

CSE 123 Computer Networks

Homework 2 Solutions

(Total Points: 60)

Instructions:

Take a printout of this template, write answers in the spaces provided below each question, and submit the scanned copies of your homework on Gradescope. You can even write your answers electronically.

Q1 Learning Bridges (15 pt)

Consider the extended LAN shown in Figure 1; circles correspond to learning bridges while squares are hosts. Assume all bridges were just turned on and no frames have been sent.

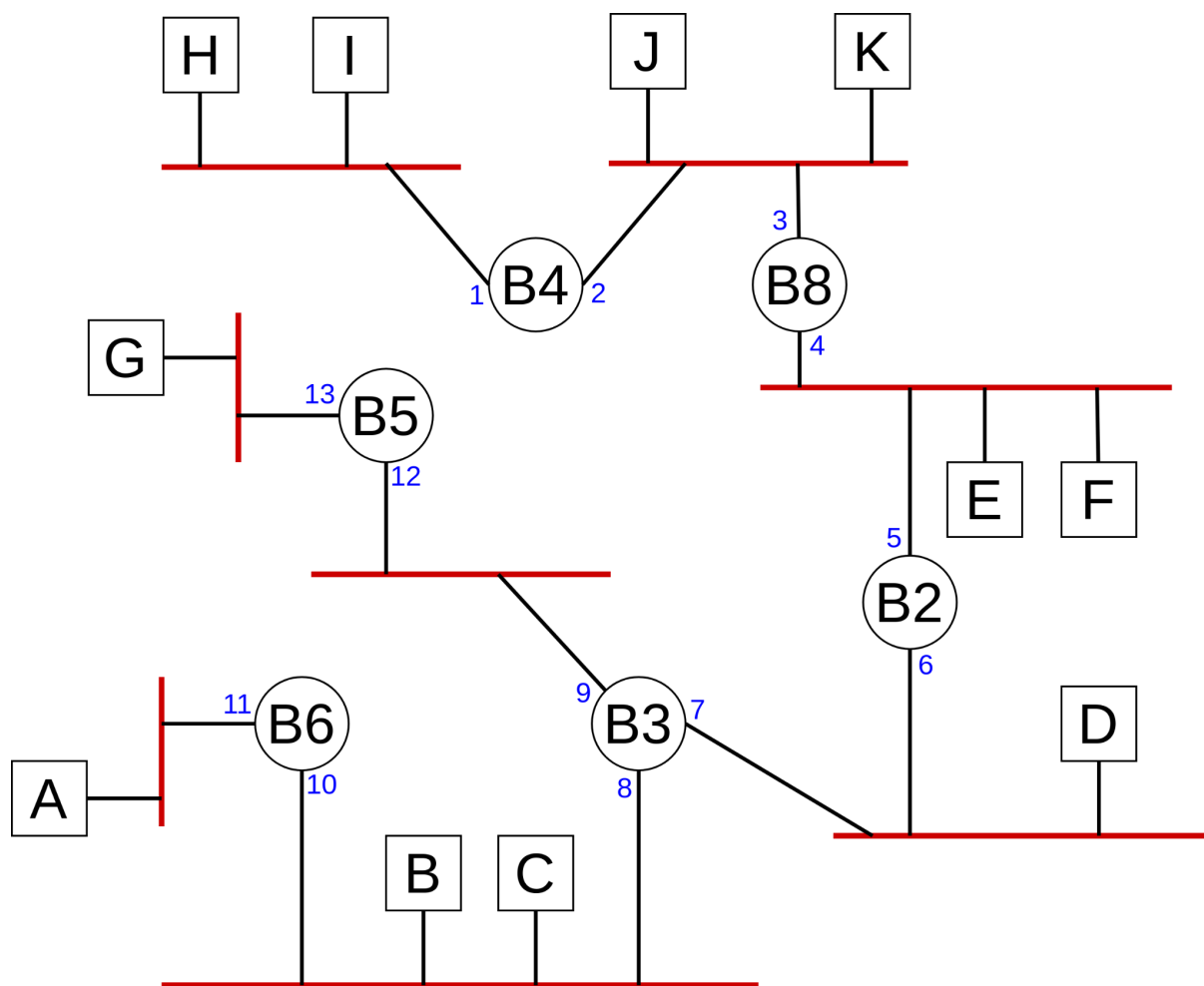


Figure 1: Sample Extended LAN

Q1.1 Suppose the following frames (and only these frames) are sent in the order indicated.

For each frame, say which **hosts** and **bridges** will receive it. **(12 pts)**

Sol: 3 pt for each correct answer; -1 pt for each additional bridge or host shown in the answer

Partial Credits: 2 pts allotted if ONE host or bridge or both missing in the answer;

1 pts allotted if TWO hosts or bridges or both missing in the answer;

Sr. No.	Frame	Recipients
1	B sends a frame to E	Hosts: A, C, D, E, F, G, H, I, J, K (all hosts except B) Bridges: B2, B3, B4, B5, B6, B8 (all bridges)
2	H sends a frame to A	Hosts: A, B, C, D, E, F, G, I, J, K (all hosts except H) Bridges: B2, B3, B4, B5, B6, B8 (all bridges)
3	G sends a frame to B	Hosts: B, C Bridges: B5, B3, B6
4	E sends a frame to H	Hosts: F, J, K, H, I Bridges: B4, B8, B2

Q1.2 After the four frames in Q1.1 are sent and received at their respective destinations, show the table entries present in the forwarding table of **bridge B8**. **(3 pts)**

Sol: +1 pt for each correct table entry; -0.5 pt for each table entry that is never learned by bridge but shown in answer.

Host	Egress Port
B	4
H	3
E	4

Q2 Spanning Tree Protocol (15 pt)

Q2.1 Consider the extended LAN shown in Figure 2; circles correspond to bridges while squares are hosts. The values of bridge addresses are in the order: $B1 < B2 < B3 < B4 < B5 < B6$. Mention which ports—if any—will be turned off in the final spanning tree. **(5 pt)**

Sol: Ports 12 and 17 are turned off in the final spanning tree.

+2.5 pt for each correctly indicated port; -1 pt for each additional port turned off.

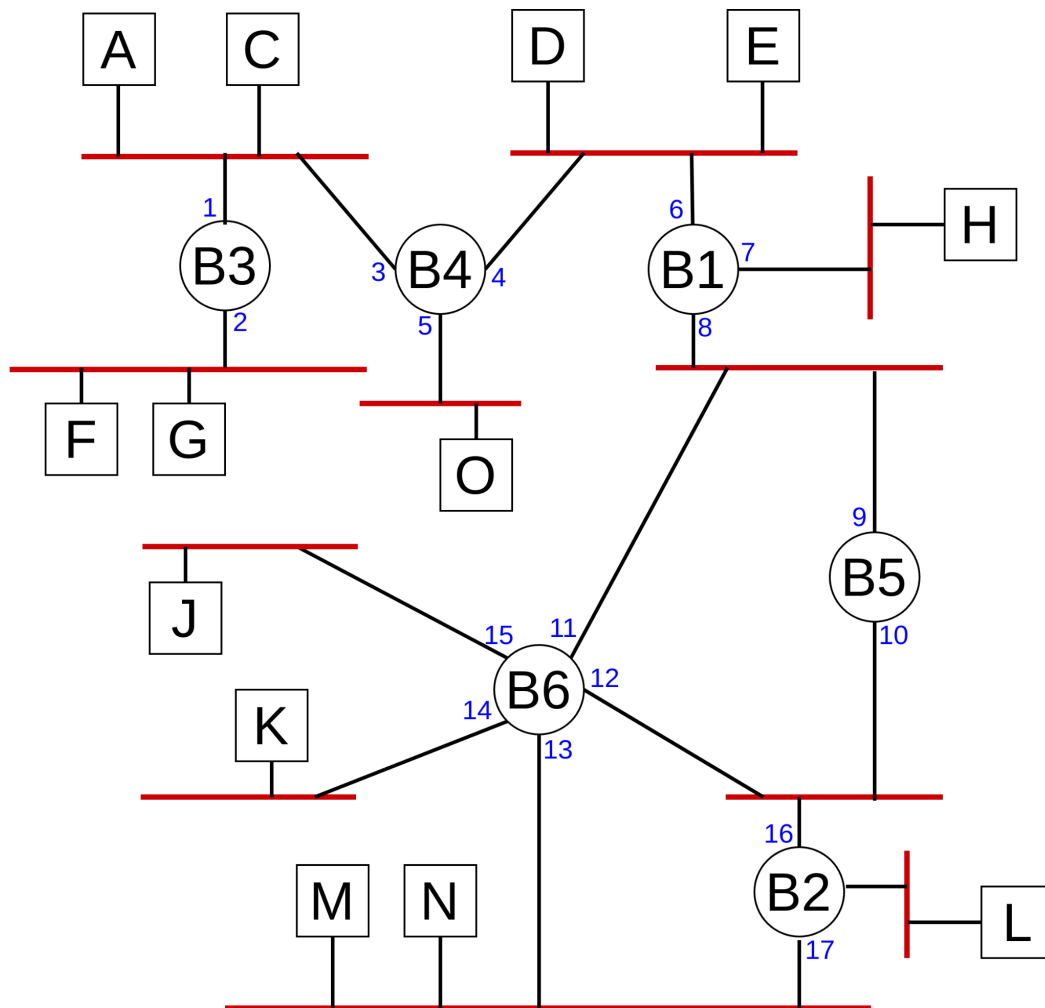


Figure 2: Sample Extended LAN

Q2.2 What is the final configuration message being sent by **B2** and **B3** (Make sure you indicate what each field specifies)? **(5 pt)**

Sol: (RootID, Distance to Root, BridgeID) $\Rightarrow$ B2 sends (B1, 2, B2); B3 sends (B1, 2, B3)

+2.5 pt for each correct configuration message.

Q2.3 Consider the extended LAN shown in Figure 3; circles correspond to bridges while squares are hosts. The values of bridge addresses are in the order: $B2 < B3 < B4 < B5 < B6 < B8 < B9$. If config message from B2 is not received for more than *MaxAge* seconds (i.e., its entries expire at all adjacent bridges), then mention which ports—if any—will be turned off in the final spanning tree. **(5 pt)**

Sol: Ports 13 and 14 will be turned off in the final spanning tree.

+2.5 pt for each correctly indicated port; -1 pt for each additional port turned off.

Note: The behavior of Ports 5 and 6 is unspecified and thus you will not be penalized if you mentioned that those ports are turned off.

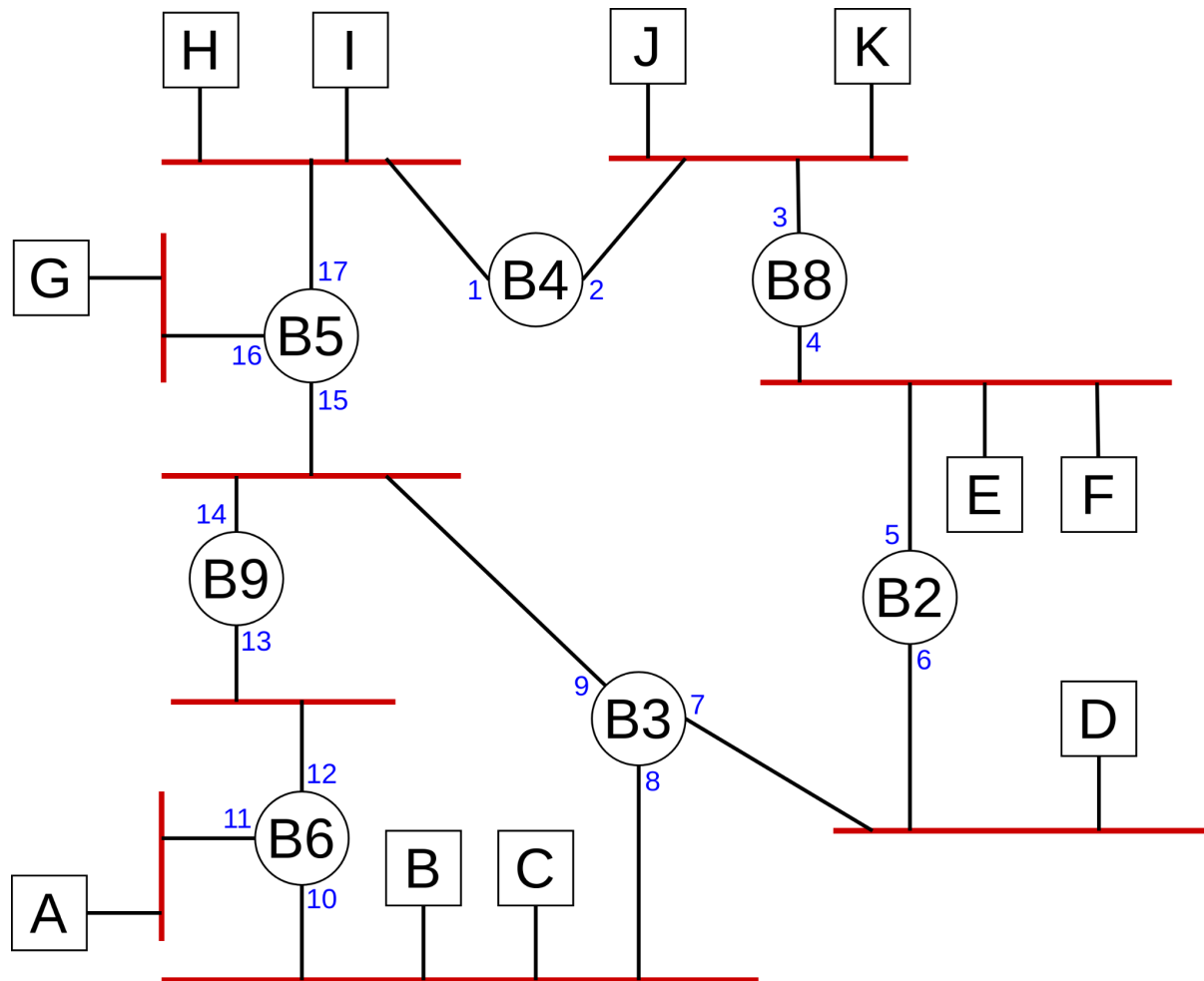


Figure 3: Sample Extended LAN

Q3 Fragmentation (10 pt)

Q3.1 Suppose a router receives the below-shown IPv4 packet and needs to forward it out on a link with 300-byte MTU. Mention the IP ID, Flags (i.e., MF and DF), TTL, Length, Offset of the last fragment? **Please note that the Offset field value in the below IPv4 packet is encoded in (bytes / 8) form. Follow the same in your answer as well. (5 pt)**

IP ID	MF	DF	TTL	Length	Offset (in bytes/8 form)
15	0	0	10	1500	370

**Sol: +0.5 pt for correct IP ID; +1 pt for correct MF; +0.5 pt for correct DF
+0.5 pt for correct TTL; +1 pt for correct Length; +1.5 pt for correct Offset**

IP ID	MF	DF	TTL	Length	Offset (in bytes/8 form)
15	0	0	9	100	545

Q3.2 Suppose a router receives the below-shown IPv4 packet and needs to forward it out on a link with 380-byte MTU. Mention the IP ID, Flags (i.e., MF and DF), TTL, Length, Offset of the 3rd fragment? **Please note that the Offset field value in the below IPv4 packet is encoded in (bytes / 8) form. Follow the same in your answer as well. (5 pt)**

IP ID	MF	DF	TTL	Length	Offset (in bytes/8 form)
6	0	0	31	1500	10

**Sol: +0.5 pt for correct IP ID; +1 pt for correct MF; +0.5 pt for correct DF
+0.5 pt for correct TTL; +1 pt for correct Length; +1.5 pt for correct Offset**

IP ID	MF	DF	TTL	Length	Offset (in bytes/8 form)
6	1	0	30	380	100

Q4 Class-based IP Addressing and Subnetting (15 pt)

Q4.1 In a campus network that uses class-based IP addressing, a host is assigned **172.16.56.22** IP address.

- (a) What is the class of the above IP address? **(1 pt)**
- (b) If the campus network is divided into **16 subnetworks**, then:
- (i) What is the subnet mask for the above IP address? **(2 pt)**
 - (ii) What is the subnetwork address to which the above IP address belongs? **(2 pt)**

Sol:

(a) Class B

(b) (i) Subnet Mask: 255.255.240.0 (ii) Subnetwork Address: 172.16.48.0

Q4.2 In an enterprise network that uses class-based IP addressing, a host is assigned **202.109.31.220** IP address.

- (a) What is the class of the above IP address? **(1 pt)**
- (b) If the enterprise network is divided into **4 subnetworks**, then:
 - (i) What is the subnet mask for the above IP address? **(2 pt)**
 - (ii) What is the subnetwork address to which the above IP address belongs? **(2 pt)**

Sol:

(a) Class C

(b) (i) Subnet Mask: 255.255.255.192 (ii) Subnetwork Address: 202.109.31.192

Q4.3 In an ISP network that uses class-based IP addressing, a host is assigned **102.58.212.226** IP address.

- (a) What is the class of the above IP address? **(1 pt)**
- (b) If the ISP network is divided into **32 subnetworks**, then:
 - (i) What is the subnet mask for the above IP address? **(2 pt)**
 - (ii) What is the subnetwork address to which the above IP address belongs? **(2 pt)**

Sol:

(a) Class A

(b) (i) Subnet Mask: 255.248.0.0 (ii) Subnetwork Address: 102.56.0.0

Q5 Longest Matching Prefix (5 pt)

Consider the below forwarding table of a router implementing the longest prefix match policy to lookup destination IP addresses.

Destination	Egress Port
192.168.36.0/26	7
192.168.36.4/30	4
192.168.36.32/28	6
192.168.36.48/28	3
192.169.36.32/28	2
default	0

Sol:

+2.5 pt for each correct answer.

The router will forward an IP packet having a destination IP address **192.168.36.44** to port 6.

The router will forward an IP packet having a destination IP address **192.168.36.6** to port 4.