Q1. Given that MTBF=2000 hours and MTTR=4 Hours, calculate unavailability for single and dual processor systems in 30 years of exchange operation.

Ans:

U=4/2000

$=2*10^{-3}$

In 30 years of operation total hours =30*365.25*24*U

= 525.96 hours in 30 years

U_D=2*16/2000*2000

$=8*10^{-6}$

In 30 years of operation total hours =30*365.25*24* U_D

= 2.10384 hours in 30 years

Q2. Differentiate between single stage and multistage networks

Ans:

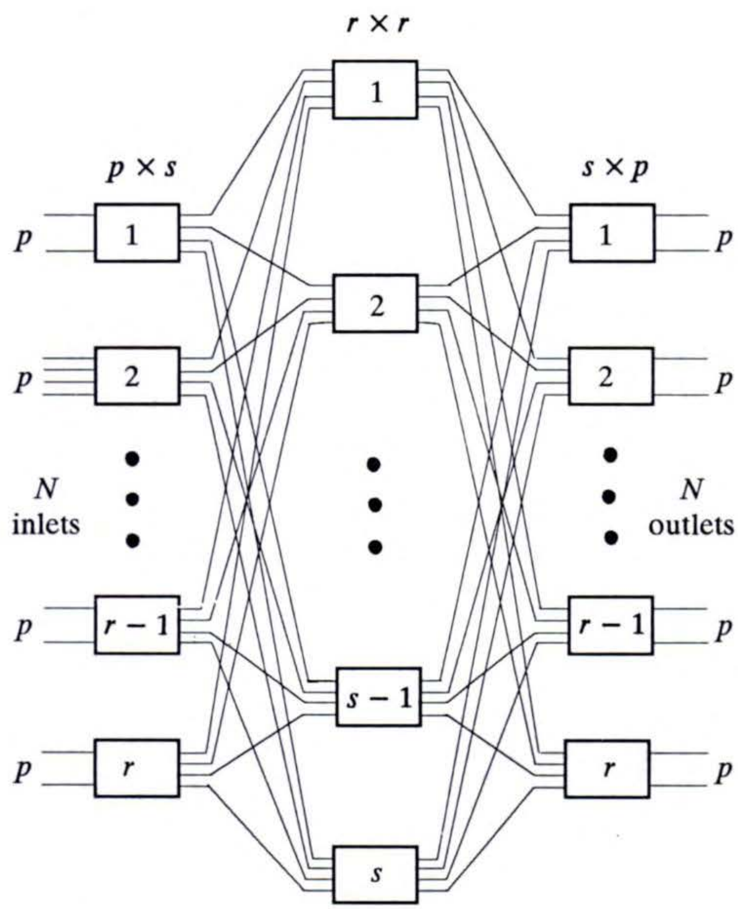
S.No.	Single stage	Multistage
1.	Inlet to outlet connection is through a single crosspoint.	Inlet to outlet connection is through multiple crosspoints.
2.	Use of a single crosspoint per connection results in better quality link.	Use of multiple crosspoints may degrade the quality of a connection.
3.	Each individual crosspoint can be used for only one inlet/outlet pair connection.	Same crosspoint can be used to establish connection between a number of inlet/outlet pairs.
4.	A specific crosspoint is needed for each specific connection.	A specific connection may be established by using different sets of crosspoints.
5.	If a crosspoint fails, associated connection cannot be established. There is no redundancy.	Alternative cross-points and paths are available.
6.	Crosspoints are inefficiently used. Only one crosspoint in each row or column of a square or triangular switch matrix is ever in use, even if all the lines are active.	Crosspoints are used efficiently.
7.	Number of crosspoints is prohibitive.	Number of crosspoints is reduced significantly.
8.	A large number of crosspoints in each inlet/outlet leads to to capacitive loading.	There is no capacitive loading problem.
9.	The network is nonblocking in character.	The network is blocking in character.
10.	Time for establishing a call is less.	Time for establishing a call is more.

Q3. Explain Three Stage Network with the help of diagram

Ans:

Three-Stage Networks

The blocking probability and the number of switching elements can be reduced significantly by adopting a three-stage structure in place of two-stage networks. The general structure of an $N \times N$ three-stage blocking network is shown The N inlets and N outlets are divided into r blocks of p inlets and p outlets each respectively. The network is realised by using switching matrices of size $p \times s$ in stage 1, $r \times r$ in stage 2, and $s \times p$ in



$N \times N$ three-stage switching network.

stage 3. Unlike the two-stage network discussed here any arbitrary inlet in the first stage has s alternative paths to reach any arbitrary outlet in the third stage. The total number of switching elements is given by

$$S = rps + sr^2 + spr = 2Ns + sr^2 = s(2N + r^2)$$

If we use square matrices in the first and third stages, we have $p = s = (N/r)$ and, therefore,

$$S = \frac{2N^2}{r} + Nr$$

Equation (4.15) indicates that there is an optimum value for r that would minimise the value of S. To obtain this value of r, we differentiate set it equal to zero and determine the value of r:

$$\frac{dS}{dr} = \frac{-2N^2}{r^2} + N = 0$$

Therefore, $r = \sqrt{2N}$. The second derivative, being positive at this value of r, indicates that the value of S is minimum, i.e.

$$S_{\min} = 2N\sqrt{2N}$$

and $p = N/r = \sqrt{N/2}$. The optimum ratio of the number of blocks to the number of inputs per block is given by

$$r/p = \sqrt{2N}/\sqrt{N/2} = 2$$