Network Layer Quiz Solutions

1. State True or False (Provide a one-line explanation)

(a) The count-to-infinity problem in Distance-Vector (DV) routing protocols occurs when a new node joins the subnet
False: Occurs when a node *leaves* a subnet.

(b) When DV routing is used, nodes do not learn the complete topology of the network
True: Nodes just learn the best *next* hop for forwarding a packet to any destination

(c) DV routing nodes determines the shortest path to any destination
True: Complete knowledge of the topology (or even the sink tree) is not required for determining the shortest route.

(d) In the link-state (LS) approach nodes exchange topology information only with their neighbors
False: The link state packet created by every node is flooded to all nodes in the subnet.

(e) The "age" field in packets that are flooded is to ensure that the packet is dropped after the number of hops indicated in the field
False: The age field represents the time after which the packet should be disregarded (if cached, removed from cache). This field helps in preventing ambiguities in determining higher sequence numbers (fresher packets) as sequence numbers will need to be wrapped around.

(f) In congestion control techniques employing "warning bit" routers send an IP packet with a warning bit set directly to the source
False: Warning bit is set by a router in the path and forwarded along the usual path to the destination. The destination is expected to include a warning bit in ACK packets sent to the source.

(g) Once a "choke" packet is sent from a router to a source, the source reduces its output rate till it receives an "unchoke" packet from the router which sent the choke packet.
False: The source returns to normal operation when no choke packets are received for a certain duration

(h) When packets are fragmented by the IP layer, they are reassembled by the MAC layer.
False: MAC layer does not know anything about the structure and contents of IP packets. Routers fragment IP packets. Reassembly is performed only at the destination.

(i) IP uses a hierarchical numbering scheme for fragments to handle IP fragments that may be fragmented further by other routers en route
False: IP employs a linear numbering scheme

(j) The fragmenting policy in the IP layer dictates that fragment offsets be multiples of 8 bytes – thus no IP packet can have less than 8 bytes of payload
False: Only packets which have more fragments (MF) bit set will need to be at least 8 bytes long. An unfragmented IP packet or the last fragment does not have this limitation.

(k) The Time-to-live (TTL) field in the IP layer uses Unix time (number of seconds since 1/1/1970).
False: TTL is a misnomer. The 8-bit field simply indicates the number of hops. When created the source sets the maximum number of hops. Every router forwarding the packet decrements this field by one.

(l) Congestion can be overcome if we have an unlimited amount of storage (for buffering packets) in routers
False: Delaying packets causes time-outs and packets to be resent, which can further increase congestion

(m) The "Type of Service" field in IP header is often ignored by most routers
True: Because they can be easily abused by the sender.

(n) The "header checksum" is recomputed at every hop
True: As router change the TTL field in the IP packet the check-sum has to be recomputed. (In some cases routers may also need to change some other fields in the IP header – for example, when the router requires to fragment a packet).

(o) The binary value of IHL field is interpreted as the length of the IP header in kilobytes
False: Length of the IP header in the number of 32-bit words. Typically IHL is 5 (20 bytes). Maximum IHL value is 15 (60 bytes - which gives 40 additional bytes for IP options; but IP options are rarely (if ever) used)

(p) ARP protocol employs IP packets to send ARP requests and responses
False: They are MAC packets. MAC packets are sent to a broadcast address, requesting the MAC address corresponding to a particular IP address

(q) DHCP allows both manual and automatic assignment of IP addresses
True: Typically some machines (identified by their MAC address) are provided fixed IP addresses. A second pool of IP addresses are reserved for dynamic allocation.

(r) If a new transport layer protocol (apart from TCP and UDP) is invented, all routers will require modification
False: Routers do not have to worry about the payload of IP packets (which are transport packets)

(s) If a new transport layer protocol (apart from TCP and UDP) is invented all NATs will require modification
True: Unlike routers, NATs need to modify some parameters in the transport header. So need to be aware of the transport later protocol used.

(t) ICMP echo packets are addressed to port 14
False: ICMP packets do not carry any transport layer payload – so they are not addressed to any port number.

2. A router has the following entries in its routing table

135.46.56.0/22 Interface 0
135.46.60.0/22 Interface 1
172.53.40.0/23 Interface 3
default Interface 4

For each of the following destination IP addresses (in an IP packet received by the router) , what does the router do?

a) 135.46.63.10
b) 135.46.57.14
c) 135.46.52.2
d) 172.53.40.7
e) 172.53.56.7

135.46.56.0 /22 represents the range of addresses 135.46.56.0 to 135.46.59.255
135.46.60.0/22 135.46.60.0 to 135.46.63.255
172.53.40.0/23 172.53.40.0 to 172.53.41.255

135.46.63.10 → Interface 1
135.46.57.14 → Interface 0
135.46.52.2 → Interface 4 (default)
172.53.40.7 → Interface 3
172.53.56.7 → Interface 4 (default)