

**SCHDF0018 - HIGHER DIPLOMA IN COMPUTER SCIENCE EXAMINATION
ARBDF0015 – THIRD YEAR ARTS EXAMINATION**

COMPUTER SCIENCE

**COMPP303: Networks and Internet Systems
COMP3616: Networks and Internet Systems**

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Question 1

(1-a) *Connection-oriented*: modelled on the telephone system.

1. establish a connection
2. use the connection (for data transfer)
3. release the connection

Essential feature: sender pushes objects (e.g. bits, packets) in at one end of the connection, and receiver takes them out *in the same order* at the other end.

Connectionless: each message is sent independently of any other messages going from the same sender to the same receiver: modelled on the postal service.

Essential features: each message must *include the receiver's address*, and messages can be received in a *different order* to the order in which they were transmitted.

(1-b) node throughput = 75 frames/sec, or $(75 * 1,500) = 112,500$ bits/sec
system throughput = $60 * (\text{node throughput}) = 4,500$ frames/sec, or 6,750,000 bits/sec
maximum system rate = $(10,000,000 / 1,500) = 6,666.67$ frames/sec, or 10,000,000 bits/sec
efficiency = $(4,500 / 6,666.67)$ or $(6,750,000 / 10,000,000) = \mathbf{0.675}$, or **67.5%**

(1-c) in the Lecture Notes (or any computer networks textbook).

(1-d) IP address: 154.33.7.220
Mask: 255.255.252.0 (255 means all-1's)

Subnetwork address is Boolean-AND of these: 154.33.4.0 or **154.33.x.y** with **x=00000100** and **y=11011100**

Since this is a Class B address, the Netid is 154.33, the 6-bit Subnetid is 000001, and the 10-bit Hostid is 0011011100.

Question 2

(2-a) **X = 3, Y = 0, Z = 1, W = 1**

(2-b) see lecture notes.

Question 3

(3-a)

1. The Single Parity Check can detect any odd number of bit errors in a transmitted codeword: TRUE.
2. In Ethernet, a node wishing to transmit might never be allowed to access the channel: TRUE.
3. The IEEE 802 Medium Access Control (MAC) protocol is independent of the particular broadcast Local Area Network technology (Ethernet, Token Ring, Token Bus, etc) being used: FALSE.

(3-b)

UDP: connectionless transport protocol ; TCP: connection-oriented transport protocol.
UDP: 8 byte header; TCP: 20-60 byte header.
UDP: no flow/congestion control; TCP: supports flow/congestion control (sliding window).
UDP: unreliable delivery; TCP: reliable (using ACKs and Timeouts).
UDP: transports IP packets; TCP: byte-oriented, doesn't preserve message boundaries end-to-end.

Question 4

(4-a)

- desirable properties of a routing algorithm:
- correctness, simplicity, efficiency – obviously
 - robustness – since usually the entire network can't be "re-booted" !!!
 - stability – routing algorithm reaches equilibrium in a reasonable time
 - fairness, optimality (often in conflict)
 - optimality – with respect to what ? What are we trying to optimise ?!
-- average Packet delay ? total Packet throughput ?
-- but these goals are also in conflict: operating any network near capacity implies long queueing delays in node buffers
-- compromise – minimise number of relays (or hops) a Packet needs

(4-b)

Datagram packet-switching:

- Each packet is treated individually within the network, so successive packets may follow different routes through the network. Each packet contains the receiver's address and a sequence number (so that receiver can put them into correct order). Network nodes are routers, which have routing tables telling them which output link to use for each possible destination. No connection set-up needed.
- Flexible routing possible (e.g. if a router crashes).
- Network resources are *not shared at the same time*: each packet monopolises a link during its transmission, after which the link is available for other packet transmissions.
- Ideal for *short-lived* bursty traffic; less suitable for *long-lived* &/or *interactive* bursty traffic.

Virtual circuit packet-switching:

- A route is set up in the network between sender and receiver (by making appropriate entries in the routing tables).
 - Resources may or may not be reserved for this route. If resources need to be reserved and are not available, the connection request is blocked.
 - Each packet contains its virtual circuit identifier.
 - Routers have routing tables telling them which output link to use for each established virtual circuit.
- Connection set-up required, which may involve significant delay.
- Network resources are *not shared at the same time*: each packet monopolises a link during its transmission, after which the link is available for other packet transmissions.

Question 5

(5-a)	Transmission number	Sender's Congestion Window (kB)	Threshold (kB)
	0	2	64
	1	4	64
	2	8	64
	3	16	64
	4	32	64
	5	2	16
	6	4	16
	7	8	16
	8	16	16
	9	18	16
	10	20	16
	11	2	10
	12	4	10
	13	8	10
	14	10	10
	15	12	10
	16	12	10

(5-b) in the Lecture Notes (or any computer networks textbook).