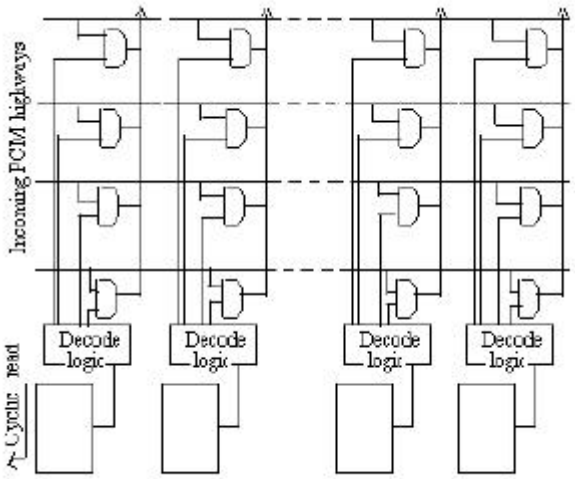
No. of cross points in secondary stage = $n\,(N/n)^2 = N^2/n$

No. of cross points per tertiary stage = $n^2(N/n) = nN$

and the total number of cross points = $C_3 = N(2n + N/n)$

By differentiating the above equation with respect to n and equating to zero, it can be shown that the number of cross points is a minimum when

$$n = \sqrt{(N/2)}$$

2	A grading is required to connect 20 outgoing trunk to switches of availability 10.Design a progressive grading. Draw the grading diagram.	10	C4
3a)	Explain about space switch for K incoming PCM highways and m outgoing PCM highways. **Space switches:** Cross point matrix connects incoming and outgoing PCM highways. Different channels of an incoming PCM frame may need to be switched by different cross points in order to reach different destinations.Crosspoint is a 2 input AND gate. One input is connected to incoming PCM highway and another to connection store that produces a pulse at required instants. Figure below shows space switches with k incoming, m outgoing PCM highways carrying n channels. The connection store for each column of cross points is a memory with an address location for each time slot which stores the number of the cross point to be operated in that time slot. This number is written into the address by the controlling processor in order to set up the connection. The numbers are read out cyclically in synchronism with incoming PCM frame. In each time slot, the number stored at corresponding store address is read out and decoding logic converts this into a pulse on a single lead to operate relevant cross point. Since a cross point can make a different connection in each of n time slots, it is equivalent to n cross points in a space division network.  fig. Space switch	5	C3
b)	Explain STS and TST switching network in detail.	5	C4

Time-Space-Time (T-S-T) switching network:

Each of the m incoming and m outgoing PCM highways are connected to a time switch The incoming and outgoing time switches are connected by the space switch. To make a connection between time slot X of an incoming highway and time slot Y of an outgoing highway, it is necessary to choose a time slot Z which is free in the connection store of the incoming highway and the speech store of the outgoing highway. The connection is established by setting the incoming time switch to shift from X to Z setting the outgoing time switch to shift from Z to Y and operating the appropriate cross point at time Z in each frame.

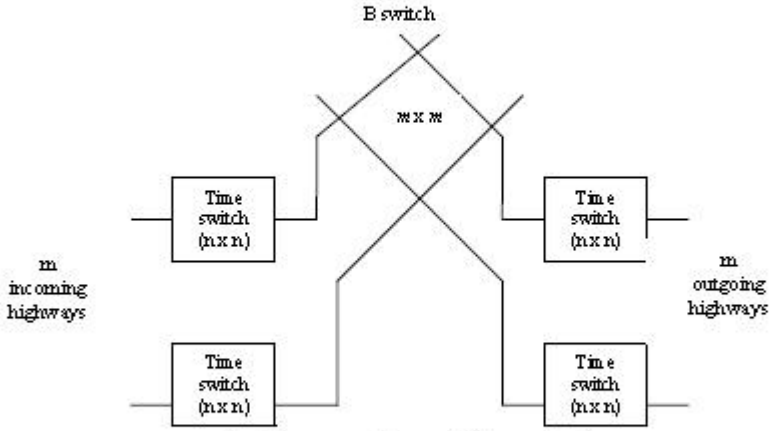


Fig. Time-space-time switching network

Bidirectional paths:

PCM transmission systems use four wire circuits, it is necessary to provide separate paths for the send and receive channels. One way of doing this would be to provide a separate switching network for each direction of transmission. However this may be avoided by connecting the send highways of both incoming and outgoing circuits to one side of the switch and the receive highways to the other side as shown in the figure.

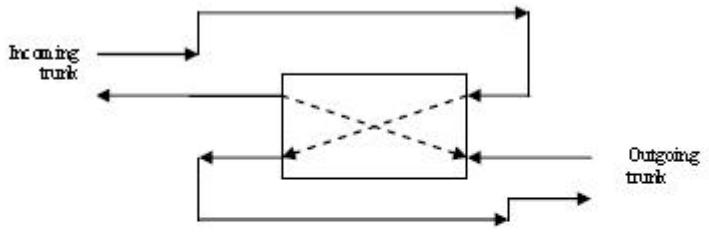
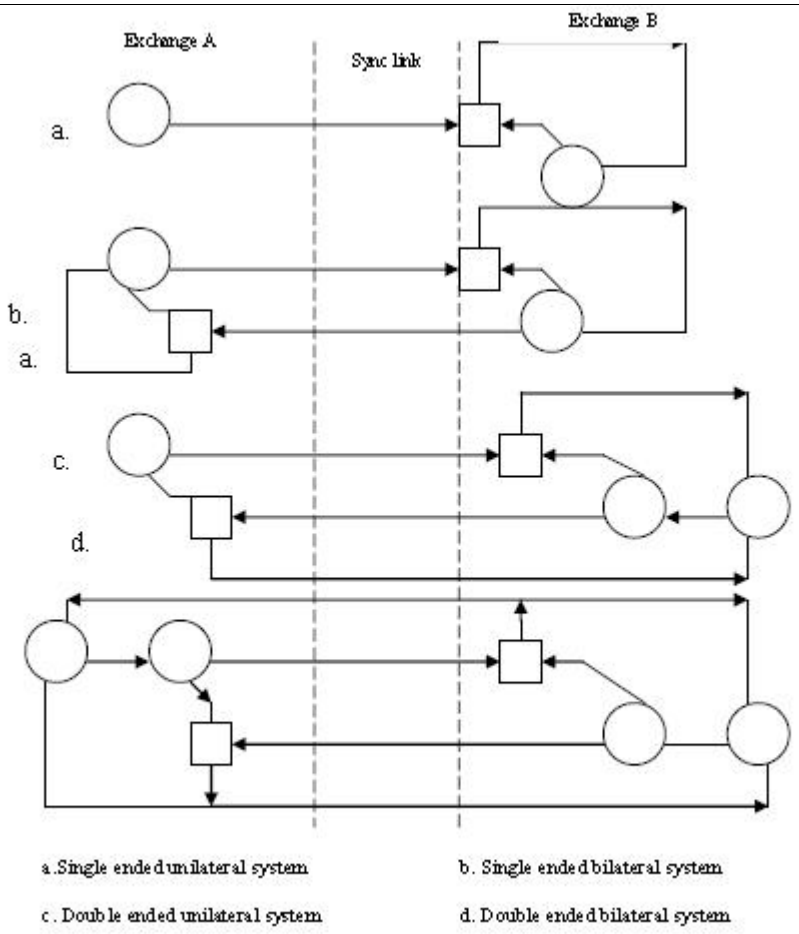


Fig. Bidirectional transmission through time-division switching network

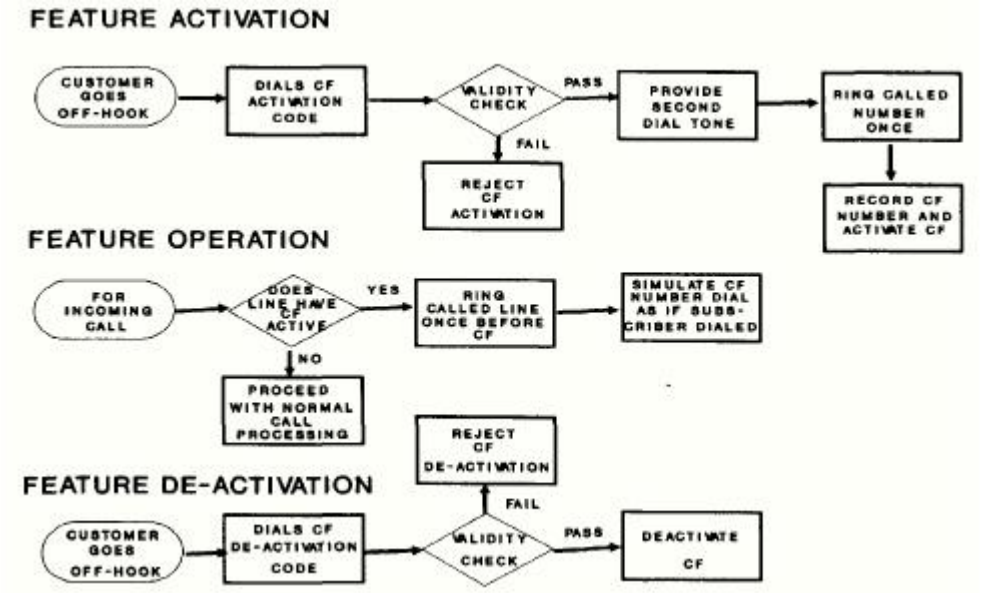
In an STS network, the same speech store address in the time switch may be used for each direction of transmission.

In a TST network, speech in the two directions must be carried through the space switch using different time slots.

4	Explain about synchronization networks and its types.	10	C4



5	Explain Basic software architecture with level 1 control, level 2 control and level 3 control of a typical digital switching system.	10	C3
6a)	Explain software linkages during a call.	5	C3

	Software Linkages during a Call The software linkages to these hardware subsystems will be discussed now. An example of possible software linkages required during a typical call is shown in Fig. 5.4. The line control programs scan the status of lines via the line modules and report the status to the network status program, which in turn works with the network control programs. The line control program also works with the line service circuit programs in providing dial tone, digit receivers, ringing circuits, etc., to the subscriber lines. The network control program orders a network connection through the switching fabric when a subscriber goes off- hook and completes the dialing of all digits for a call. The call processing programs are usually responsible for call processing functions and interface with the feature programs, translation and office data, and automatic message accounting and maintenance programs. The maintenance program is responsible for system recovery, system iagnostics, backup, and other maintenance-related functions. All these functions are available during call processing. Once the call processing program determines for the subscriber line the allowed features and attributes, it allows a call to be established through the switching fabric. The called subscriber may reside in the calling subscriber's digital switch or may be in another digital switch. If the called subscriber is not in the same digital switch, then an outgoing trunk is used to establish a connection to the other digital switch or tandem office. Under this condition, the proper type of outgoing trunk is selected and assigned a proper trunk circuit for signaling and supervision. When the called subscriber answers the phone, a talking path is established through the switching network while the line and the trunks are constantly scanned for disconnect from either side. If the subscriber resides in the same digital switch/ the special internal line and trunk circuits are used to complete and monitor the call. See Fig. 5.3 for a basic call model. If the called subscriber resides in the same digital switch, the call is classified as an intraoffice call; if the called subscriber resides outside the digital switch/ the call is termed an interoffice call.		
b)	Explain Feature Flow Diagrams for activation, operation and Deactivation of a feature in a digital switching system and write a note on Feature interaction.  	5	C3

	Feature Activation. The feature is activated when the customer goes hook and dials an activation code. The software checks for the correct validation code. If the activation code is wrong, the subscriber does not get the second dial tone. If the activation code is correct, the subscriber gets a second dial tone and is allowed to dial the call-forwarding telephone number. The call-forwarded subscriber line is rung once, and the number is recorded in the system memory for future use. **Feature Operation.** Now, suppose the subscriber receives a call on the line that has the CF feature activated. The system rings the called subscriber once and then forwards the call to a number previously recorded by the subscriber during feature activation. This feature can be deactivated when the subscriber goes off-hook and dials the deactivation code. If the code is valid, the CF number is removed; otherwise, the deactivation request is ignored. Note that this was a very simplified flow diagram for a feature. The actual flow diagrams for some of the features are far more complex. **2. Feature Interaction** One of the obvious problems that can arise owing to the existence of so many features on a single digital switching system is feature interaction. This can happen even in the most advanced and best-designed digital switches. One way to minimize this problem is to conduct regression tests on the software and related hardware. This subject is discussed in greater detail in chapter 6, which addresses software reliability and quality assessment issues.		
7	Design a 3-stage network with 100 incoming line and 400 outgoing line. Specify assumptions and draw the 3 stage network.	10	C4

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Occupancy measures the extent to which a stage in a multistage network is occupied or is busy. Traffic on the network is measured in terms of the occupancy of the servers in the network. Erlang measure indicates the average no. of servers and therefore,

Occupancy period = total traffic ÷ no. of servers of links

For mode 1, the choice of a secondary switch determines the A and B links.

Probability that both links are free = $(1-a)(1-b)$

Probability of blocking = $1 - (1-a)(1-b)$

However there are g_2 secondary switches,

Probability that all g_2 independent paths is simultaneously blocked is

$B_1 = [1-(1-a)(1-b)]g_2$

$= [a + (1-a)b]g_2$

For mode 2,

Probability of blocking for a particular trunk

$= 1 - (1-B_1)(1-c)$

$= B_1 + (1-B_1)c$

Therefore probability of simultaneous blocking for all g3 independent paths is

$B_2 = [B_1 + c(1-B_1)]g_3$ where g_3 is the no. of tertiary switches.