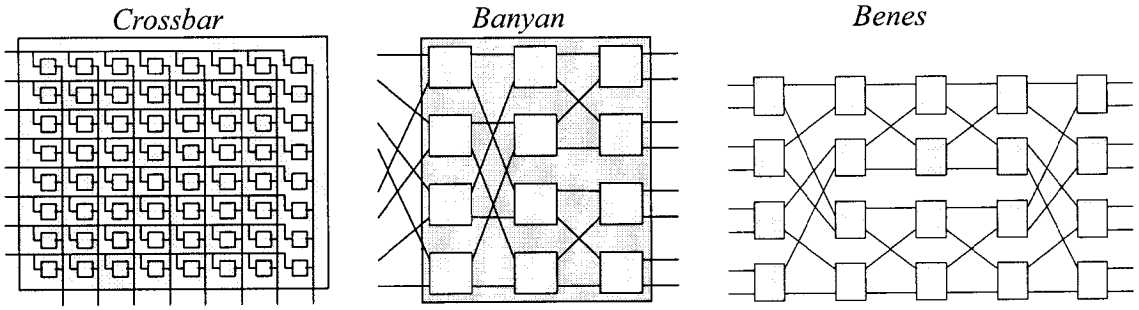
Course S-38.3165 (Switching Technology) exam questions, August 30, 2010

1. Answer the following switch fabric related questions.
   a.) What is meant by Head of Line (HOL) blocking?
   b.) What is the difference between a strict-sense non-blocking and a rearrangeably non-blocking switch fabric?
   c.) How many separate point-to-point connection patterns, which occupy all outlets of a switch fabric, can be set up through an MxN switch ($M \geq N$)?

2. About the switch fabrics.
   a.) What is a sorting network and for what purpose is it used in case of switch fabrics?
   b.) What is meant by cost-index, fan-out and logical depth?
   c.) Give the cost-index, fan-out and logical depth of the below switch fabrics. Assume that the switch blocks of the multistage switches are constructed of crossbar structures.



3. The known parameters of a Clos network are $m_1 = 3$, $n_3 = 2$, $r_1 = 3$, $r_3 = 4$.
   a.) Determine the other parameters when the Clos network is strict-sense non-blocking and draw the network.
   b.) Determine the other parameters when the Clos network is rearrangeably non-blocking and draw the network.

4. An ATM switch is equipped with eight STM-4 interface cards and each of them has one input and one output interface.
   a.) What should be the total throughput (bits/s) of the switch fabric if plain ATM cells are carried through the switch fabric?
   b.) What should be the total throughput (bits/s) of the switch fabric if the ATM cells are carried through the fabric in frames that implement a 53-octet payload and a 2-octet control field?
   c.) Suppose that each input interface makes the routing decisions of the ATM cells locally, i.e. each input interface implements a Routing Information Table (RIT). What should be the routing capacity (cells/s) of an STM-4 interface to avoid overflows of its input buffers?

5. Five end-devices should have logical full connectivity via the optical network that interconnects them. Topology of the physical network is either a star or a ring (see the figures below). Optical fibre links are assumed to be bi-directional and optical network access stations (NAS) are elementary ones. What is the required number of wavelengths, the spectrum reuse factor and the number of optical transceivers in each NAS in the two physical topologies, when using

   a.) static broadcast star switches

   b.) static wavelength selective cross-connect components (WSXC)

   c.) If a logical switching device (enabling time division techniques to be applied) is located between the end station and NAS then how will change the answers of a.) and b.)?

Network topologies and required network components: