CSC 458: Computer Networks, Fall 2019

Department of Computer Science, University of Toronto

Handout # 12 – Solutions to Sample Midterm **Date:** Thursday, October 10th

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.*

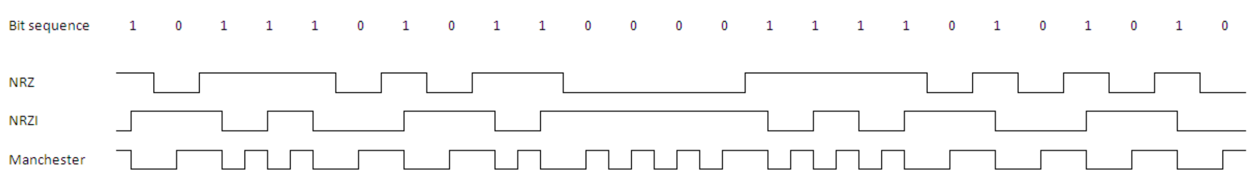
(b.)

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 2nd router (and hence, in the 3rd 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 → R1 → R2 → B

a) end-to-end latency = $d_{transmission\_A} + d_{propagation\_1} + d_{transmission\_R1} + d_{propagation\_2} + d_{transmission\_R2} + d_{propagation\_3}$

= (100,000 * 8) / 1000 + 0.02 + (100,000 * 8) / 1000,000 + 0.02
+ (100,000 * 8) / 10,000 + 0.02
= 880.86 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 sec

Our bottleneck is A; hence, after the arrival of the first packet, we have a packet every 1000 * 8 / 1000(bit/s) = 8 sec (we are sending the packets back to back at the source).

Total latency = 8.868 + 99 * 8 = 800.868 sec.