# S-38.165 (Switching Technology) examination questions, December 13, 2005

1. Switching and routing.

   a.) What is meant by circuit switching and packet switching?

   b.) What sort of a switch is a self routing one?

   c.) In packet switched networks that are based on the Internet Protocol (IP), Classful Address scheme was replaced with Classless InterDomain Routing scheme. Why was this replacement done and what advantages were gained by this?

2. A 4x4 optical switch (shown beside) is composed of wavelength multiplexers (WMUX) and wavelength demultiplexers (WDMUX).
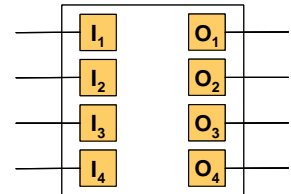
   a.) Sketch the construction of the switch as the fabric is a static broadcast star. Add to the figure all required wavelengths (λ_i) so that full connectivity becomes possible.

   b.) Sketch the construction of the switch as the fabric is a static wavelength router. Add to the figure all required wavelengths (λ_i) so that full connectivity becomes possible.

   In both cases, illustrate all WMUX and WDMUX components that are needed at the input and output stages as well as all connections between them.

3. Blocking is closely related to switches.

   a.) What is meant by blocking and how are switches categorized based on blocking?

   b.) The switchboard of a company has an E1 interface to the telecommunications network. During a rush hour, voice traffic between the switchboard and the telecommunications network is 42 Erlangs. How long each voice channel (of the E1 interface) is engaged during the rush hour on the average?

   c.) The switchboard is updated to implement two E1 interfaces to the telecommunications network. After the update, each voice channel is engaged 30 minutes on the average during a rush hour. How many Erlangs is the voice traffic between the switchboard and the telecommunications network during a rush hour?

4. Synchronization of telecommunications networks.

   a.) Explain why synchronization is needed in transport networks that are based on the conventional PDH and SDH techniques?

   b.) Two adjacent PDH networks are synchronized to their own reference clock sources. The accuracy of both the clock sources is 10^{-9}. How frequently slips occur in the PDH traffic between the two networks?

5. The below shown 20x20 Clos network is rearrangeably non-blocking and the table beside the figure gives all connections already established through the network. Each line of the table represents a connection between the given input stage and output stage switch blocks, and the connection is formed via the given middle stage switch block.

   a.) How should the switching network be developed to make it a strictly non-blocking 20x20 switch? Reason your solution.

b.) Is it possible to establish a connection between switch block 1 at the input stage and switch block 3 at the output stage, when the connections listed in the table are valid? Reason your solution.

c.) A new connection should be set up between switch block 3 at the input stage and switch block 2 at the output stage. Show by using Paull's matrix how the existing connections should be rearranged to set up the new connection. What is the minimum number of connections that need to be rearranged?
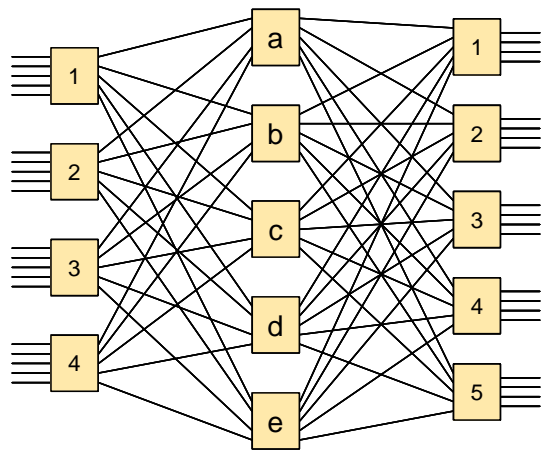
Input stage switch block	Middle stage switch block	Output stage switch block
1	a	1
1	b	2
1		3
1	c	4
1	e	5
2	b	1
2	a	2
2	c,d	3
2	e	4
2		5
3	c	1
3		2
3	b	3
3	d	4
3	a	5
4	d	1
4	e	2
4	a	3
4	b	4
4	c	5