Network Systems (201600146/201600197), Test 2

March 8, 2019, 13:45–15:15

Answers

1. Physical media

1 pt (a) E.

1 pt (b) D.

1 pt (c) E.

The formula says $C = B\log_2(1 + SNR)$. Using the Taylor series expansion, this gives $C = B \cdot SNR + \mathcal{O}(SNR^2)$, so for small SNR the capacity C is linear in the SNR.
This question was found the most difficult, and to some extent tested things that are not really the topic of this exam, namely Taylor series math, so we decided to treat it as a bonus question (i.e., if you got all questions right except for this one, then you still get a 10 as the grade).
The most popular answer was D, which, to be honest, I find surprising: firstly because practically it cannot be right (SNR=0 means zero signal, and clearly without a signal you cannot transport any information), and secondly because of the math (if you substitute SNR=0 into the formula, the outcome is 0, not non-zero).

1 pt (d) D.

Option F was popular but is wrong: the stuffing rule is that always a 0 is inserted after five 1s, so that extra 0 must also always be removed.

1 pt (e) C.

2. Sharing a medium

1 pt (a) C.

In the study material, we derived that the maximum possible efficiency of slotted ALOHA for a large number of nodes, using the optimal transmision probability, is e^{-1}, which is about 37%.

1 pt (b) B.

The optimal transmission probability is $1/N$, where N is the number of active stations, 65 in this case.

2 pt (c) In each round $65 \times 45 = 2925$ seconds are spent on the MP's talking,
while $650 \times 5 = 3250$ are spent on the polls,
giving an efficiency of $\frac{2925}{2925 + 3250} = \frac{2925}{6175} = 0.4737 = 47\%$.

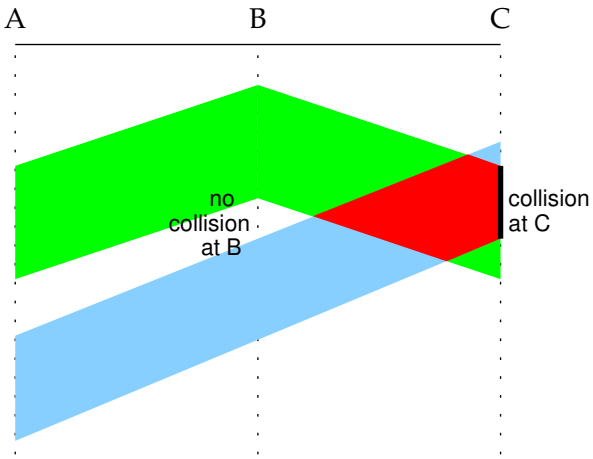
1 pt (d) F.

The total time spent per round on polls is independent of how many MPs do speak (since also the silent MPs need to be polled), so the efficiency is highest when we maximize the amount of time spent on speaking, i.e., when all MPs speak.

1 pt (e) B.

With ALOHA, an MP might be unlucky and have a collision everytime he/she tries to speak, so there's no upper bound how many tries he/she needs.
With polling, worst case the MP has to wait until all other MPs have spoken, but with an upper bound on how long each MP speaks (45 seconds), this does give an upper bound on how long our MP has to wait.

2 pt (f)



Note that it was given that C's carrier detect is broken, so it's even allowed for C to start transmitting after it starts receiving the signal from B.

---

3. (Inter)Networking

1 pt (a) A.

It's the bridge with the lowest identifier.

2 pt (b) B4-E, B5-F, B7-I.

Each LAN remains connected towards the root only along the path with the fewest hops; in case of equal number of hops, the bridge with the lowest identifier is used.

1 pt (c) B.

If B2 does not modifiy the spanning tree messages as it should (put its own identifier in, increment the root path cost), B4 sees messages coming from B2 that are exactly the same as the ones B1 sent, so it cannot know there's another bridge between them.

2 pt (d) 3 and 5.

The 1000 byte packet from A can go to X without problems, as the MTU on that link is larger than 1000.
X has to fragment the packet into fragments of at most 500 bytes each. Since each fragment gets its own 20-byte IP header, the 1000 bytes from A do not fit in two 500-byte fragments, but need three, of sizes 500, 500, and 40 bytes.
Each of these fragments arrive at Y, which cannot send the 500-byte fragments over the 492 byte MTU of the next link. So those fragments are fragmented further, leading to a total of five fragments arriving at Y.

1 pt (e) B.

1 pt (f) D.

1 pt (g) F.

1 pt (h) D.

First DNS to find the IP address from the hostname, then ARP to find the MAC address belonging to that IP address.

1 pt (i) F.

---

4. Routing

1 pt (a) A.

4 pt (b)

Step	Confirmed	Tentative
1	(A,0,-)	(B,2,B), (C,5,C), (D,1,D)
2	(A,0,-),(D,1,D)	(B,2,B), (C,5,C), (F,**9**,**D**)
3	(A,0,-),(D,1,D), (B,2,B)	(C,5,C), (F,9,D), (E,3,B)
4	(A,0,-),(D,1,D), (B,2,B), (E,3,B)	(C,**4**,B), (F,**7**,B)
5	(A,0,-),(D,1,D), (B,2,B), (E,3,B), (C,4,B)	(F,**6**,B)
6	(A,0,-),(D,1,D), (B,2,B), (E,3,B), (C,4,B), (F,6,B)	