

Course S-38.165 (Switching Technology) examination questions, May 9, 2005

1. Different sorts of switching equipment (e.g. PCM/PDH or ATM) have equal basic functionality.
 - a.) Name the most important functional blocks of a switching device and explain what functionality is typically implemented in them.
 - b.) What are the most essential differences between a circuit switched and a packet switched switching device and how do these differences affect the structure of a switch?
2. Suppose you have an $M \times N$ switch that can be used for setting up point-to-point and point-to-multipoint connections ($M \geq N$). Deduce expressions for the following cases.
 - a.) What is the number of all possible point-to-point connection patterns that can be set up through an $M \times N$ switch? Count also patterns that do not occupy all outlets.
 - b.) How many different point-to-point connection patterns, which occupy all outlets, can be set up through an $M \times N$ switch?
 - c.) How many different point-to-multipoint connection patterns can be set up through an $M \times N$ switch? Count only real multipoint patterns, i.e., an inlet is connected to at least two outlets.
3. The switch fabric of a router is based on a 32-bit wide shared bus and the bus clock rate is 150 MHz. One 32-bit word is transferred across the bus in three bus clock cycles. It is also known that 10 % of the bus capacity is used for control of the routing device.
 - a.) If the router is equipped with Fast Ethernet (100 Mbits/s) interfaces, then what is the maximum number of such interfaces that can be attached to the router without overloading the switching bus?
 - b.) Assume that two Fast Ethernet interfaces are implemented on a single line card. If the card has a routing table, then how fast should the routing logic be to avoid loss of IP packets (due to the routing) in every possible loading situation?
 - c.) Explain what kind of weaknesses and strengths do the bus type switch fabric implementations have.
4. An $N \times N$ crossbar type of a switching matrix is to be constructed of 2×2 crosspoint components. The maximum input current of a crosspoint component's inlet is 4 mA and the maximum output current of an outlet is 180 mA.
 - a.) What is the maximum size of the switch matrix and how is fan-out related to dimensioning of the maximum size?
 - b.) What is the logical depth of this maximum size switch matrix and what is meant by the logic depth?
 - c.) Is the constructed switch matrix strictly non-blocking and what is meant by strictly non-blocking switch fabrics?

5. An Optical Network Node (ONN) is able to support 0.6 nm wave length channel spacing in the 1550 nm region. Suppose that the speed of the light in an optical fibre is $\frac{2}{3}$ of the light speed in space and the used modulation efficiency is 0.2 bits/Hz.
- a.) What is the transport capacity (bits/s) of such a light wave channel?
 - b.) If such a transport channel utilises 8B10B block coding, then what is the link rate (bits/s) seen by the terminating device (just before the line coder)?
 - c.) An ONN is connected to a Network Access Station (NAS) with two fibre pairs. When each fibre carries two optical channels (such as described above), then what should be the switching capacity (bits/s) of the transmission processor and reception processor of the NAS?