Sections on Exam: Post Mid 1 → Today 3/29

CPE 348 **Exam #2 (50+3 pts)** **November 4 2020**

Name $\boxed{3.3 - 5.2 \text{ (TCP SW)}}$

no congestion cntrl
assume no Q's

1) (6 pts) TCP is operating over a 1.28×10^9 bits per second link.
↳ byte oriented → TO or retransmission

a) (3 pts) If TCP utilizes the full bandwidth continuously, how long will it take for the 32 bit sequence number to wrap around?
→ each reps. 1 byte
→ retransmission can slow down wrap-around

$$\frac{2^{32} \times 8 \text{ (bits)}}{1.28 \times 10^9 \text{ b/s}} = \boxed{26.84 \text{ s}}$$

b) (3 pts) If each sequence number is modified to represent 2^n bytes of data instead of 1 byte, what is the smallest value of n such that wraparound does not occur before 120 seconds?

conv. to bits
× # bytes per

$8 = 2^3$

$$\frac{2^{32} \times 8 \times 2^n}{1.28 \times 10^9} > 120 \text{ s}$$

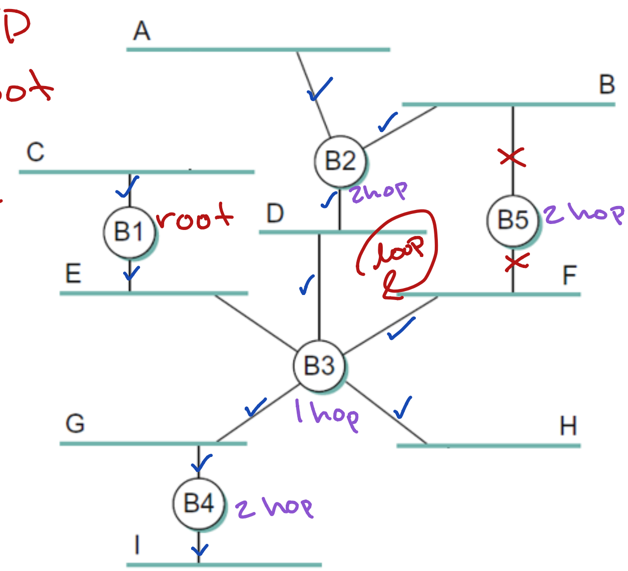
Simp. numerator:

$$35 + n \geq \log_2 (120 \times 1.28 \times 10^9)$$

$$35 + n \geq 37.16 \Rightarrow \boxed{n = 3} \ (\lceil n \rceil)$$

2) (3 pts) Given the extended LANs connected by 5 bridges shown below, indicate the trimmed network by the spanning tree algorithm to avoid possible loops. (e.g., answer should in this format: B4 → I, indicating that the connection between B4 and LAN I is trimmed.)

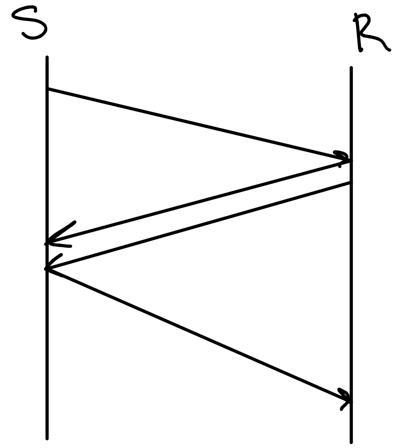
1. root → smallest ID
2. shortest d to root
3. tiebreaker
= keep smaller ID



trimmed
B5 - B
B5 - F

2) (13 pts) Answer the following short answer questions.

a) (3 pts) Draw the four-way handshake used to terminate a TCP connection.



★ Know 3-way handshake to connect + 4-way to disconnect

★ label Seq. Num!

b) (2 pts) What is the goal that the boarder gateway protocol (BGP) promises to achieve?

reachable path (not optimal)

no universal cost metric

→ Why can it not promise an optimal path? dif. cost metrics

c) (2 pts) In what kind of situation would you choose the PIM – Sparse Mode rather than the PIM – Dense Mode?

→ won't have a question like this on Exam 2?

d) (2 pts) In which application do you prefer UDP to TCP?

streaming

(services that don't req. high reliability)

e) (2 pts) what is the potential problem using distance-vector based routing algorithm? List a couple of solutions to addressing this problem.

Count to infinity problem

* know when the 2 algos are run

* contrast w/ LSR

1. set a cost upper bound
2. split horizon → don't send info back to neighbor

f) (2 pts) Briefly explain how VPN (virtual private network) works.

edge router adds a header ("dummy header") & enables an IP tunnel to transmit to the dest edge router.

* know pros & cons to tunneling

Classless Inter-Domain Routing.

4) (8 pts) A router has the following (CIDR) entries in its routing table

addr/prefix ↑ indicates common bits

Address/mask	Next Hop
160.80.0.0/18	Interface 0
160.80.64.0/18	Interface 1
160.80.128.0/19	Interface 2
160.80.160.0/19	Router 1
160.80.208.0/20	Router 2
Default	Router 3

Tricks
- check common bits first
- 255 → take other
- same → stays

★ really only 3rd octets to check.

What is the next hop that the router selects when it receives IP packets with the addresses shown below. **Show all of your work or explain how you determined the next hop.**

a) **160.80.176.5** **Next Hop** router 1

★ rule ↓ pick longest match

0: 00|00 0000
64: 01|00 0000
128: 100|0 0000
160: 101|0 0000

176 ⇒ 101|1 0000

b) **160.80.232.8** **Next Hop** router 3

208: 1101|0000

232 ⇒ 1110 1000
no match w/ prefix

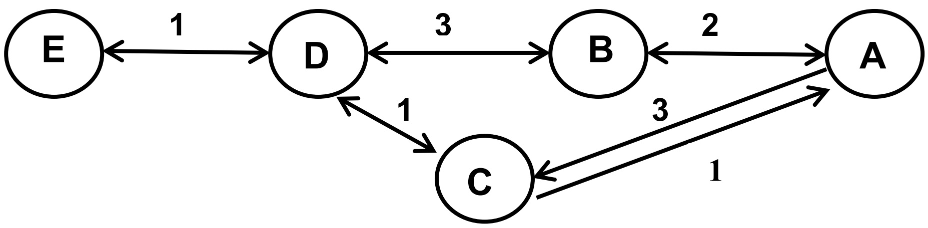
c) **160.80.44.25** **Next Hop** interface 0

44 ⇒ 00|10 1100

d) **160.80.156.144** **Next Hop** interface 2

156 ⇒ 100|1 1100

5) (8 pts) The Distance Vector Routing Algorithm is to be performed on the network shown. Note that cost is measured in **delay** and link **may not be symmetric**. Fill in the first three tables. For each of the distance vector tables, complete the known routing table for node C. (Hint: cost can be simply added up.)



* We had a little chat here I missed.

Info at Node	Cost to reach node – initial table				
	A	B	C	D	E
A	---	2 / B	3 / C	∞	∞
B	2 / A	---	∞	3 / D	∞
C	1 / A	∞	---	1 / D	∞
D	∞	3 / B	1 / C	---	1 / E
E	∞	∞	∞	1 / D	---

Node C Routing Table		
Destination	Cost	NextHop
A	1	A
B	—	—
D	1	D
E	—	—

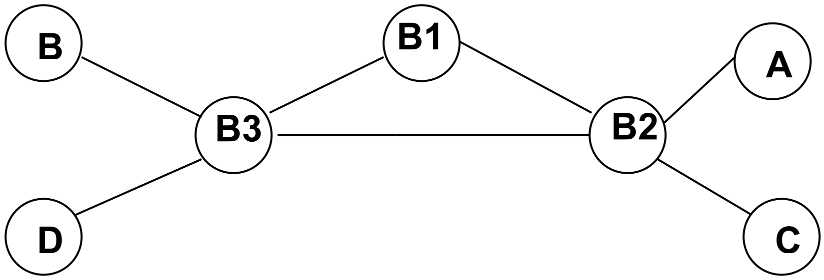
Info at Node	Cost to reach node – after 1 exchange				
	A	B	C	D	E
A	---	2 / B	3 / C	4 / C	∞
B	2 / A	---	4 / D	3 / D	4 / D
C	1 / A	3 / A	---	1 / D	2 / D
D	2 / C	3 / B	1 / C	---	1 / E
E	∞	4 / D	2 / D	1 / D	---

Node C Routing Table		
Destination	Cost	NextHop
A	1	A
B	3	A
D	1	D
E	2	D

Info at Node	Cost to reach node – after 2 exchanges				
	A	B	C	D	E
A	---	2 / B	3 / C	4 / C	5 / C
B	2 / A	---	4 / D	3 / D	4 / D
C	1 / A	3 / A	---	1 / D	2 / D
D	2 / A	3 / B	1 / C	---	1 / E
E	3 / D	4 / D	2 / D	1 / D	---

Node C Routing Table		
Destination	Cost	NextHop
A	1	A
B	3	A
D	1	D
E	2	D

6) (12 pts) Consider the following network where A, B, C and D are nodes and B1, B2 and B3 are learning bridges.



Assume that the forwarding tables for the three bridges are all empty when the **four transmissions below are made in the order indicated.** After the transmissions have been made, what are the contents of the forwarding tables for the three bridges? Indicate a port(interface) on a bridge by the node or bridge that it is connected to. For example, B3 has a B interface, a D interface, a B2 interface and a B1 interface.

Transmissions: Assumed to be unidirectional communication.
#1) A transmits to C #2) B transmits to D #3) C transmits to A #4) D transmits to C

Fill in the table below for the three Bridges. If a destination node is unknown for a bridge, write **unknown** for the interface (in that case the bridge would forward a packet out on all outgoing interfaces).

If a bridge learns about a node from more than one bridge, give the bridge that first sent the packet to the bridge. For example, B3 forwards a packet being transmitted from D to an unknown destination. B1 receives the packet from B3 and B2. Since B3 sends the packet to B1 (1 hop away) before B2 (packet travels 2 hops – B3 to B2 then B2 to B1), B1 will list B3 as the interface for contacting D.

Bridge B1		Bridge B2		Bridge B3	
Destination	**Interface**	**Destination**	**Interface**	**Destination**	**Interface**
A	B1	**A**	A	**A**	B2
B	B3	**B**	B3	**B**	B
C	—	**C**	C	**C**	—
D	B3	**D**	B3	**D**	D

7) Bonus (3 pts) How do you like this course so far? Is there any change you recommend?