

- Please give short and readable answers.
- If not readable, the answer is wrong.
- List of subanswers is preferred over long and full sentences.

Question A1: Optical and electronic networking components

1. Give six, speed-ordered, physical effects used in optical switching fabrics.
2. Which optical filter components can be used in OADMs?
3. Which optical sources are preferred in the 800nm, 1300nm, and 1550nm windows?
4. Describe (a) TCAM-device, (b) Hierarchical fast access and huge memory storage.

Question A2: Interconnects

1. Characterize the interfaces of 40 Gigabit and 100 Gigabit Ethernet systems.
2. Describe an interface between asynchronous and synchronous digital circuits.
3. Give the SPI4 main characteristics.

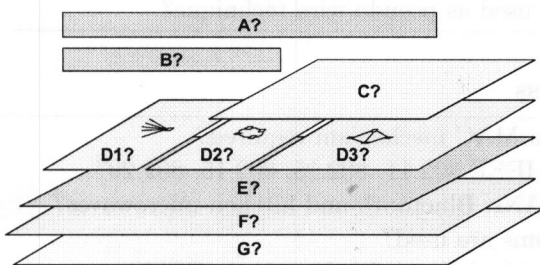
Question A3: Systems

1. Give the components of (a) Fibre-Channel SAN, (b) InfiniBand SAN.
2. Give six different categories of network processor kernels.
3. Which technologies can be used to implement high-capacity backplanes?

Question A4: Laser structures

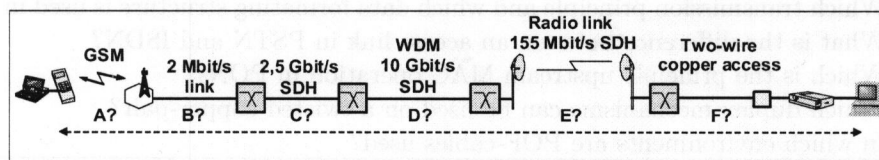
1. Describe the difference between gain-guided and index-guided laser diodes.
2. Describe the difference between Fabry-Perot laser and distributed feedback laser.
3. What structures can be used to produce short optical pulses?

Question B1: Networking



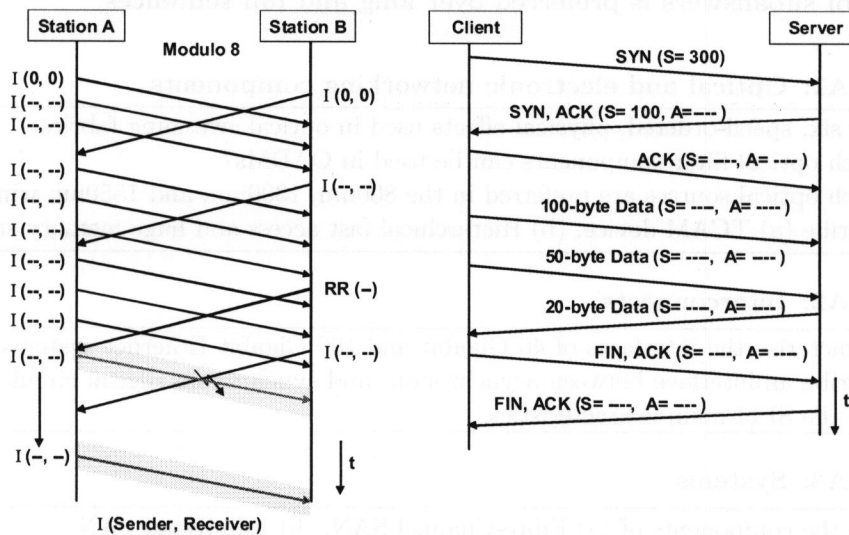
1. Give network-plane names A to G.
2. Give purpose of plane G.
3. Give the four QoS categories.
4. Give the differences of:
 - a) Path protection, section protection.
 - b) Soft-state, hard-state tables.
 - c) Isochronous, synchronous mode.
 - d) Leaky bucket, token bucket.
 - e) Flow control, congestion control.

Question B2: Circuit-switching



1. Which multiplex methods are valid on each of the sections A to F?
2. Which procedure maps packets onto SDH transmission channels?

Question B3: Packet-switching



We consider two flow-control diagrams of two different protocol layers:

1. Which protocol scenarios have been shown? Complete the numbering in the figures.
2. Which units are acknowledged? Different in each scenario.

3. Which network protocol dynamically assigns IP addresses?
4. In which way care-of addresses are provided in MIPv4 and how it is in MIPv6?
5. Which two protocol groups exist in order to realize IP multicast.
6. Give the multicast address structures for IPv4 and IPv6.
7. Which are the five transmission units that can be labeled in GMPLS?
8. Which forwarding technologies can be used as pseudo-wire technique?

Question B4: Mobile and wireless access

1. In which access network topologies is a MAC mechanism required?
2. Which wireless technologies belong to IEEE 802.11, 802.15, 802.16, 802.20?
3. Which frequency band is used by WLANs, Bluetooth and kitchen-microwaves?
4. Which cellular mobile access mechanisms are used?
5. Which logical channel groups (no individual channels) do exist in GSM?

Question B5: Wired access

1. Which transmission principle and which data forming structure is used in ADSL?
2. What is the difference between an access link in PSTN and ISDN?
3. Which is the principle upstream MAC operation in PONs?
4. Which duplex mechanisms can be used on a twisted copper-pair?
5. In which environments are POF-cables used?