ASSIGNMENT 1

1. a) Sketch a T-S-T network to connect *m* incoming lines to m outgoing lines, each carrying *n* PCM channels. Explain briefly how it operates.

   b) A T-S-T network has ten incoming highways and ten outgoing highways, each carrying 32 PCM channels. The average occupancy of the incoming channels is 0.6 E.
      a. Derive an equivalent space division network.
      b. Estimate the blocking probability.
      c. Estimate the grade of service when an incoming call must be connected to a selected outgoing highway but may use any free channel on it.

2. A plesiochronous digital network uses 2.048 Mbit/s line systems whose frames contain 256 bits. The exchange clocks have a frequency stability of 1 part in 10^7.
      a. Prove that a connection of seven inter- exchange links can have about 20 slips per hour.
      b. On average, what proportion of bits are then received in error?
      c. In what percentage of 3 minute telephone calls on such connections will clicks be audible?

3. A message switching centre sends messages on an outgoing circuit at the rate of 480 characters per second. The average number of characters per message is 24 and the message lengths have a negative exponential distribution. The input of message is a Poisson process and they are served in order of arrival. How many messages can be handled per second if the mean delay (averaged all over messages) is not to exceed 0.5 second?

4. An S-T-S network has 16 incoming and 16 outgoing highways, each of which conveys 24 PCM channels. In between space switches there are 20 links containing time switches. During busy hour 300 E of traffic is offered which is evenly distributed on all time slots on all outgoing highways. Find out G.O.S.
      a. In Mode 1
      b. In Mode 2

5. In the digital switching subsystem of System X, as shown in Fig 1, the sending and receiving time switches each have a speech store containing 1024 storage locations and so can serve 32 PCM systems (each having 32 time slots). The complete switching network contains up to 96 time switches, serving up to 3072 PCM systems. The space switch is thus of size 96 x 96 and handles 1024 channels. However, to minimize problems of pulse distribution, the 1024 channel highways are each split into two highways of 512 channels each. For security, the complete network is duplicated.
      If the switch is fully equipped and the average occupancy of incoming channels is less than 0.45 E, show that connections to outgoing routes (which may use any free time slot) have negligible loss probability.

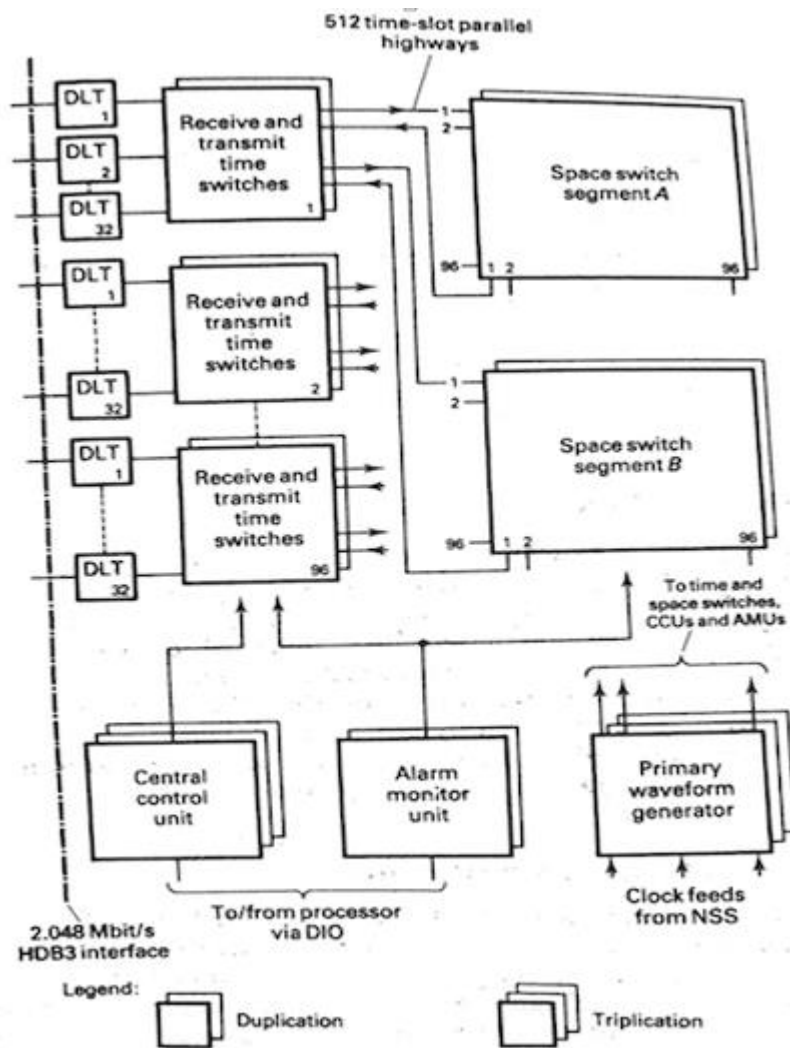6. Write short note on "Application of Graph Theory to Link Systems"

Figure 1: Mark 1 digital switching subsystem of system X. DLT = Digital Line Terminating unit. (Figure taken from J. E. Flood, Telecommunications switching, traffic and networks).