

CSC 458: Computer Networks, Fall 2016

Department of Computer Science, University of Toronto

Handout # 12 – Solutions to Sample Midterm

Date: Tuesday, October 18th

1. Layering.

(c)

2. Reliable Flooding.

(b)

(d)

3. Longest Prefix Match Lookups. Which of the following are true?

(b)

(c)

(d)

4. Transmission Rate.

(e) 829.44 Mbps

Longer Questions

5.

(a.)

1. Data-rate of the link.
2. Length of the link.
3. Delay of packets traversing the link.
4. Price to send a packet over the link.
5. Packet error-rate on the link.

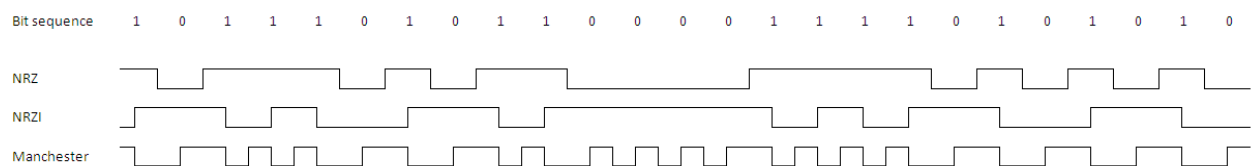
(b.)

The length of longest loop-free path in the network is 7 (it couldn't be larger than that in any network of 8 routers). So every router will hear of the lowest cost path within seven steps.

(c.)

Step	New entry in shortest path set, S (Router, Next-hop, Cost), S
1	(R1, R1, 0), S = {R ₁ }
2	(R6, R6, 1), S = {R ₁ , R ₆ }
3	(R8, R8, 2), S = {R ₁ , R ₆ , R ₈ }
4	(R3, R6, 4), S = {R ₁ , R ₆ , R ₈ , R ₃ }
5	(R5, R6, 5), S = {R ₁ , R ₆ , R ₈ , R ₃ , R ₅ }
6	(R7, R8, 7), S = {R ₁ , R ₆ , R ₈ , R ₃ , R ₅ , R ₇ }
7	(R2, R6, 8), S = {R ₁ , R ₆ , R ₈ , R ₃ , R ₅ , R ₇ , R ₂ }
8	(R4, R8, 9), S = {R ₁ , R ₆ , R ₈ , R ₃ , R ₅ , R ₇ , R ₂ , R ₄ }

6.



7.

Note:

The first router has an MTU of 1500, this means that the 3000 byte message has to be splitted at the source. We will need three packets to transmit 3000 tcp message with MTU 1500 because we have to account for IP header on top of each packet that we are sending.

Packet in router 1	Length (ip hdr + tcp msg)	offset
#1	$20 + ((1500 - 20)/8)*8 = 20 + 1480$	0
#2	$20 + (1500 - 20)/8 * 8 = 20 + 1480$	$1480 / 8 = 185$
#3	$20 + (3000 - 1480 - 1480) = 20 + 40$	370

Packets in 2 nd router (and hence, in the 3 rd router and the dst)	Length (ip hdr + tcp msg)	Offset
#1	$20 + ((800 - 20) / 8 * 8) = 20 + 776$	0
#2	$20 + (((1500 - 776) - 20) / 8) * 8 = 20 + 704$	$776 / 8 = 97$
#3	$20 + 776$	$97 + 704 / 8 = 185$
#4	$20 + 704$	282
#5	$20 + 40$	370

8. $A \rightarrow R1 \rightarrow R2 \rightarrow B$

a) end-to-end latency = $d_{\text{transmission}_A} + d_{\text{propagation}_1} + d_{\text{transmission}_{R1}} + d_{\text{propagation}_2} + d_{\text{transmission}_{R2}} + d_{\text{propagation}_3}$

$$= (100,000 * 8) / 1000 + 0.02 + (100,000 * 8) / 1000,000 + 0.02 + (100,000 * 8) / 10,000 + 0.02$$

$$= 880.86 \text{ sec}$$

b) end-to-end latency for the first packet =

$$(1000 * 8) / 1000 + 0.02 + (1000 * 8) / 1000,000 + 0.02 + (1000 * 8) / 10,000 + 0.02$$

$$= 8.868 \text{ sec}$$

Our bottleneck is A; hence, after the arrival of the first packet, we have a packet every $1000 * 8 / 1000(\text{bit/s}) = 8 \text{ sec}$ (we are sending the packets back to back at the source).
Total latency = $8.868 + 99 * 8 = 800.868 \text{ sec}$.