Network Systems (201600146/201600197), Test 1

March 9, 2018, 13:45–15:15

Answers

1. Physical media and framing

1 pt (a) E.
Many chose C, but there's no need for a curved surface: total internal reflection also occurs on flat surfaces.

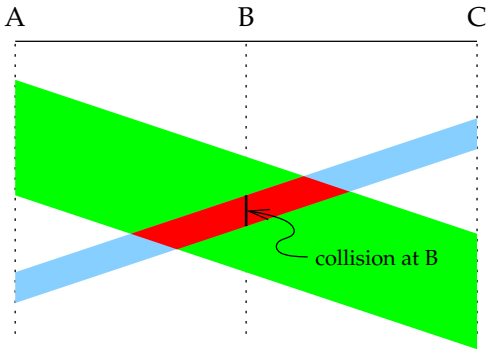
1 pt (b) C.
Single-mode fiber has less spreading in time of the light pulse, so pulses can be sent shorter after each other.

1 pt (c) A.

1 pt (d) A.
Many chose D, but there is no requirement for the flag to be a complete byte, as the processing happens bit-by-bit.
The stuffing rule from A is a direct adaptation of the normal stuffing rule, which ensures that it is always possible on the receiving side to know whether a 0 after a number of 1s is a stuffed zero or marks a flag.

1 pt (e) D.
Out of every 9 bits sent on the wire, 8 would be user data, hence $8/9 \cdot 100\%$.

2. Medium access control



3 pt (a)

1 pt (b) C.
Channel partitioning gives each node half of the transmission time; only one of them is activel, so only half of 100 Mbit/s is used

1 pt (c) F.
Now both nodes are using their time on the channel.

1 pt (d) D.
In each round, Q=30000 bits are sent, which takes 0.3 ms, and twice d_poll=0.1 ms is wasted, so 30000 bits are sent every $0.3 + 2 \cdot 0.1 = 0.5$ ms.

1 pt (e) E.
In each round, $2Q$=60000 bits are sent, which takes 0.6 ms, and twice d_poll=0.1 ms is wasted, so 60000 bits are sent every $2 \cdot 0.3 + 2 \cdot 0.1 = 0.8$ ms.

1 pt (f) F.
Since only one node is active, there will never be collisions, so all frames are fresh and transmitted immediately.

1 pt (g) C.
Follows from substitution in the formula derived in the book.

3. (Inter)Networking

1 pt (a) D.

1 pt (b) D.
Note that we need not worry about TTL becoming 0 at the next hop, since the next hop might be the packet's final destination.

1 pt (c) D.
First DNS to look up the IP address, then ARP to query the corresponding MAC address (assuming it's on the same local network, otherwise we can't find its MAC address).

1 pt (d) D.
Note that 130.89.8.0 and 130.89.12.14 differ in the 22nd bit, as $8_{10} = 00001000_2$ and $12_{10} = 00001100_2$.

1 pt (e) A.
Answer A matches, since it has a prefixlength of only 2, saying the first to bits are 0, which is also the case for our byte $13_{10} = 00001101_2$, so they match.
Answer D does not match, since has a prefixlength of 30, requiring everything except the last two bits to match, while the mismatch is in the 3rd-last bit.

1 pt (f) C.
It must be in the forwarding table of a router, otherwise the router can't do the longest-prefix-match algorithm.
It is not in one of the packet headers: just check those header formats, there's no field for them.
A bridge only looks at MAC addresses, so a bridge doesn't care about IP addresses nor prefix lengths.

1 pt (g) G.
Bridges do their forwarding based on MAC addresses, learning them into their forwarding tables. However, they do not change the MAC addresses.
More than 2/3 of all students chose F here. That is wrong. However, it *was* the correct answer to question 3d of *last year's* exam; I guess that's why so many students chose it. The difference is that last year's question was about packets being forwarded by *routers*, while this year's question was about *bridges*.

1 pt (h) Fragment 2 is a complete packet on its own, and fragments 6, 7 and 8 together also form a complete packet.
Fragment 1 actually fits entirely inside fragment 2. The other fragments do not belong together to form any more complete packets.

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4. Dijkstra's algorithm

4 pt (a)

Step	Confirmed	Tentative
1	(A,0,-)	(B,5,B), (C,1,C), (E,7,E)
2	(A,0,-),(C,1,C)	(B,5,B), (E,6,C), (D,3,C)
3	(A,0,-),(C,1,C), (D,3,C)	(B,4,C), (E,6,C)
4	(A,0,-),(C,1,C), (D,3,C), (B,4,C)	(E,5,C)
5	(A,0,-),(C,1,C), (D,3,C), (B,4,C), (E,5,C)	

Alternatively, one can have separate steps for moving a path to the Confirmed set, and for updating Tentative.

1 pt (b) C.
For example, the path from A to B went via C and D at cost 4, but if the cost of each link increases by 1, this path A – C – D – B would cost 7, while the direct path A – B would cost only 6, so the latter is preferred.

1 pt (c) A.
Nothing changes, as all path costs are doubled, so whichever path was cheapest remains the cheapest.