CS 31204: Computer Networks
Spring 2023

Full Marks: 20 **Class Test 2, April 6, 2023** **Time: 50 minutes**

NAME: **ROLL NO.:**

1. State two advantages of a link state routing protocol over a distance vector routing protocol. (2)

   1. No restriction on network size (does not have the counting to infinity problem)
   2. Faster convergence time
   3. More efficient if not too much network change as full updates are only sent at periods much larger than in distance vector protocols

   Any two is fine. 1 mark for each. Partial marks given for some other answers also. However, saying things like load balancing, ability to keep multiple routes, ability to have different metrics etc. is not accepted as those are features of particular protocols like OSPF, not general characteristics of link state routing that give it an advantage over distance vector protocols. DV protocols can also use different metrics, can keep more than one route, nothing prevents these, just that RIP does not.

2. Suppose that a node X has the following routing table in a distance vector routing protocol (leftmost table). Now X receives the routing table (full) from a neighbour Y as shown in middle. The cost of the link X-Y is 1. Draw the new routing table of X by filling up the blank table on the right. Use as many of the blank rows as you need, but do not write anything outside the table. (3)

Destination	Next hop	Cost
A	Y	10
B	B	15
C	Z	8
Z	Z	6
Y	Y	1

Destination	Cost
A	10
D	15
B	9

Destination	Next hop	Cost
A	Y	11
B	Y	10
C	Z	8
D	Y	16
Y	Y	1
Z	Z	6

0.5 marks for each row

3. Suppose that an IPv4 packet has arrived whose fragmentation bit (M) is set to 1. Is this the first fragment of an IP datagram? Justify in one sentence. If the fragmentation offset value is 76 in this packet, how many bytes of data of the original IP datagram are there in other fragments before this packet (just write the value, no explanation is needed)? (1 + 1)

   No, it may or may not be the first fragment, as Fragmentation (MF) bit set to 1 only says there is at least one more fragment after this.
   0 if you say yes. 0.5 or 1 if you say no depending on justification (also accepted justification saying first fragment only if fragment offset is 0)

   Fragmentation offset is in multiples of 8-bytes, so 76 means there are 8 x 76 = 608 bytes of data before this fragment (remember sequence no. starts from 0, so data 0 to 607 are before this)
   1 mark for 608, 0 otherwise

4. Can two IP addresses of two machines in the internet be the same (with no problem in communication for either machine)? Justify your answer in one sentence. (2)

   Yes, if they are IPs in the private IP range.

   2 marks if “private IP” mentioned, 0 otherwise. Note that saying NAT can put same public IP for two machines in IP packets is not acceptable. The IP address of a machine is what is assigned to its NIC, NAT only puts the IP address on outgoing packets, it is not assigning IP to a machine.

5. Suppose that 192.168.158.56 is a valid IP address in a subnet with the subnet mask 255.255.224.0. What is the broadcast address (in dotted decimal format) for this subnet? No calculation needs to be shown. (2)

192.168.159.255

2 marks for correct answer, 0 otherwise (no part marking)

6. An organization is granted the block 56.130.0.0/16 by the ISP. It wants to create 1024 no. equal sized subnets.
(a) What will be the subnet mask for the subnets in dotted decimal form (no explanation is needed)? (1)

255.255.255.192

1 mark for correct answer, 0 otherwise (no part marking)

(b) What will be first address in the 8th subnet (subnet starting with 56.130.0.0 is the 1st subnet) that can be assigned to a host? Justify your answer clearly. (2)

8th subnet address range starts from 56.130.00011100.0 = 56.130.1.192
First address is not used for any host
So the first address that can be assigned to a host is 56.130.1.193

1 mark for showing start of addresses in 8th subnet, 1 mark for skipping first address and stating final correct answer.

7. What are the uses of the SYN and ACK flags in a TCP header? One sentence each only. (2)

SYN flag is used to indicate that the segment is for connection establishment and is carrying an initial sequence number in sequence number field..
ACK flag is used to indicate that the Acknowledgement field in the TCP segment caries a valid value.

1 mark for each. Answers varied, given credit as long as correct.

8. Why is a pseudo-header used in TCP? One sentence only. (1)

TCP pseudo-header is used to compute the checksum in a way that allows a receiver to verify that the segment has been routed to the correct IP address.

1 mark for saying any one of compute checksum or verify checksum or checking IP, 0 otherwise.

9. Consider a TCP connection between X and Y. The initial sequence number decided during connection establishment (for X to Y transfer) is 2032. X sends 2 TCP segments of size 684, and 920 bytes (including TCP header, assume there are no options), and Y replies back with a single cumulative acknowledgement. What will be the values in TCP header of the following: (i) the sequence no. field for the two segments sent, (ii) the total length fields of the two segments sent, and (iii) Acknowledgement no. field of the Acknowledgement received? Show your calculations. (3)

First note that the data part of the TCP segmentsare 664 and 900 bytes respectively (TCP header is 20 bytes).

(i) Initial sequence no. is 2032, which is used up during the connection establishment, so data sequence no. will start from 2033. So the sequence no.s in the two packets are 2033 and (2033+664) = 2697.

1 mark for 2033 (exact, given 0 if 2032 said), 1 mark for 2697 (given 0.5 if forgot to subtract header size)

(ii) This was a cut-and-paste mistake, there is no total length field in TCP segment.

So no marks deducted, 0.5 extra credit given if you noted that there is no total length field in TCP. Less than 10 people did, or at least wrote finally!

(iii) Sequence no. of last byte received = 2697+ 900 - 1= 3596. So acknowledgement no. is 3597, the next byte to expect.

1 mark for correct answer, 0.5 if correct except for subtracting header size, 0 otherwise