Midterm-Assignment

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Assignment Overview

- Mixed-Bag (Multiple Choice Questions)
- TCP Congestion Control
- HTTP
- TCP Fairness and UDP

Multiple Choice

The following questions are multiple choice questions. At least one choice is true and at least one choice is false. Please mark all the true choices with a cross. To correct a misplaced cross, draw an empty symbol to the right of the line. For each question, points will only be given if all choices are marked correctly.

Multiple Choice

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Question 1a)

UDP: Which statements are correct?

- ☐ UDP is a connection-oriented protocol.
- ☐ In UDP packet loss will be detected by a triple duplicate ACK.
- ☐ UDP provides best-effort service.
- ☐ UDP is a stateless protocol

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Question 1b)

What delays can occur in packet-switched networks?

- ☐ Queuing delays.
- ☐ Processing delays.
- ☐ Call setup delays.
- ☐ Propagation delays.

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Question 1c)

Which Internet protocols map an identifier to another identifiers?

- ☐ DNS
- ☐ HTTP
- ☐ IMAP
- ☐ SMTP

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- ☐ IMAP.
- ☐ IPv6.
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Question 1e)

Which of the following statements are true regarding persistent and non-persistent HTTP?

- ☐ Persistent HTTP requires a new TCP connection for each request.
- ☐ Non-persistent HTTP can improve performance by reducing the overhead of establishing new connections.
- ☐ Persistent HTTP allows multiple requests to be sent over a single TCP connection.
- ☐ Persistent HTTP does not require 2 RTT (round trip time) for each object that is to be transmitted.

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Question 1f)

Which of the following statements are true regarding traceroute?

- ☐ Traceroute identifies the fastest route between a source and destination.
- ☐ Traceroute determines the network hops between a source and the destination.
- ☐ Traceroute determines the network hops between a destination and the source.
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Question 1g)

Which statements about IPv6 are correct?

- ☐ IPv6 guarantees reliable data transfer.
- ☐ Forwarding in IPv6 is done via longest prefix matching.
- ☐ The IPv6 address space is more than 10,000 times larger than that of IPv4.
- ☐ With IPv6, link-local addresses are generated automatically (i.e., without requiring any intervention from an administrator).

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Question 1h)

Which statements about Open-Shortest-Path-First (OSPF) are correct?

- ☐ OSPF is an inter domain routing protocol (EGP).
- ☐ OSPF uses Dijkstra's Algorithm.
- ☐ OSPF is not a distance vector routing protocol.
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- ☐ DNS is a centralized system.
- ☐ A type resp. AAAA type resource records are used to map hostnames to IP addresses.
- ☐ The MX record is relevant for e-mail.
- ☐ In order to minimize the number of DNS requests, small TTL values should be chosen.

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Question 1j)

Routing: Which statements are correct?

- ☐ In the Internet, BGP is used to advertise routes between ASes.
- ☐ BGP guarantees optimal paths.
- ☐ The “count to infinity" problem cannot occur in link state algorithms.
- ☐ OSPF has the same feature set as BGP.

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Question 2)

Consider the sequence diagram in Figure 1 on page 7. The diagram shows an excerpt of an ongoing TCP Reno connection between Sender and Receiver. The solid arrows represent TCP segments with data while the dotted arrows correspond to TCP acknowledgments. The first segment has the sequence number 2000 and is sent at t = 0. The second segment has the sequence number 2500 and is sent at t = 1, etc. Assume that the segment with sequence number 2500 is lost on the path from sender to receiver.

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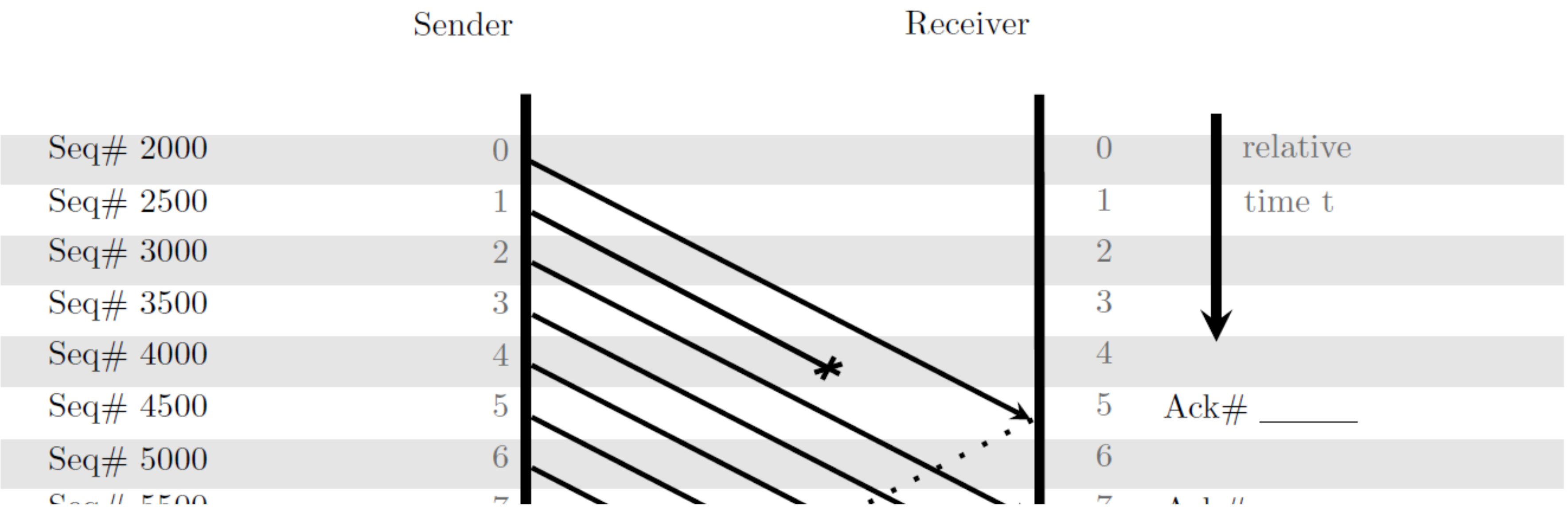
Question 2a)

What is the MSS used in the connection?



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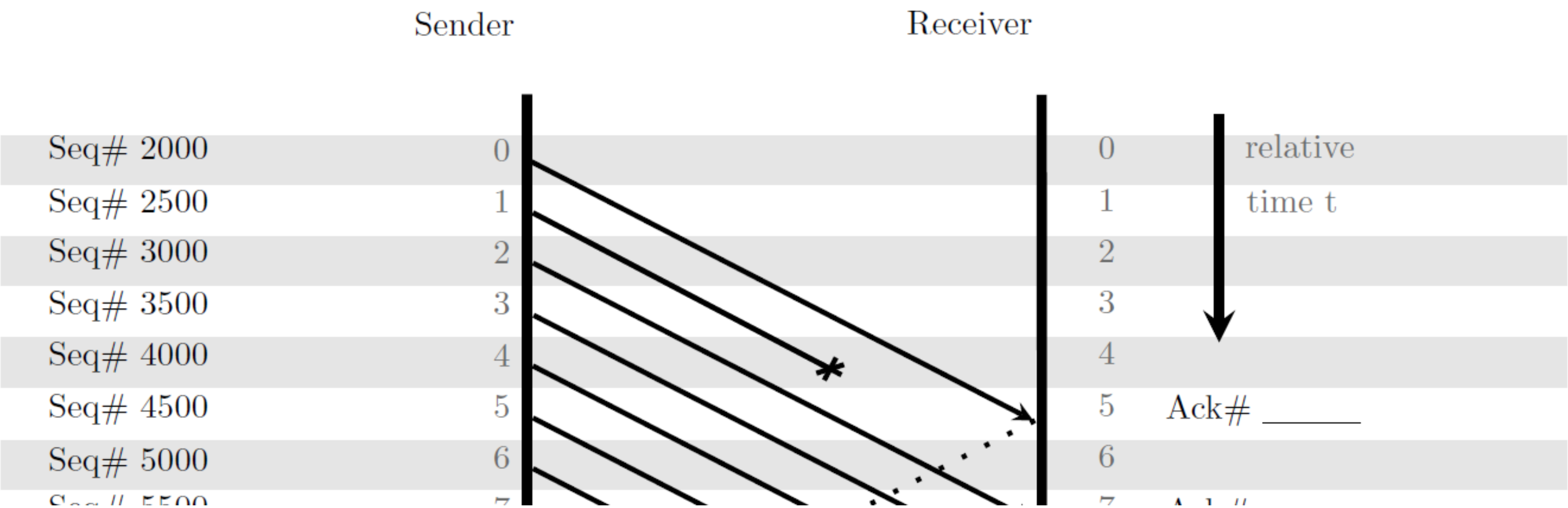

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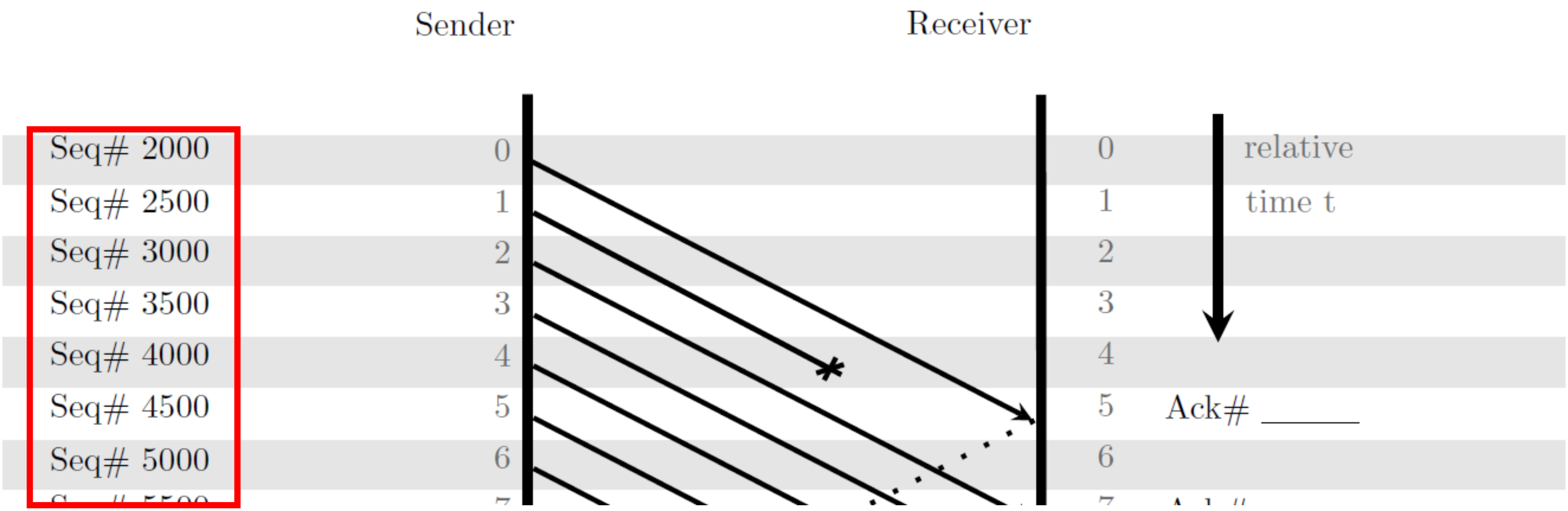
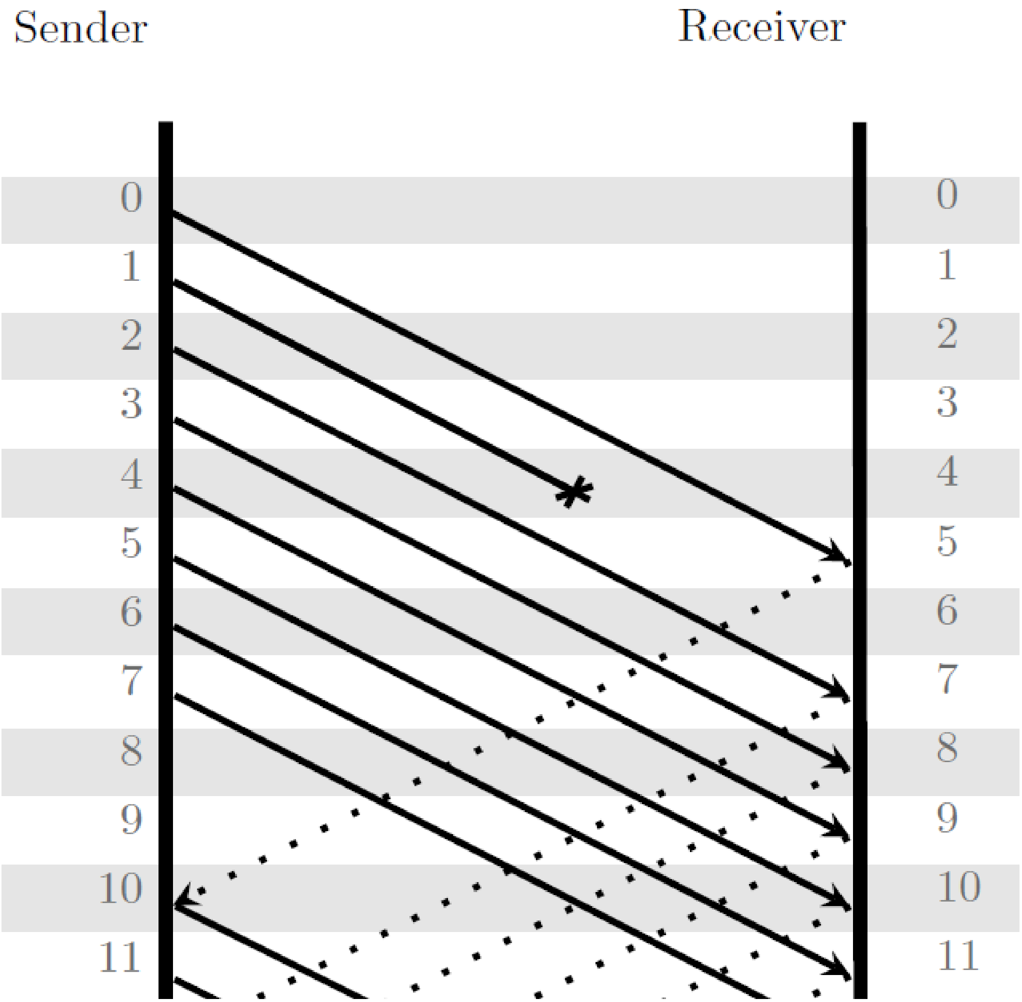
MSS: 500b



Question 2b)

What is the RTT (round trip time) based on the relative time?



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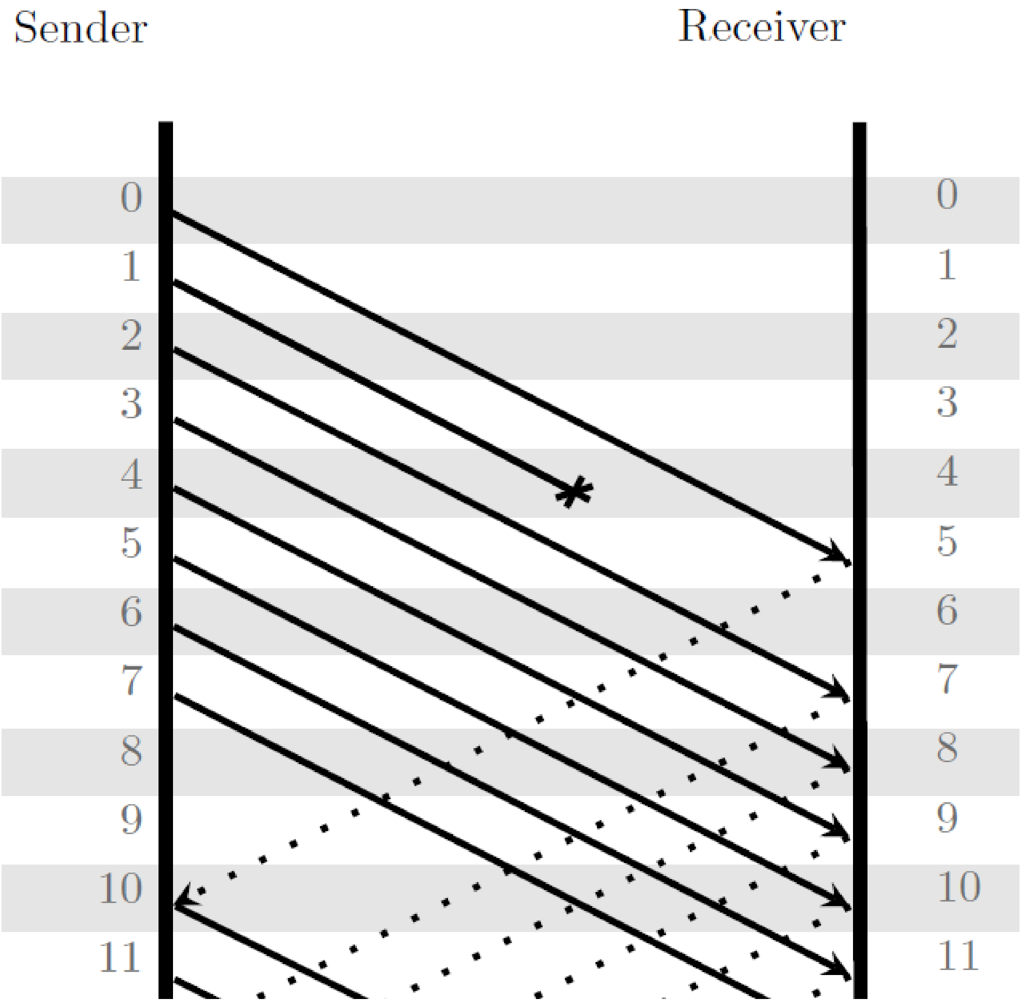

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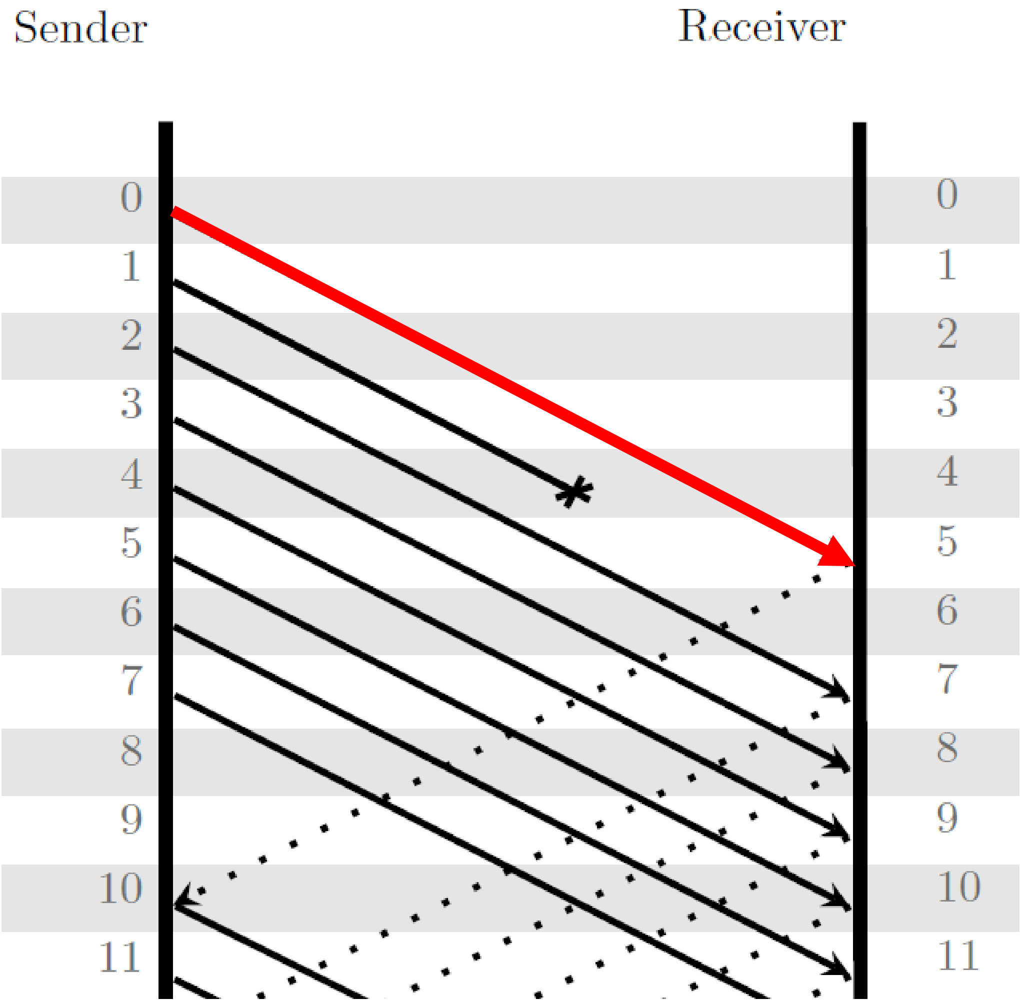

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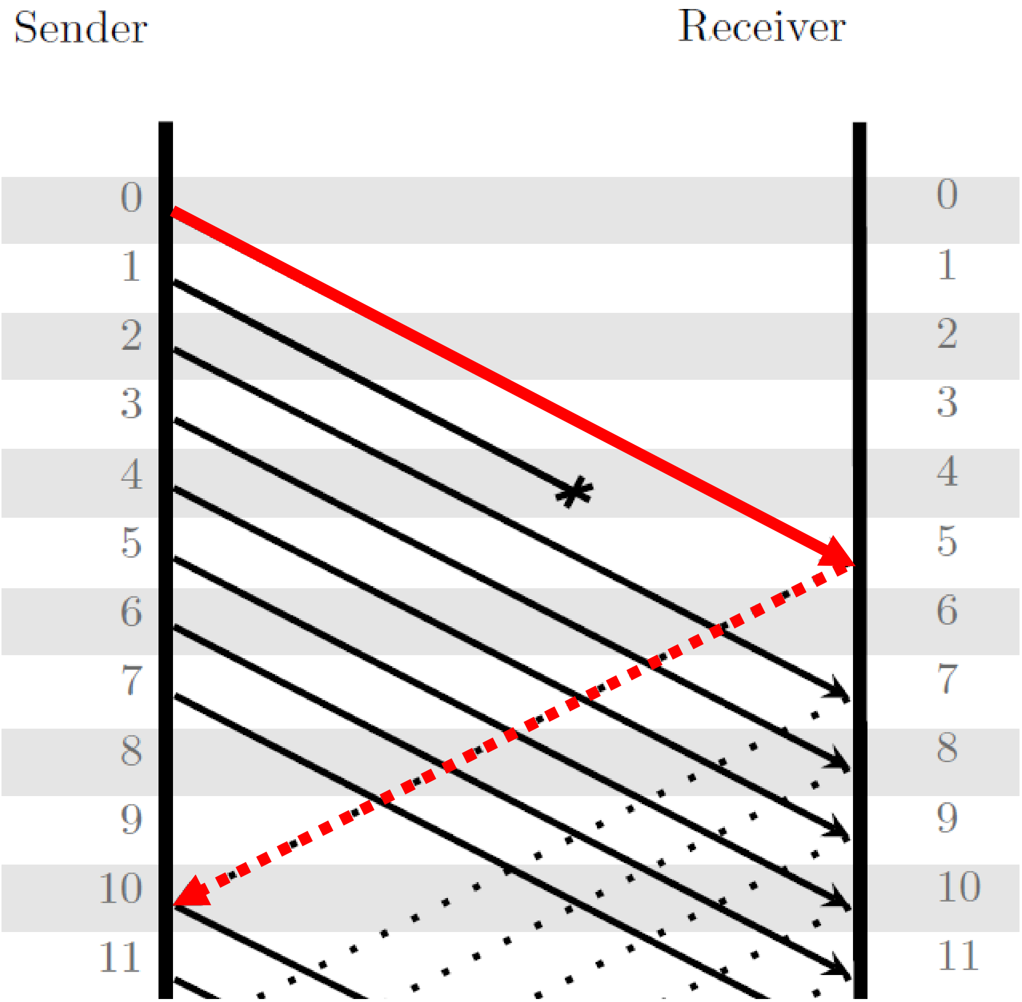

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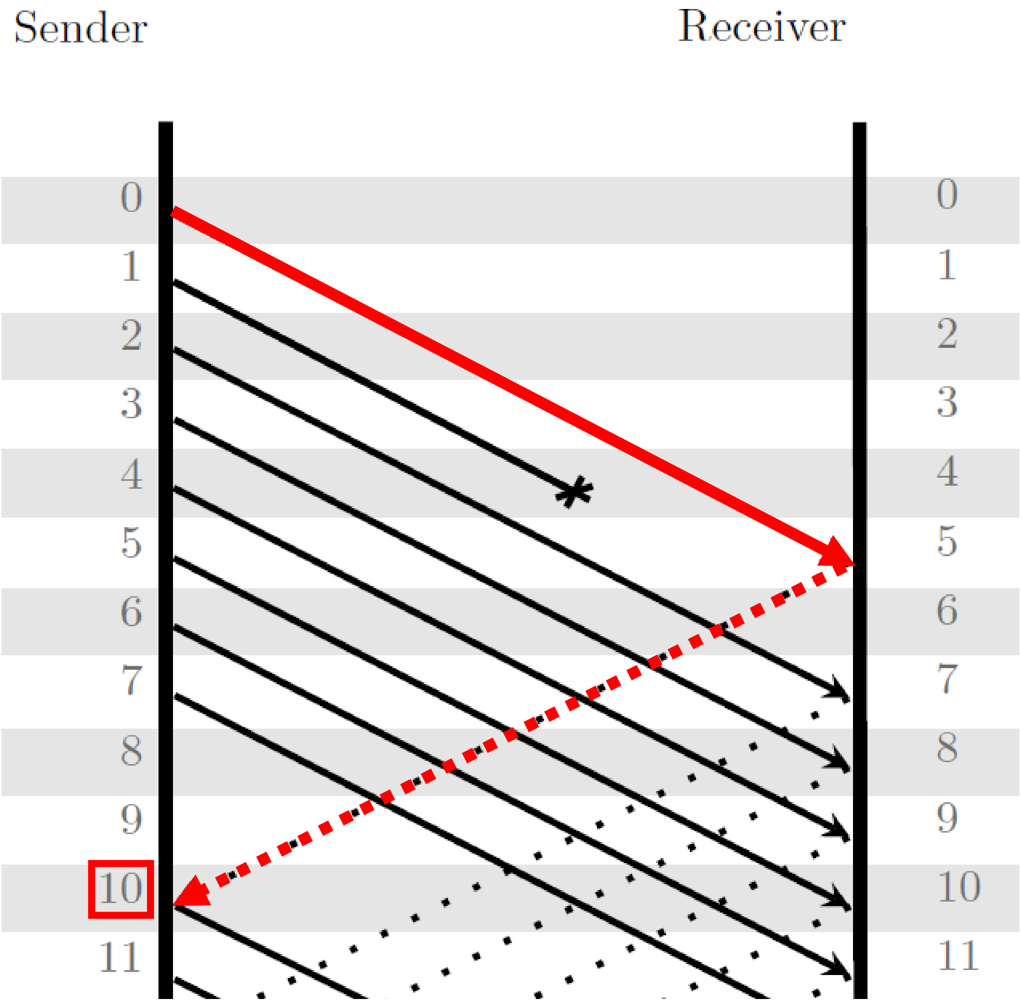

Question 2b)

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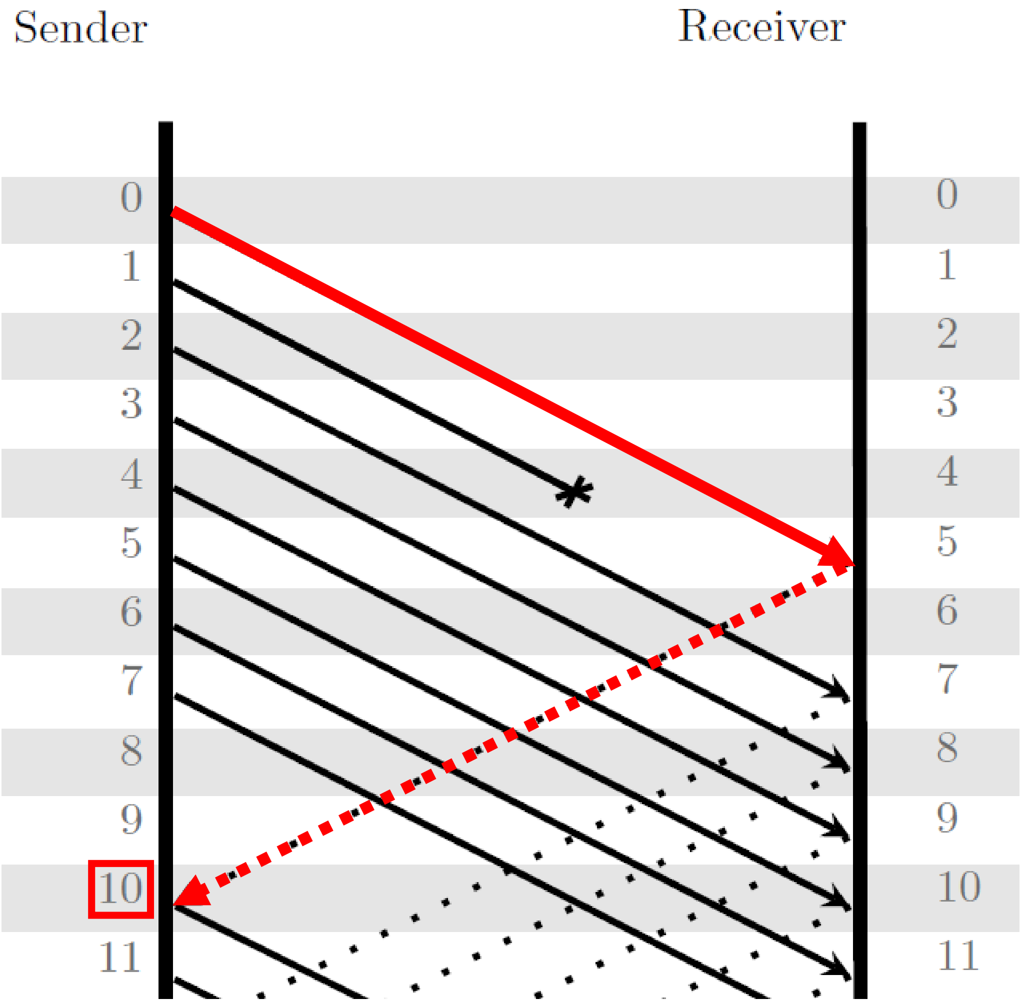
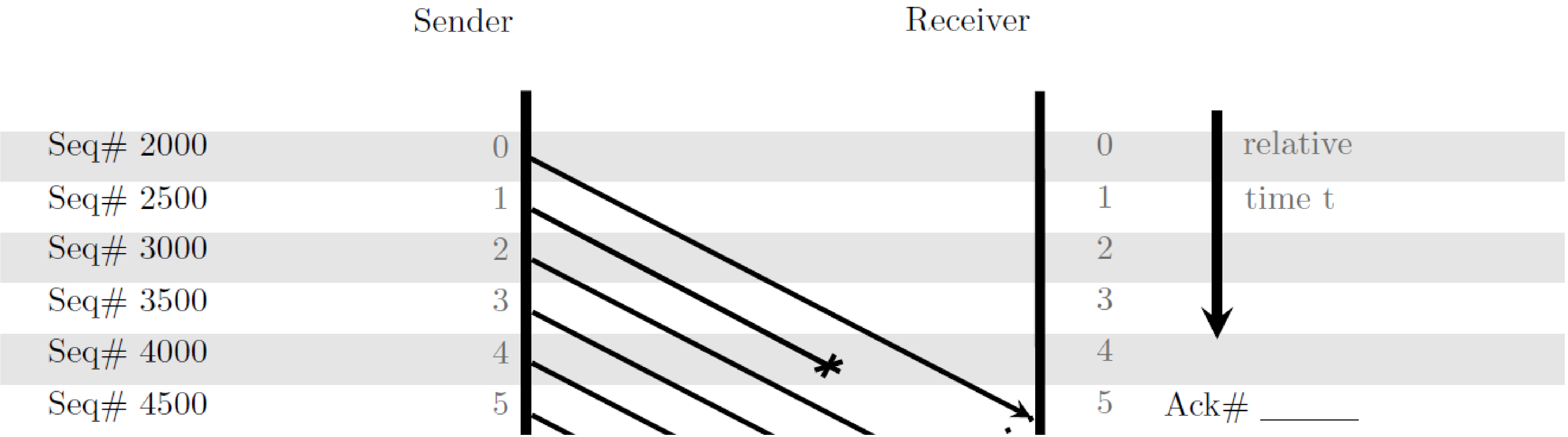
RTT = 10



Question 2c)

In Figure 1, 9 Sequence numbers (Seq#) and 12 acknowledgment numbers (Ack#) are missing. Write the correct sequence and acknowledgment numbers directly into Figure 2.



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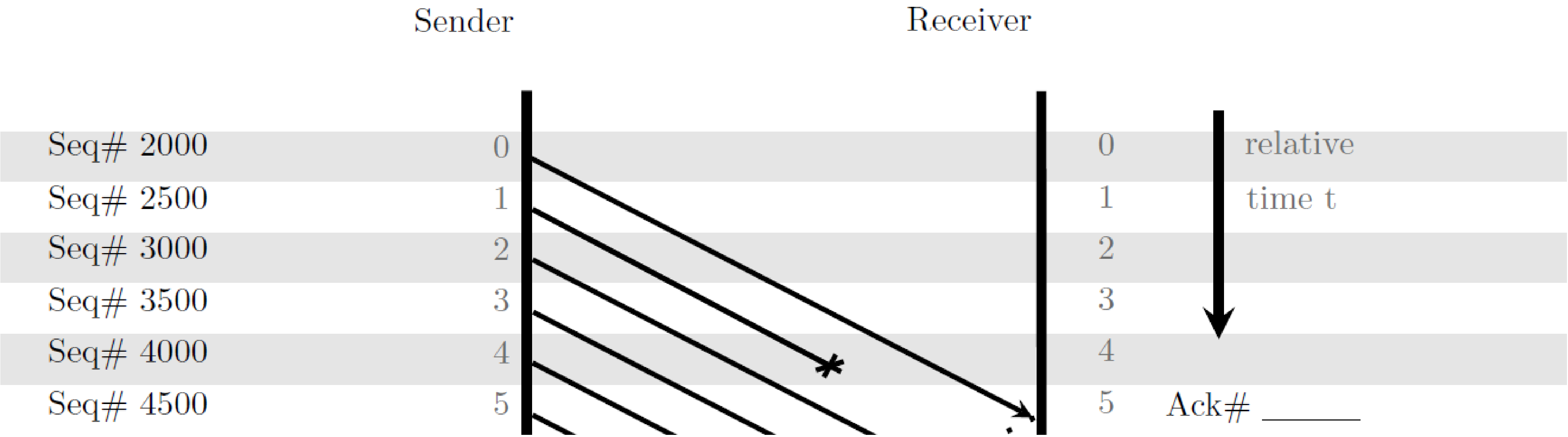

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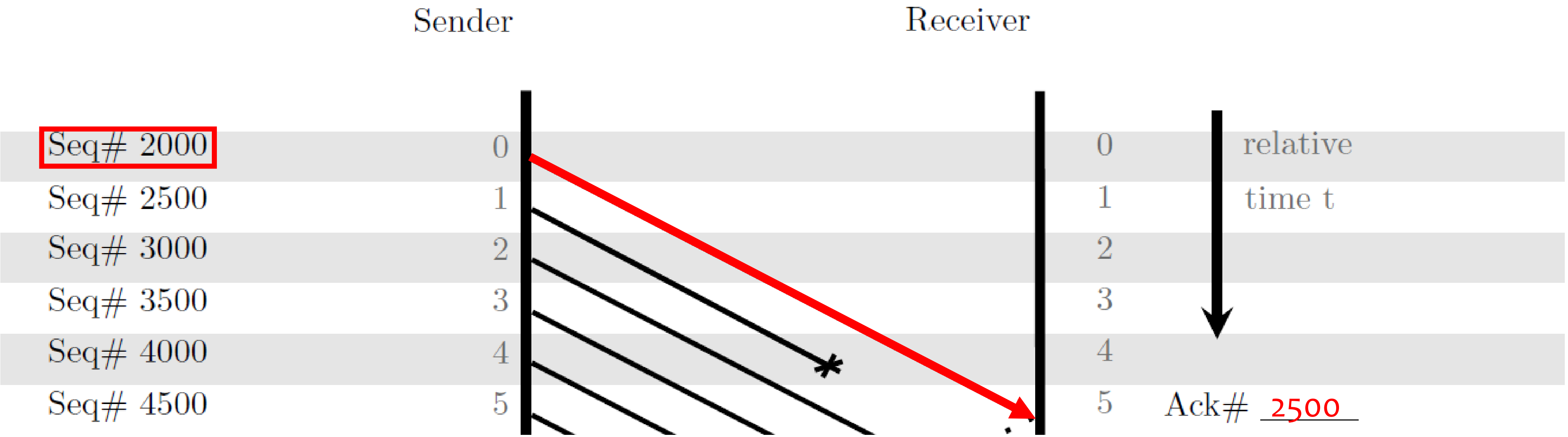

Sender

Receiver

Seq# 2000 0

Seq# 2500 1

Seq# 3000 2

Seq# 3500 3

Seq# 4000 4

Seq# 4500 5

Ack# 2500

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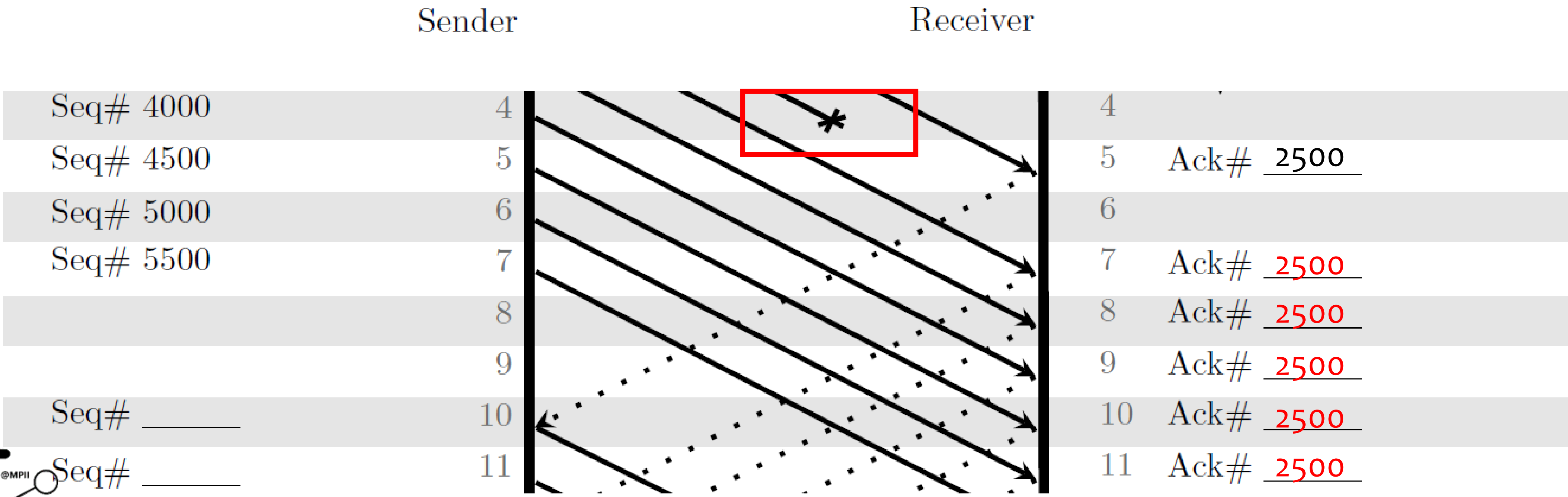

Seq# 4000	4	4	
Seq# 4500	5	5	Ack# 2500
Seq# 5000	6	6	
Seq# 5500	7	7	Ack# 2500
	8	8	Ack# 2500
	9	9	Ack# 2500
Seq# ______	10	10	Ack# 2500
Seq# ______	11	11	Ack# 2500

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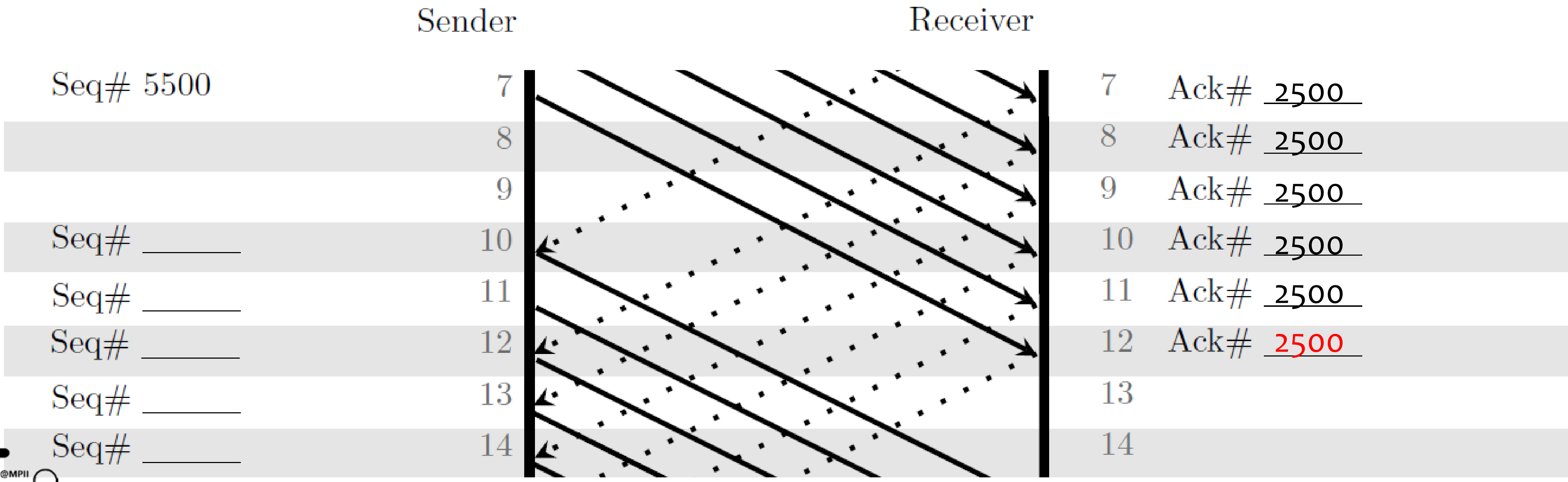

Seq# 5500
Seq# ______
Seq# ______
Seq# ______
Seq# ______
Seq# ______

Ack# 2500
Ack# 2500
Ack# 2500
Ack# 2500
Ack# 2500
Ack# 2500

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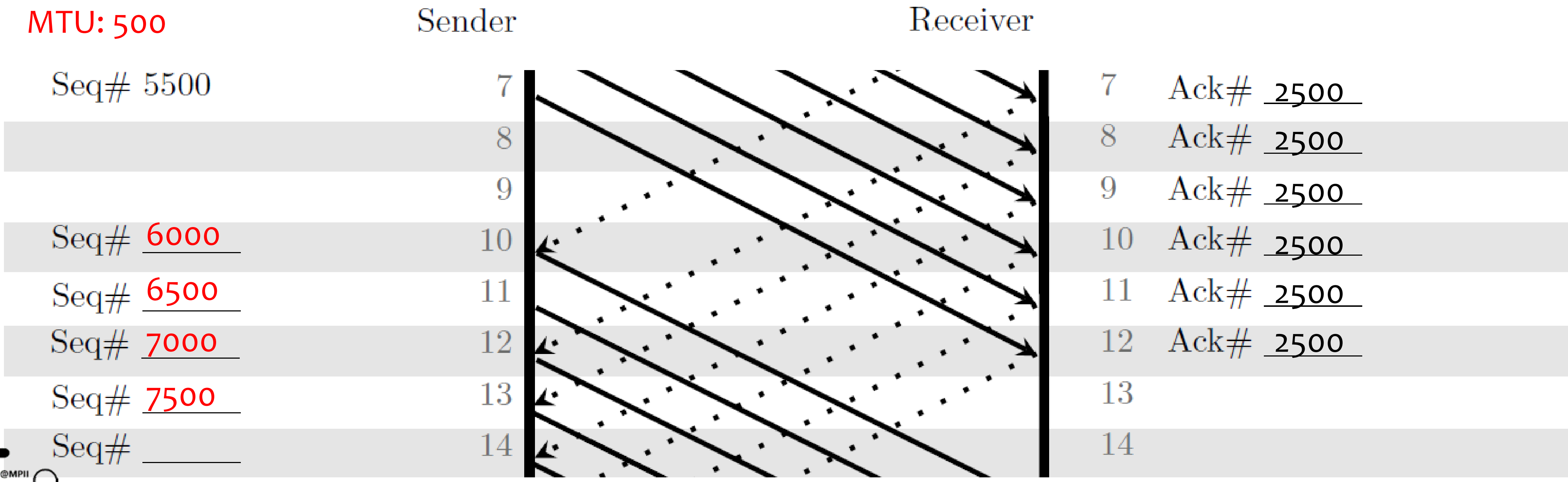
MTU: 500



Seq# 5500
Seq# 6000
Seq# 6500
Seq# 7000
Seq# 7500
Seq# ______

Ack# 2500
Ack# 2500
Ack# 2500
Ack# 2500
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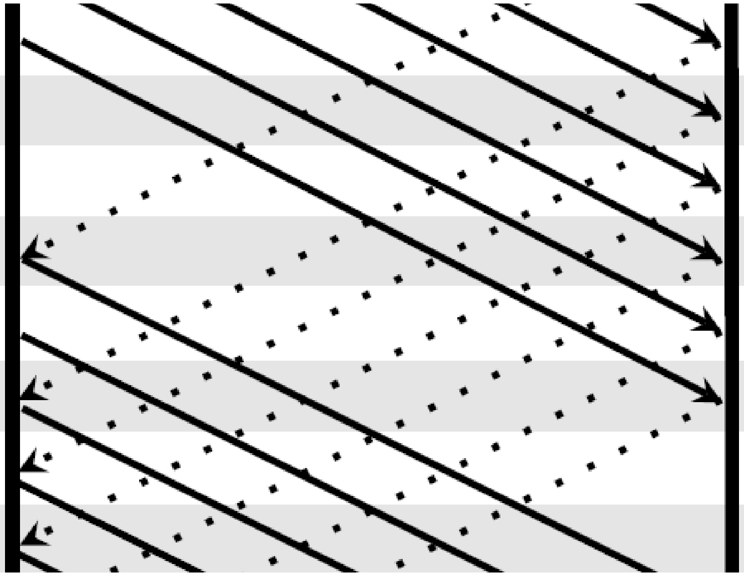

	Sender	Receiver	
Seq# 5500	7	7	Ack# 2500
	8	8	Ack# 2500
	9	9	Ack# 2500
Seq# 6000	10	10	Ack# 2500
Seq# 6500	11	11	Ack# 2500
Seq# 7000	12	12	Ack# 2500
Seq# 7500	13	13	
Seq# 2500	14	14	

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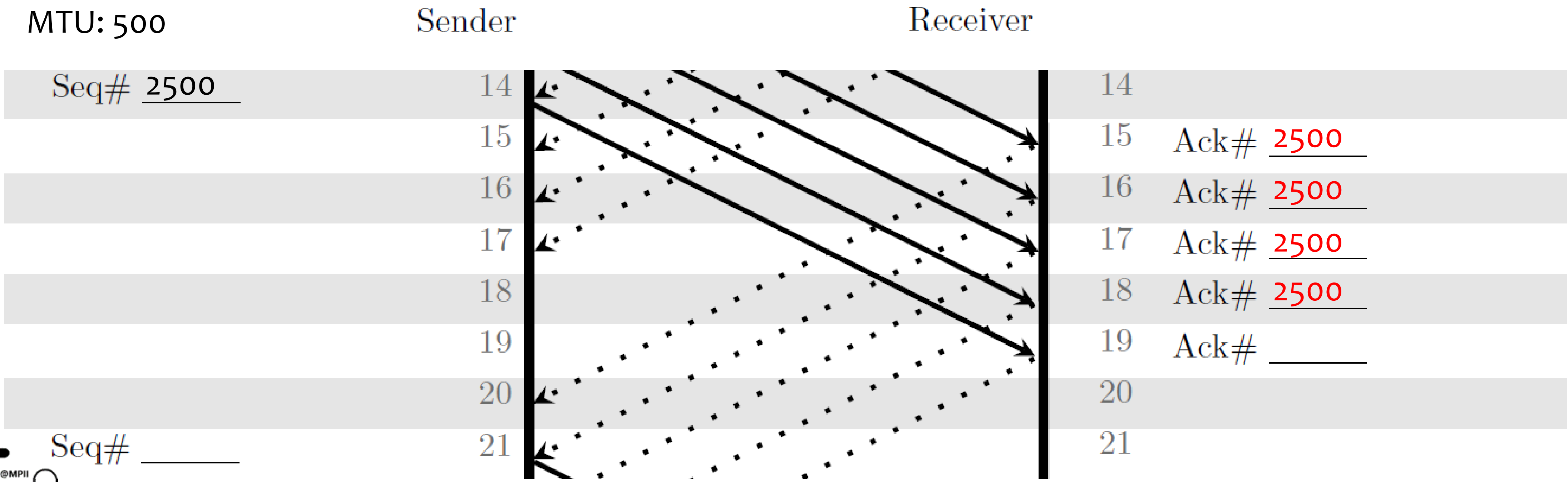

Seq# 2500

Ack# 2500

Ack# 2500

Ack# 2500

Ack# 2500

Ack# ______

Seq# ______

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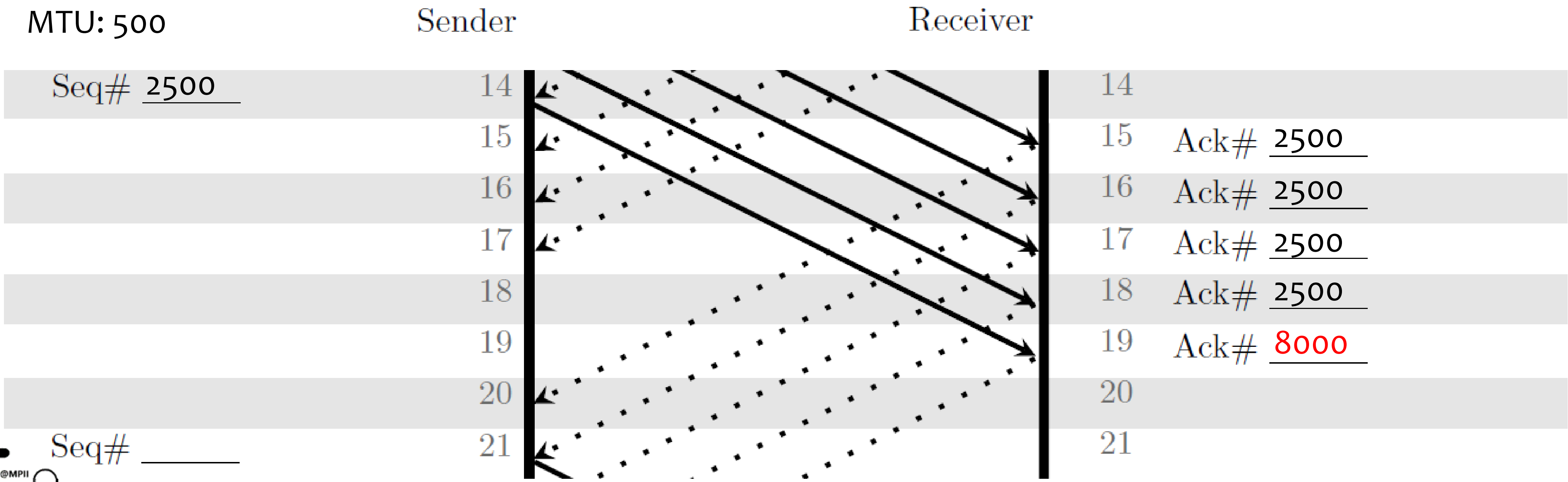

Seq# 2500

Ack# 2500

Ack# 2500

Ack# 2500

Ack# 2500

Ack# 8000

Seq# ______

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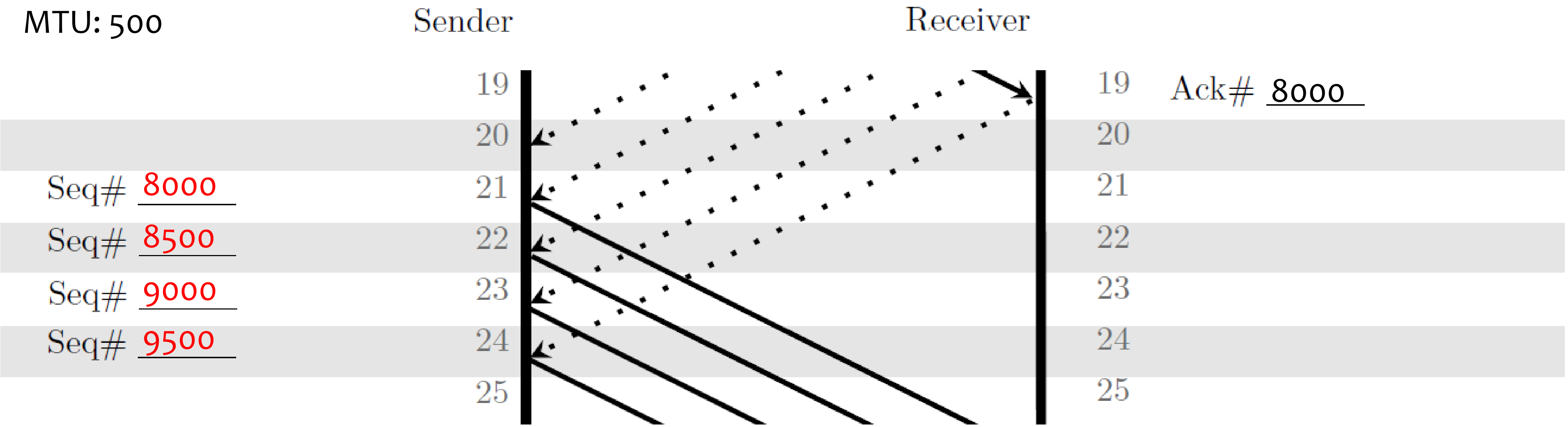
MTU: 500

Seq# 8000

Seq# 8500

Seq# 9000

Seq# 9500

Ack# 8000

Question 2d)

State the time at which the third duplicate acknowledgment arrives at the sender.

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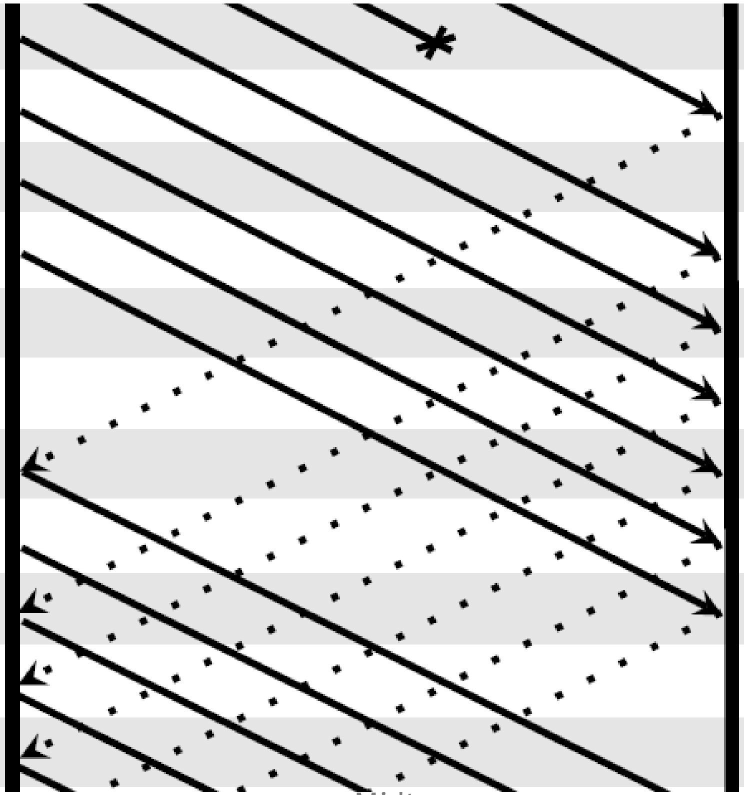

Sender			Receiver
Seq# 4000	4	4	
Seq# 4500	5	5	Ack# 2500
Seq# 5000	6	6	
Seq# 5500	7	7	Ack# 2500
	8	8	Ack# 2500
	9	9	Ack# 2500
Seq# 6000	10	10	Ack# 2500
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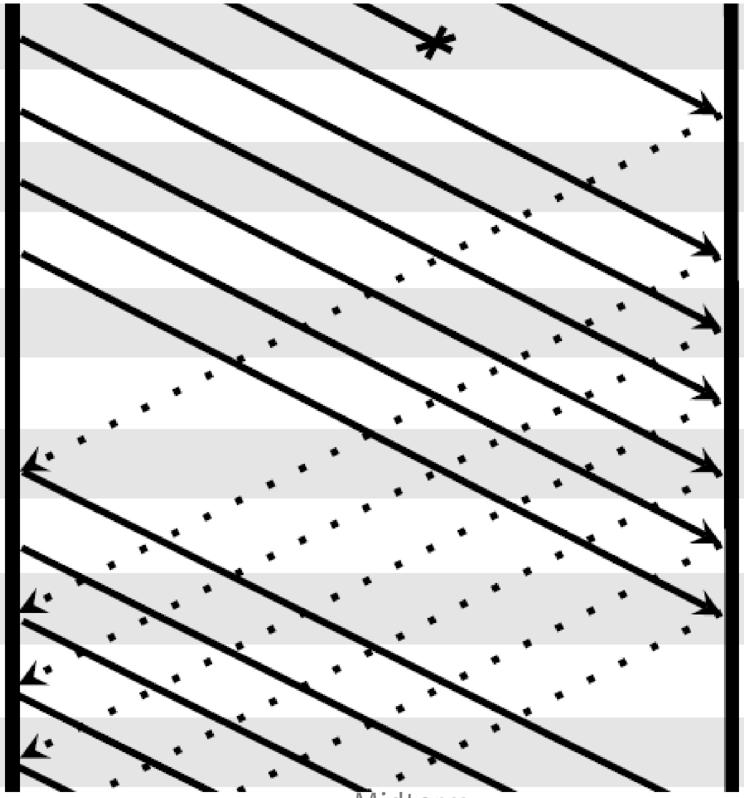

Sender			Receiver	
Seq# 4000	4	4		
Seq# 4500	5	5	Ack# 2500	Original!
Seq# 5000	6	6		
Seq# 5500	7	7	Ack# 2500	DUP!
	8	8	Ack# 2500	DUP!
	9	9	Ack# 2500	DUP!
Seq# 6000	10	10	Ack# 2500	
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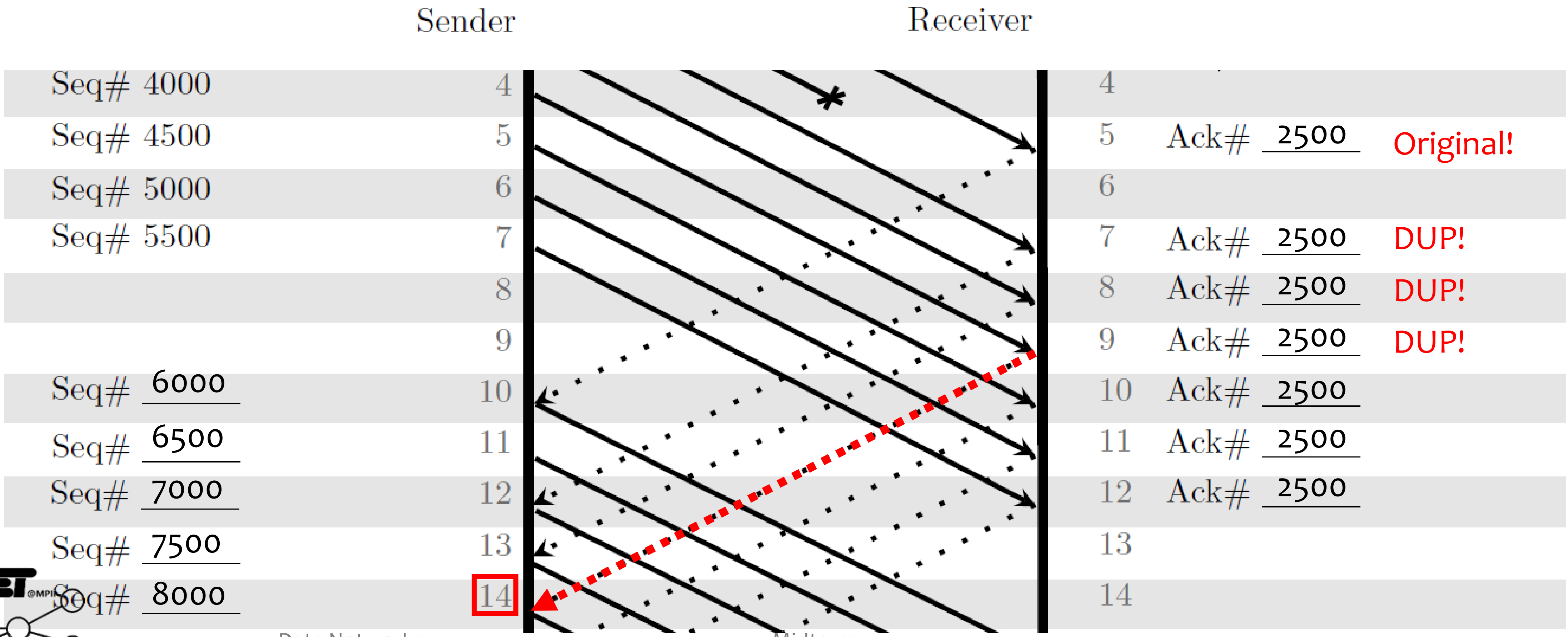

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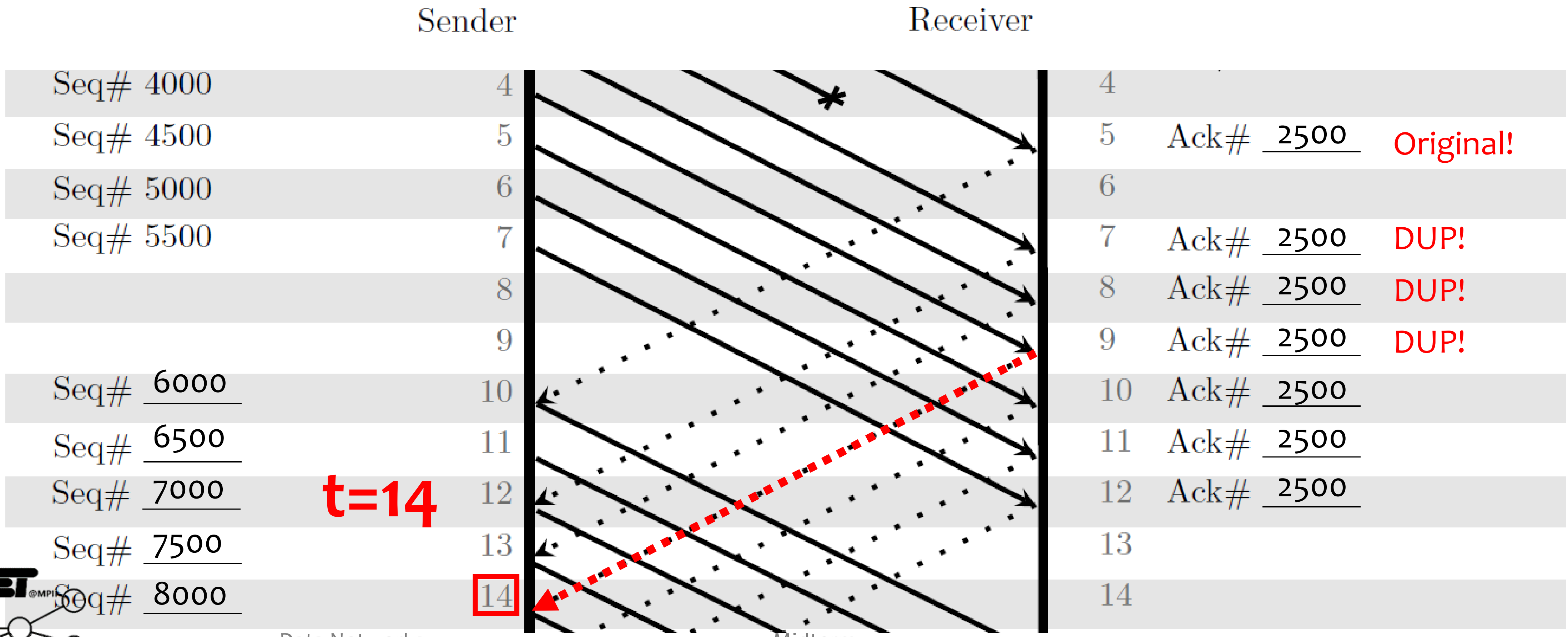

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Seq# 4500	5	5	Ack# 2500	Original!
Seq# 5000	6	6		
Seq# 5500	7	7	Ack# 2500	DUP!
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	9	9	Ack# 2500	DUP!
Seq# 6000	10	10	Ack# 2500	
Seq# 6500	11	11	Ack# 2500	
Seq# 7000	12	12	Ack# 2500	
Seq# 7500	13	13		
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t=14

Question 2e)

Explain in not more than two sentences in the space below why the sender does not transmit a segment after receiving an ACK at t = 20.

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  -> CWND is full.

  -> Must wait for missing ACKs to arrive

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- What is the congestion window?

  -> Reset by triple duplicate ACKs.

  -> CWND is full.

  -> Must wait for missing ACKs to arrive

Answer: The CWND is changed due to the triple duplicate ACKs. The number of packets in flight is greater than CWND, so the senders needs to wait for ACK of last un-ACK-ed packet in flight.

Question 2f)

Identify the congestion control state the algorithm is in at t = 25.

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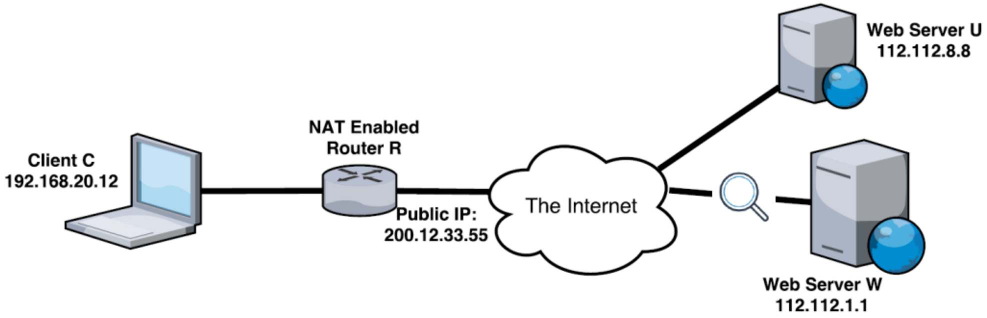
-> Congestion Avoidance

Question 3)

Consider the network depicted below. It consists of the following elements:

- Client C
- Web server *U*
- Web server *W*
- NAT Enabled Router *R*



Client C has previously fetched the front page (index.html) from Web Server U. After reading index.html, the client knows that it should download two additional files, namely pic1.jpg, and pic2.jpg from Web Server W. Client C starts fetching first pic1.jpg and then pic2.jpg; using HTTP 1.1. Client C already knows the IP address of Web Server W.

pic2.jpg has been recently deleted by the admin of Web Server W and no longer exists on the server. The client is not aware of this change.

Write down all packets visible at the link of Web Server W involving this transaction in the Table.

Consider only protocols of the network, transport and application layer, that is, IP and above. Also, consider all packets necessary for connection setup and tear-down! **When possible, the client puts multiple HTTP requests in one TCP segment.** Web Server W processes one request at a time.

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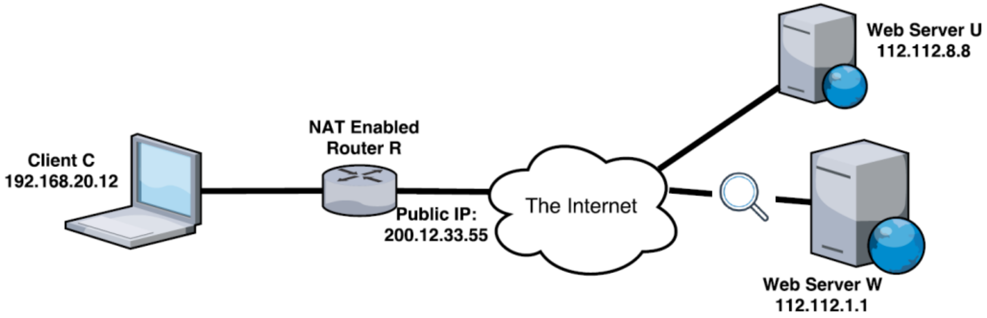
- Client *C*
- Web server *U*
- Web server *W*
- NAT Enabled Router *R*



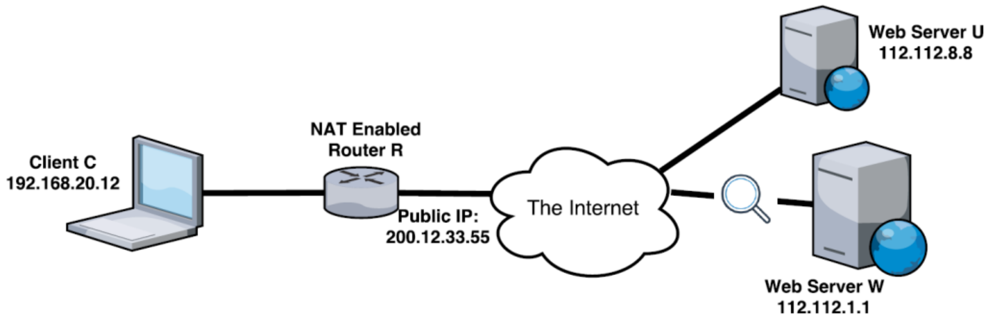
Assumptions:

- Sequence numbers always start at 3000 for C and 6000 for W.
- The client terminates the connection after the HTTP transfer.
- Maximum Segment Size (MSS): 800 Byte.
- HTTP-Header-Sizes:
  - Request: 400 Byte.
  - Response: 250 Byte.
- File size of pic1.jpg: 1350 Byte.
- File size of pic2.jpg: 550 Byte.

Question 3)

Consider the network depicted below. It consists of the following elements:

- Client C
- Web server *U*
- Web server *W*
- NAT Enabled Router *R*



Client C has previously fetched the front page (index.html) from Web Server U. After reading index.html, the client knows that it should download two additional files, namely pic1.jpg, and pic2.jpg from Web Server W. Client C starts fetching first pic1.jpg and then pic2.jpg; using HTTP 1.1. Client C already knows the IP address of Web Server W.

pic2.jpg has been recently deleted by the admin of Web Server W and no longer exists on the server. The client is not aware of this change.

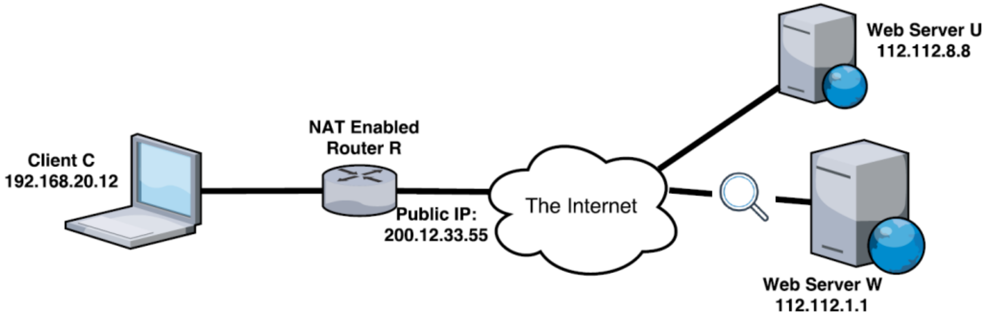
Write down all packets visible at the link of Web Server W involving this transaction in the Table.

Consider only protocols of the network, transport and application layer, that is, IP and above. Also, consider all packets necessary for connection setup and tear-down! **When possible, the client puts multiple HTTP requests in one TCP segment.** Web Server W processes one request at a time.

Question 3)

Consider the network depicted below. It consists of the following elements:

- Client C
- Web server *U*
- Web server *W*
- NAT Enabled Router *R*



Assumptions:

- Sequence numbers always start at 3000 for C and 6000 for W.
- The client terminates the connection after the HTTP transfer.
- Maximum Segment Size (MSS): 800 Byte.
- HTTP-Header-Sizes:
  - Request: 400 Byte.
  - Response: 250 Byte.
- File size of pic1.jpg: 1350 Byte.
- File size of pic2.jpg: 550 Byte.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80			SYN	

Client C starts fetching first pic1.jpg and then pic2.jpg; using HTTP 1.1. Client C already knows the IP address of Web Server W.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	

Sequence numbers always start at 3000 for C

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345		3001	SYN/ACK	

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	

Sequence numbers always start at 3000 for C and 6000 for W.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)

Client C starts fetching first pic1.jpg and then pic2.jpg; using HTTP 1.1. Client C already knows the IP address of Web Server W.

- HTTP-Header-Sizes:
  - Request: 400 Byte.

Maximum Segment Size (MSS): 800 Byte.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001			

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801		

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1

- HTTP-Header-Sizes:
  - Request: 400 Byte.
  - Response: 250 Byte.
- File size of pic1.jpg: 1350 Byte.
- File size of pic2.jpg: 550 Byte.

Maximum Segment Size (MSS): 800 Byte.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1

- HTTP-Header-Sizes:
  - Request: 400 Byte.
  - Response: 250 Byte.
- File size of pic1.jpg: 1350 Byte.
- File size of pic2.jpg: 550 Byte.

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Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	7601			HTTP Not Found (250 Bytes)

- HTTP-Header-Sizes:
  - Request: 400 Byte.
  - Response: 250 Byte.

pic2.jpg has been recently deleted by the admin of Web Server W and no longer exists on the server.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	7601			HTTP Not Found (250 Bytes)
200.12.33.55	112.112.1.1	12345	80			ACK/FIN	

The client terminates the connection after the HTTP transfer.

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	7601			HTTP Not Found (250 Bytes)
200.12.33.55	112.112.1.1	12345	80	3801	7851	ACK/FIN	

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	7601			HTTP Not Found (250 Bytes)
200.12.33.55	112.112.1.1	12345	80	3801	7851	ACK/FIN	
112.112.1.1	200.12.33.55	80	12345	7851	3802	ACK/FIN	

Question 3)

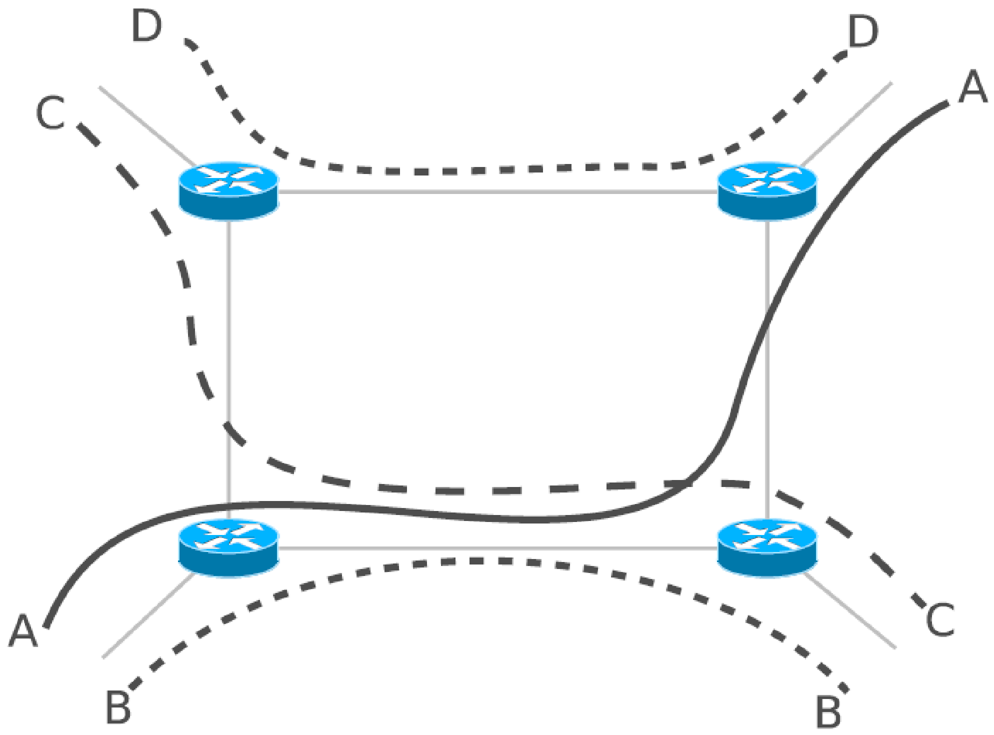
Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	7601			HTTP Not Found (250 Bytes)
200.12.33.55	112.112.1.1	12345	80	3801	7851	ACK/FIN	
112.112.1.1	200.12.33.55	80	12345	7851	3802	ACK/FIN	
200.12.33.55	112.112.1.1	12345	80	3802	7852	ACK	

Question 3)

Src IP	Dst IP	Src Port	Dst Port	Seq#	Ack#	TCP Flags	Content
200.12.33.55	112.112.1.1	12345(any)	80	3000		SYN	
112.112.1.1	200.12.33.55	80	12345	6000	3001	SYN/ACK	
200.12.33.55	112.112.1.1	12345	80	3001	6001	ACK	HTTP GET pic1 + pic2 (800 Bytes)
112.112.1.1	200.12.33.55	80	12345	6001	3801	ACK	HTTP Response Hdr (250 Bytes) + 550 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	6801			800 Bytes Pic1
112.112.1.1	200.12.33.55	80	12345	7601			HTTP Not Found (250 Bytes)
200.12.33.55	112.112.1.1	12345	80	3801	7851	ACK/FIN	
112.112.1.1	200.12.33.55	80	12345	7851	3802	ACK/FIN	
200.12.33.55	112.112.1.1	12345	80	3802	7852	ACK	

Question 4)

Consider the network topology shown in Figure 1. Assume the long-lived TCP flows, A, B, C and D exchanging large amounts of data in both directions. These are the only flows using the network. The bandwidth on all links is 100 Mbit/s. You can assume that the flows are not limited by any receiver window.



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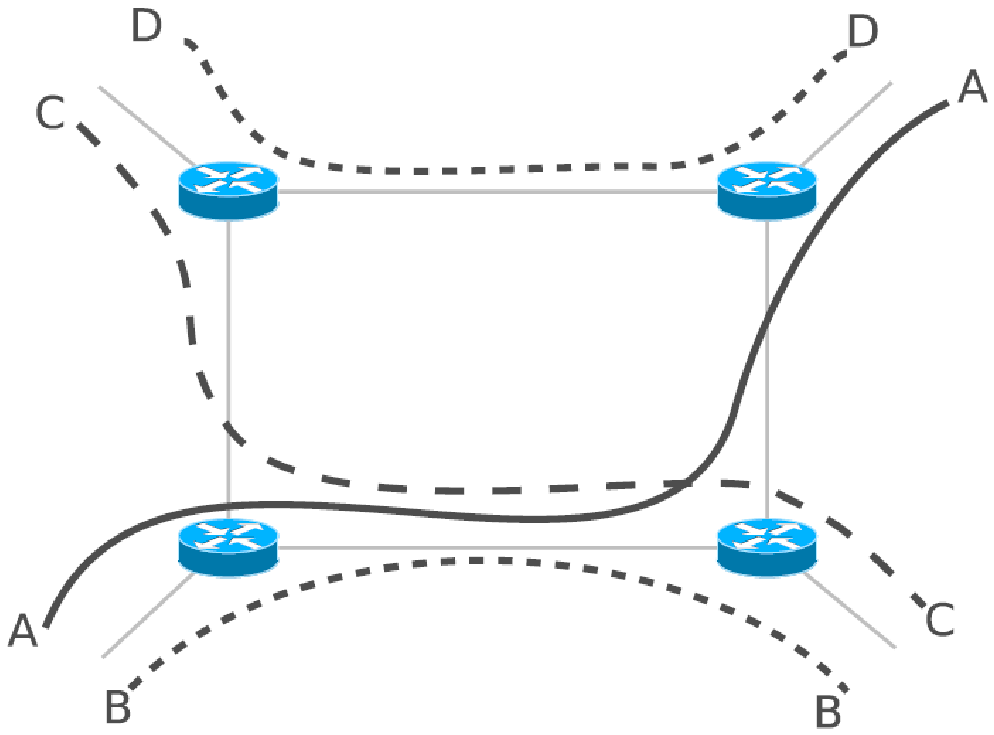
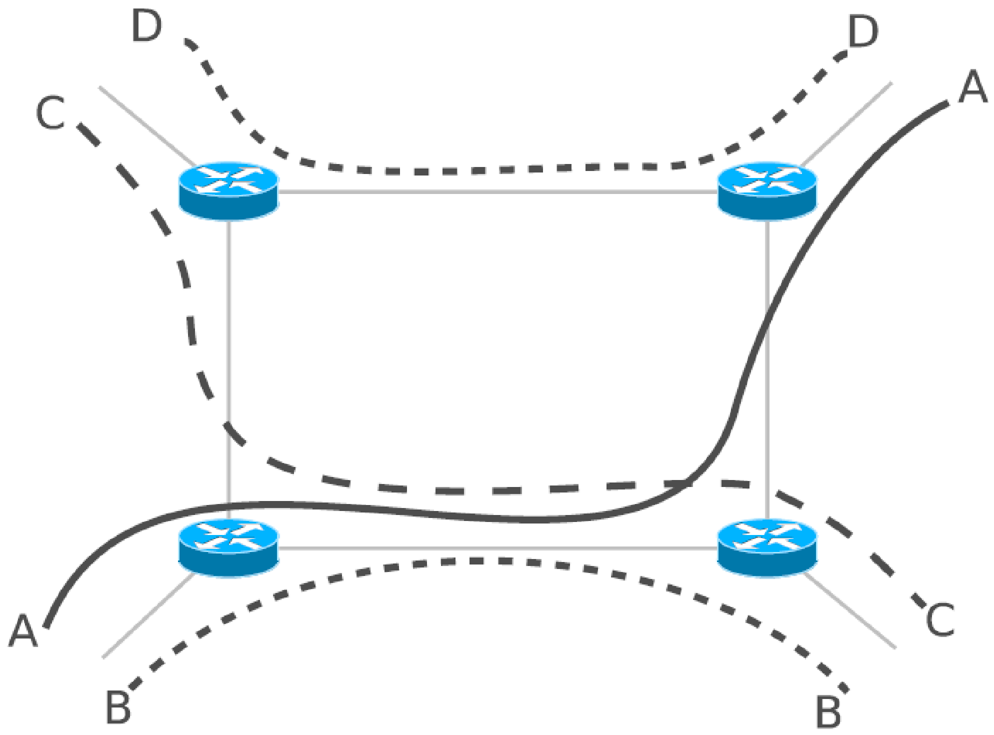


Question 4a)

Estimate the average transmission rate for each flow.



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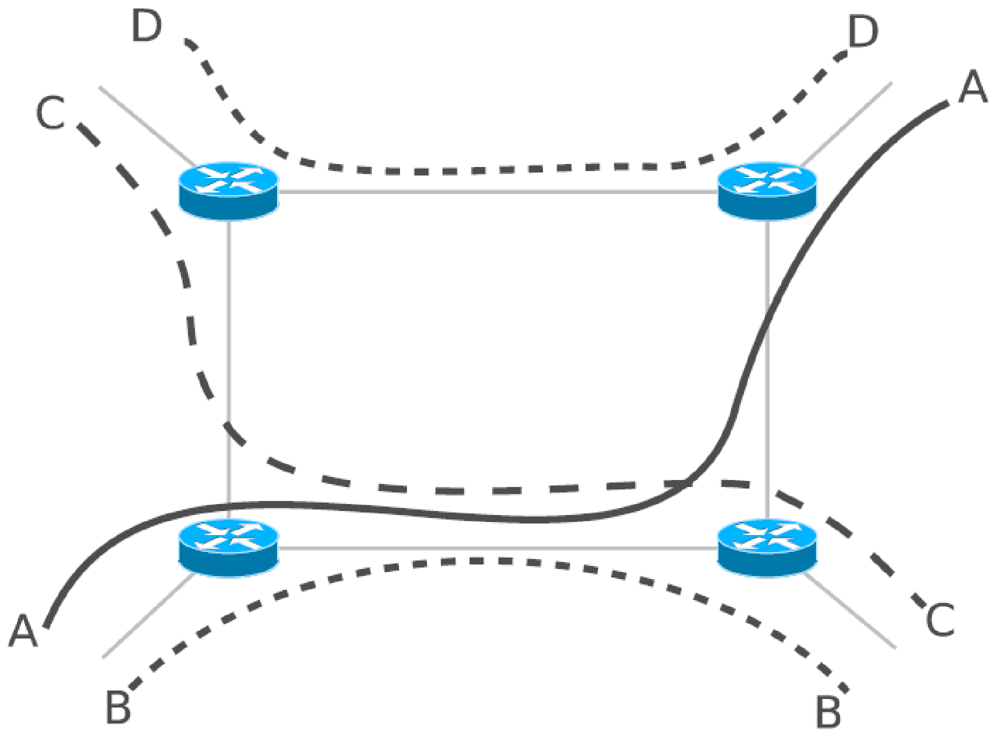
Estimate the average transmission rate for each flow.



Question 4a)

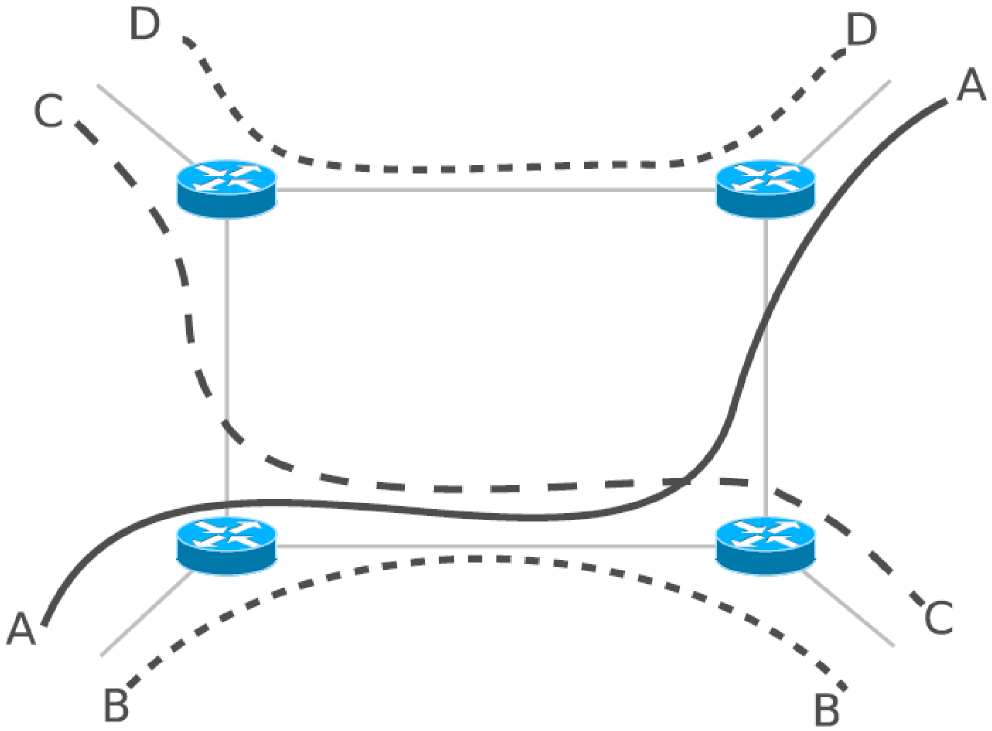
Estimate the average transmission rate for each flow.

A:

B:

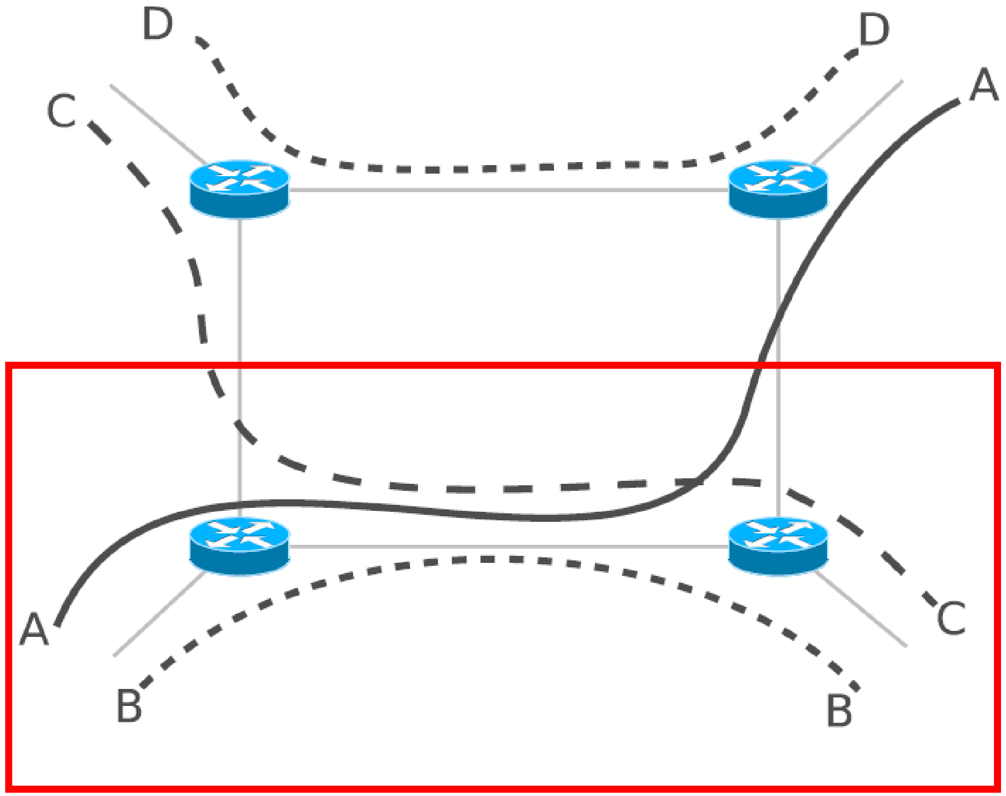
C:

D:



Question 4a)

Estimate the average transmission rate for each flow.



A: 1/3*100 Mbps (Sharing with B/C)

B:

C:

D:

Question 4a)

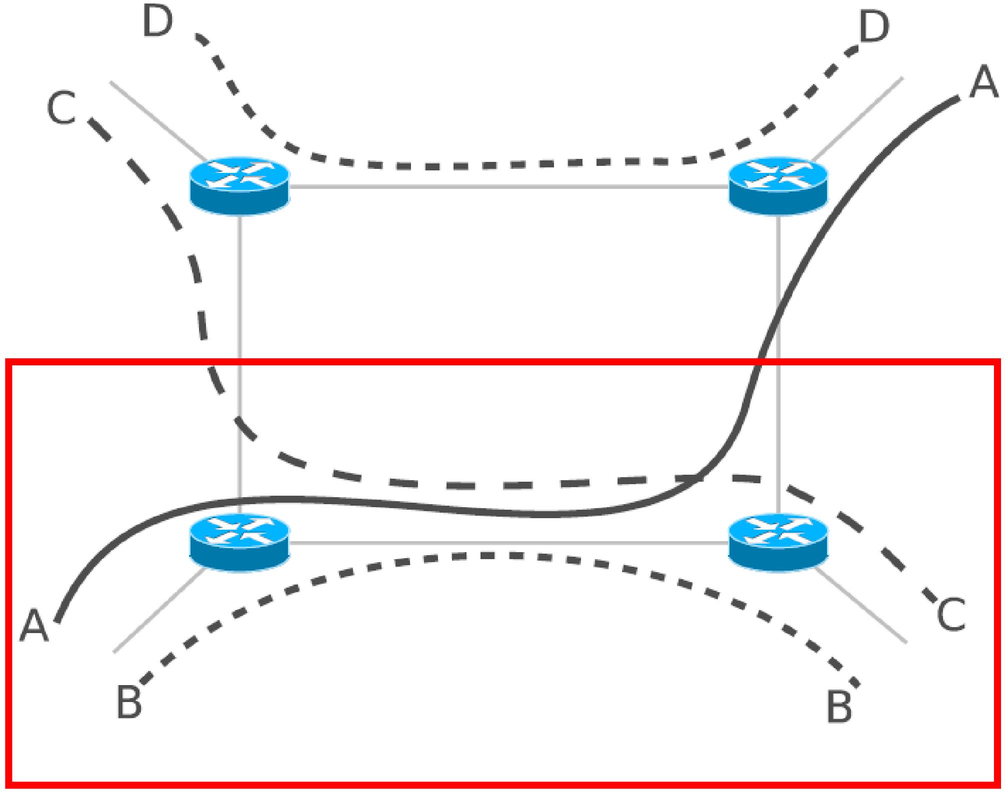
Estimate the average transmission rate for each flow.

A: 1/3*100 Mbps (Sharing with B/C)

B: 1/3*100 Mbps (Sharing with A/C)

C:

D:



Question 4a)

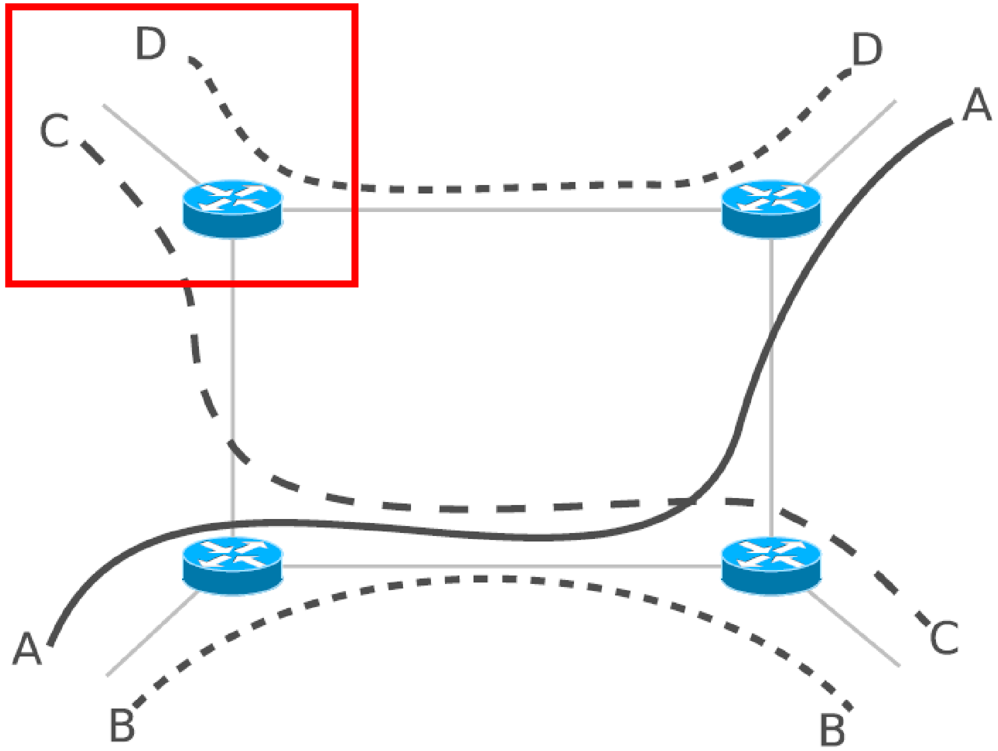
Estimate the average transmission rate for each flow.

A: 1/3*100 Mbps (Sharing with B/C)

B: 1/3*100 Mbps (Sharing with A/C)

C: 1/2*100 Mbps?

D:



Question 4a)

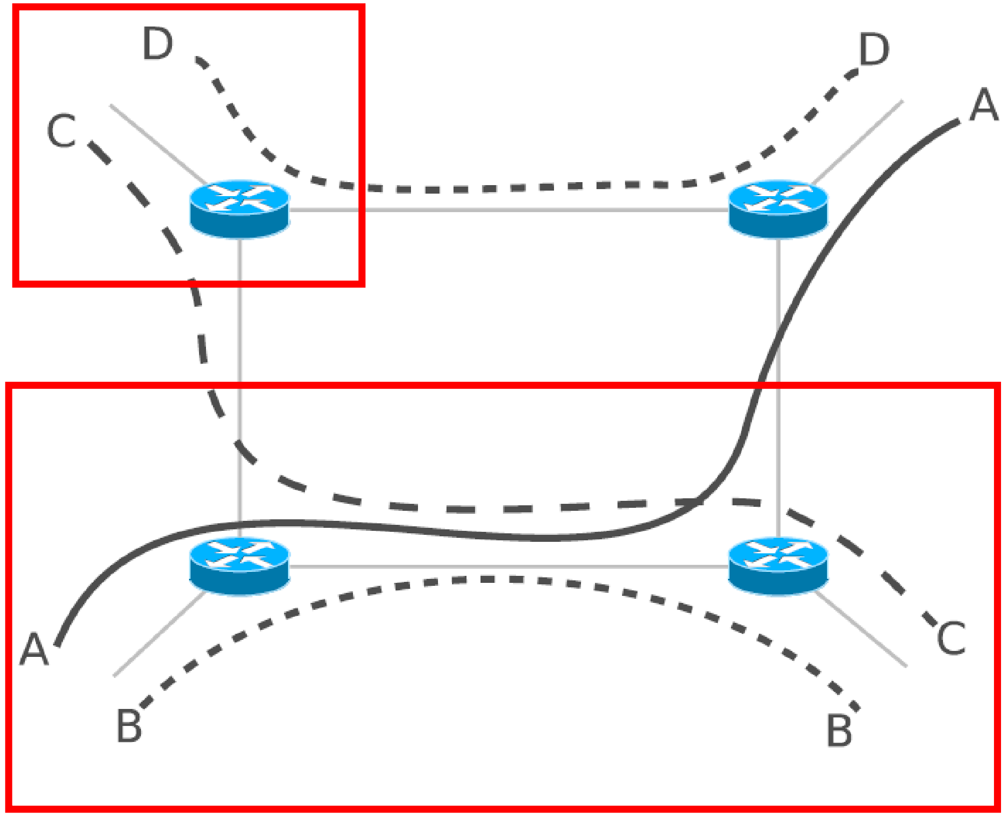
Estimate the average transmission rate for each flow.

A: 1/3*100 Mbps (Sharing with B/C)

B: 1/3*100 Mbps (Sharing with A/C)

C: ~~1/2*100 Mbps?~~ 1/3*100 Mbps

D:



Question 4a)

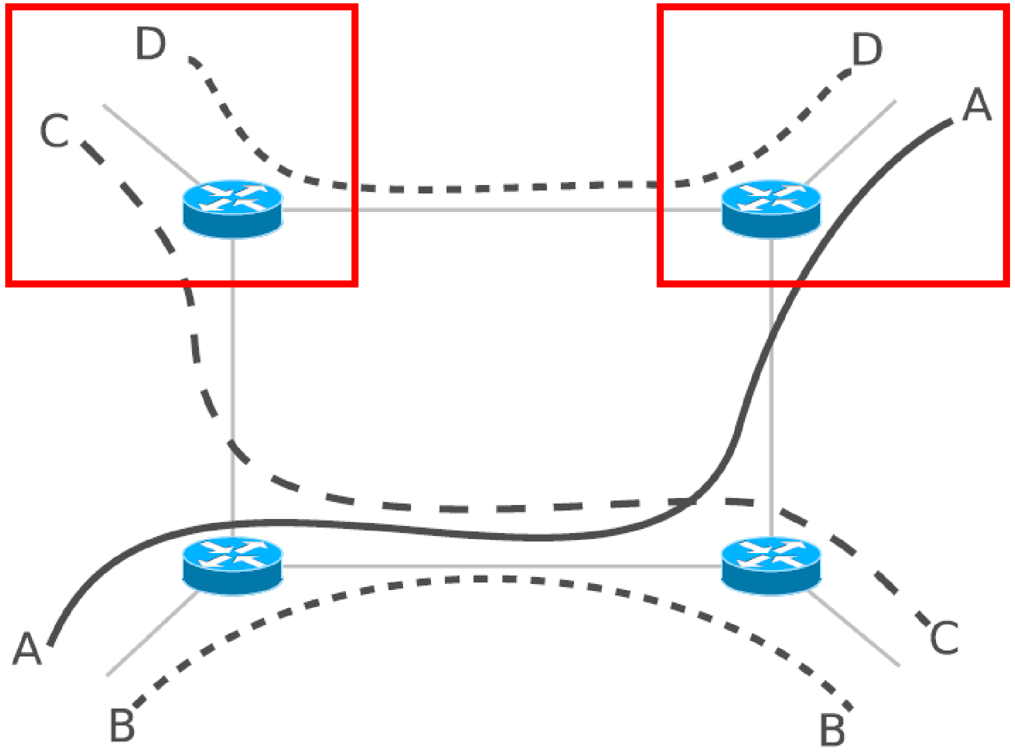
Estimate the average transmission rate for each flow.

A: 1/3*100 Mbps (Sharing with B/C)

B: 1/3*100 Mbps (Sharing with A/C)

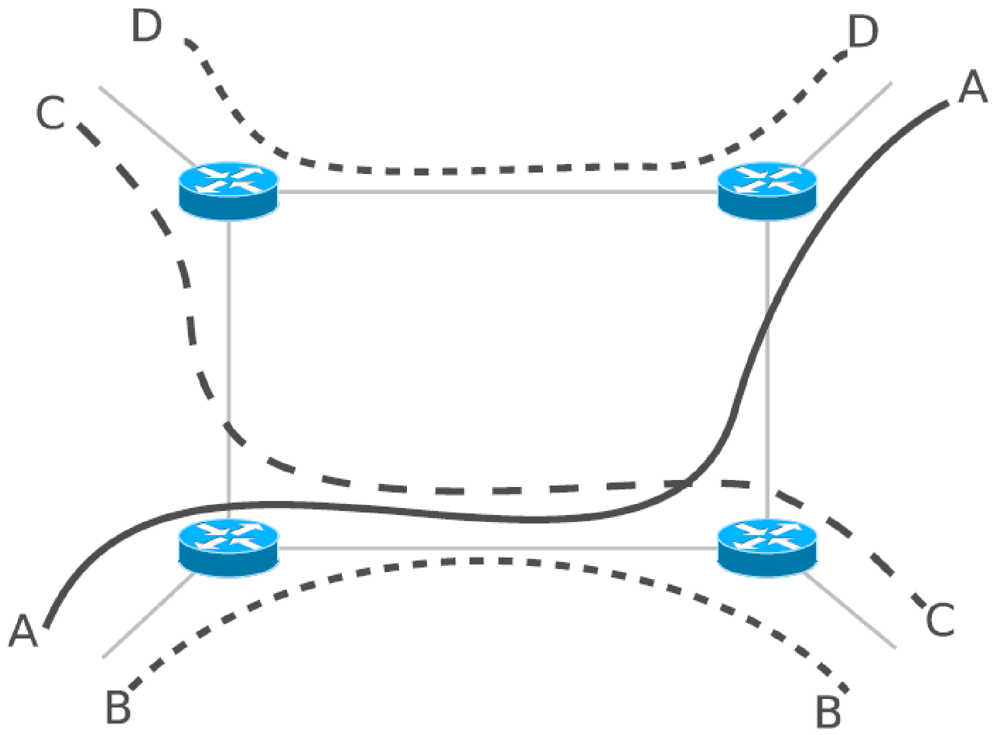
C: 1/3*100 Mbps (Sharing with A/B)

D: 2/3*100 Mbps



Question 4b)

Assume now that the TCP flow D is substituted by a UDP flow. Both endpoints still exchange data using all bandwidth available to them. Estimate the average transmission rate for each flow.



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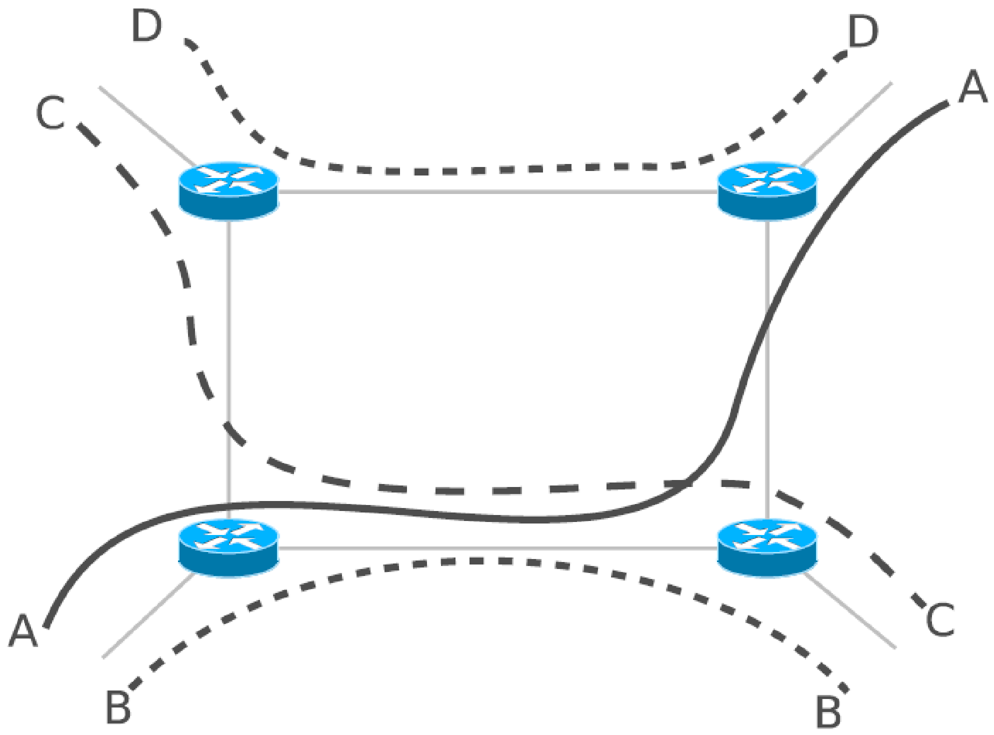

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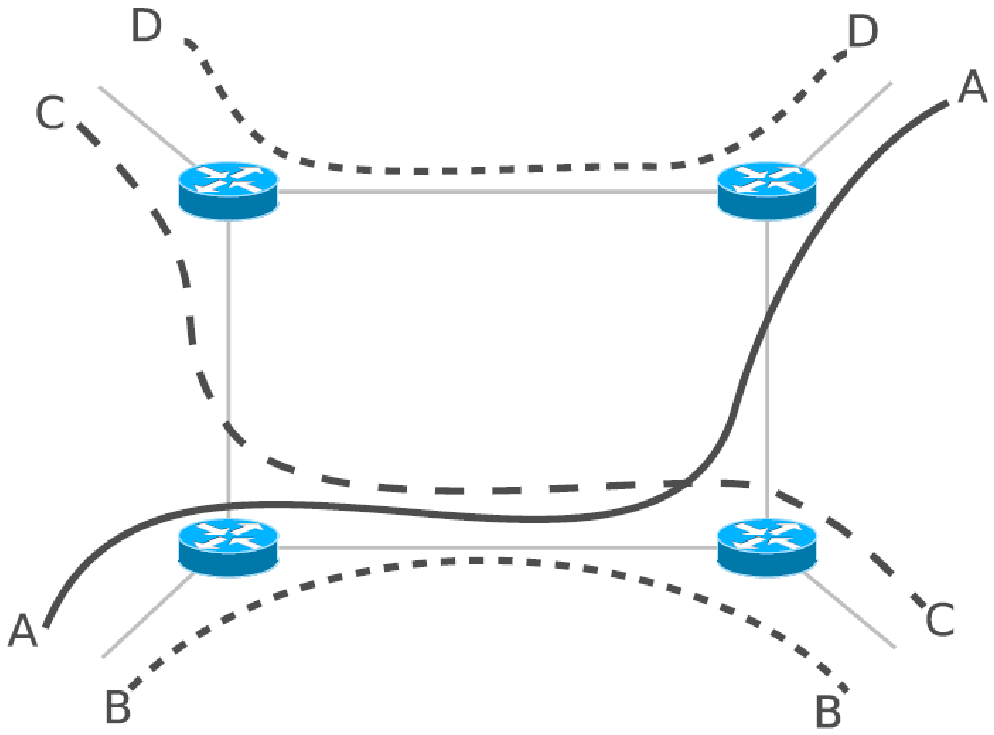


A:

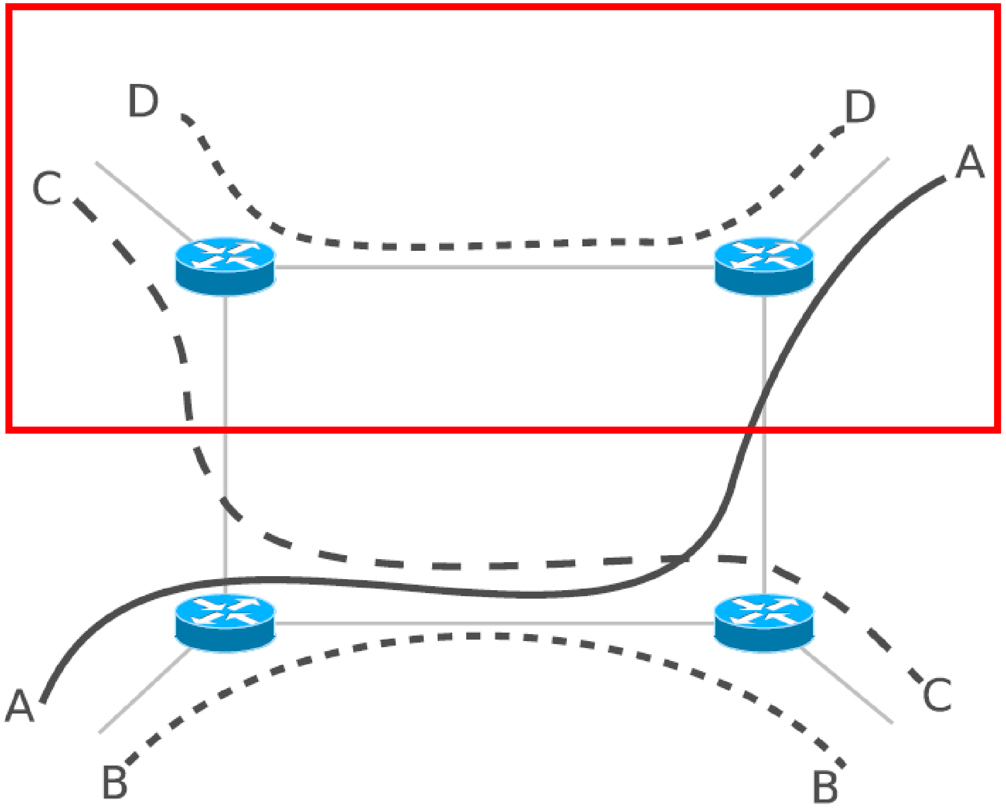
B:

C:

D:

Question 4b)

Assume now that the TCP flow D is substituted by a UDP flow. Both endpoints still exchange data using all bandwidth available to them. Estimate the average transmission rate for each flow.



A:

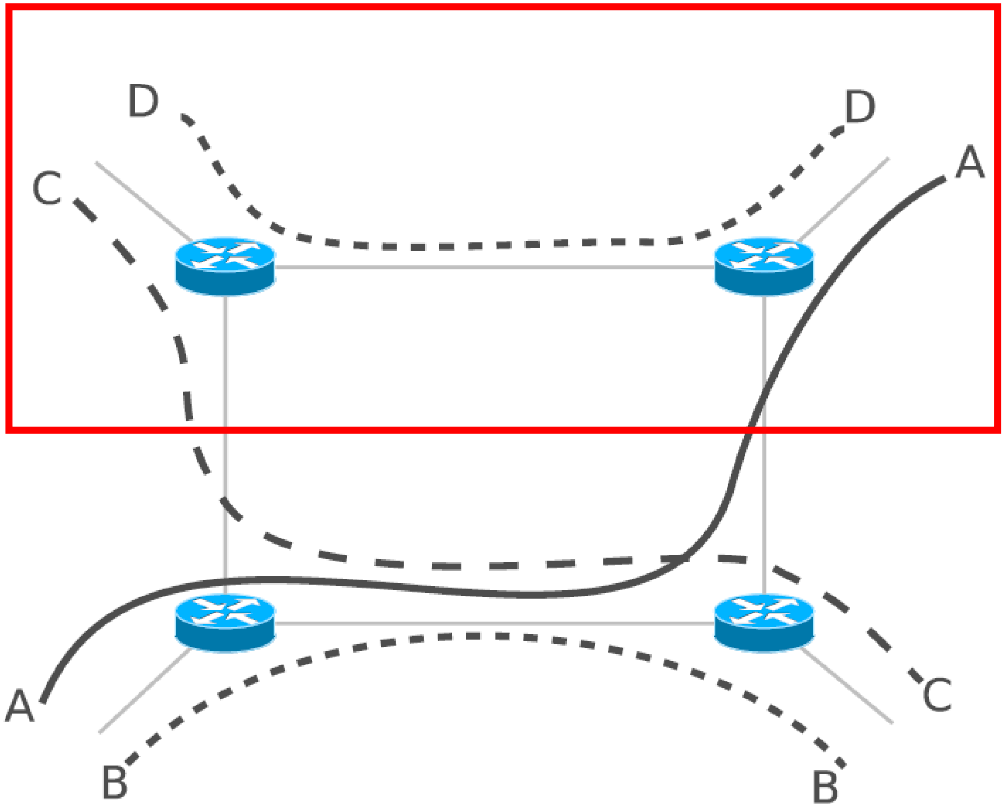
B:

C:

D: 100 mbit

Question 4b)

Assume now that the TCP flow D is substituted by a UDP flow. Both endpoints still exchange data using all bandwidth available to them. Estimate the average transmission rate for each flow.



A:

B:

C: 0 mbit (Starved by D)

D: 100 mbit

Question 4b)

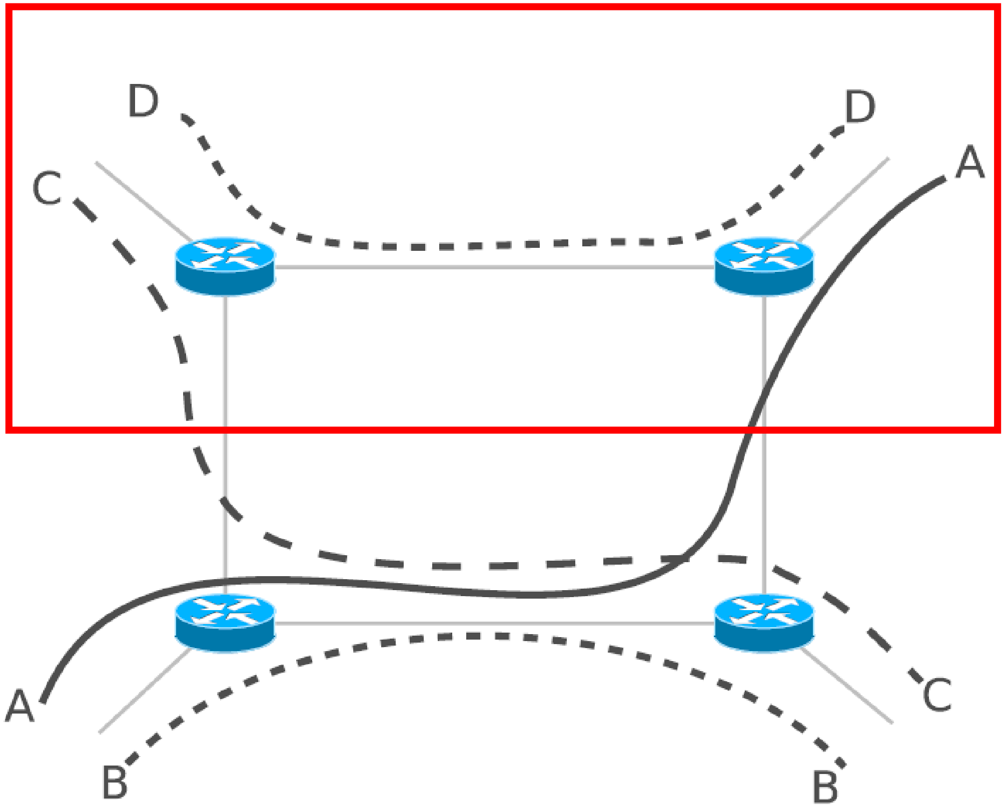
Assume now that the TCP flow D is substituted by a UDP flow. Both endpoints still exchange data using all bandwidth available to them. Estimate the average transmission rate for each flow.

A: 0 mbit (Starved by D)

B:

C: 0 mbit (Starved by D)

D: 100 mbit



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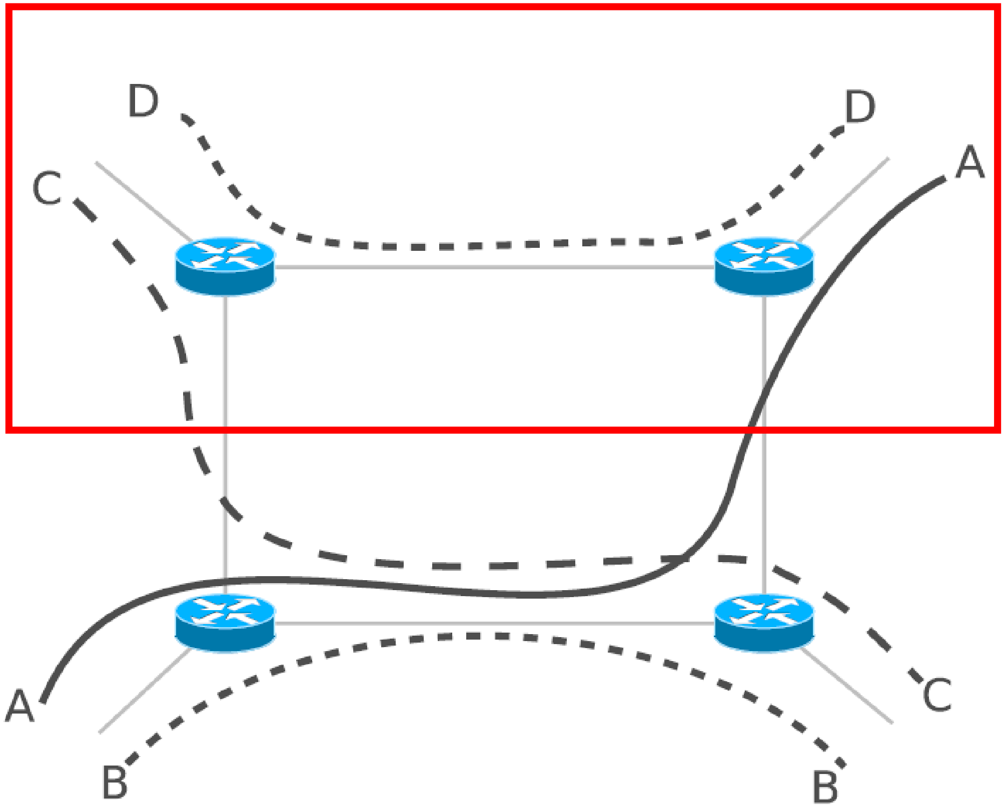


A: 0 mbit (Starved by D)

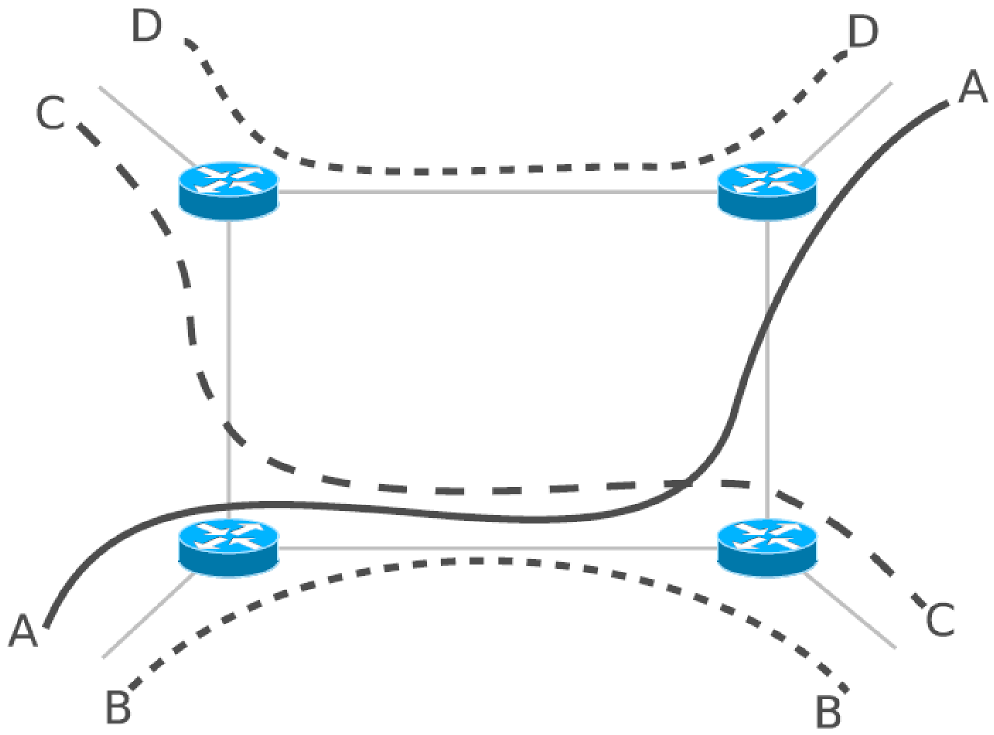
B: 100 mbit (A/C Starved!)

C: 0 mbit (Starved by D)

D: 100 mbit

Question 4c)

Assume now that the TCP flow D has the bandwidth of 50 Mbit/s instead of 100 Mbit/s. Both endpoints still exchange data using all bandwidth available to them. Given this change, estimate the new average transmission rate for each flow (A, B, C, D).



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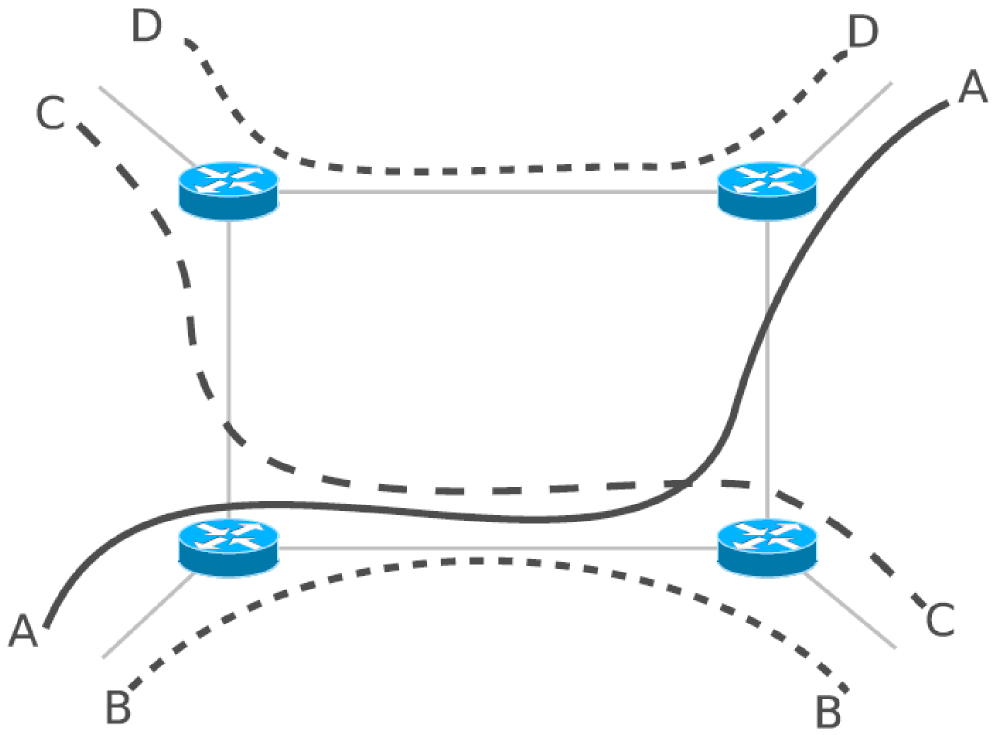

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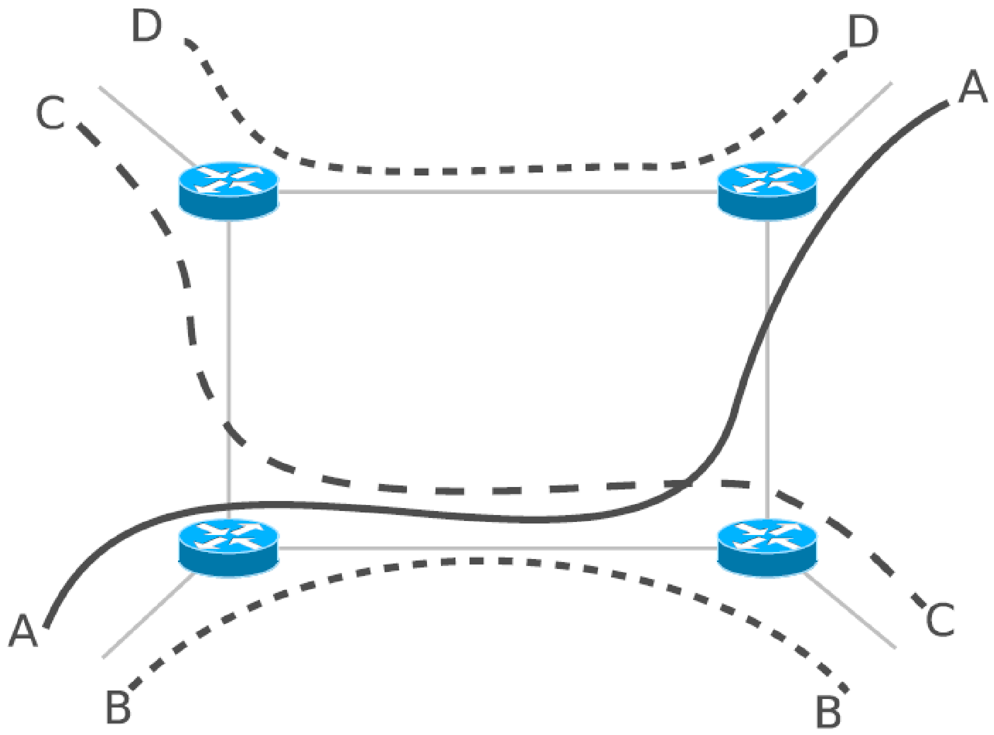


A:

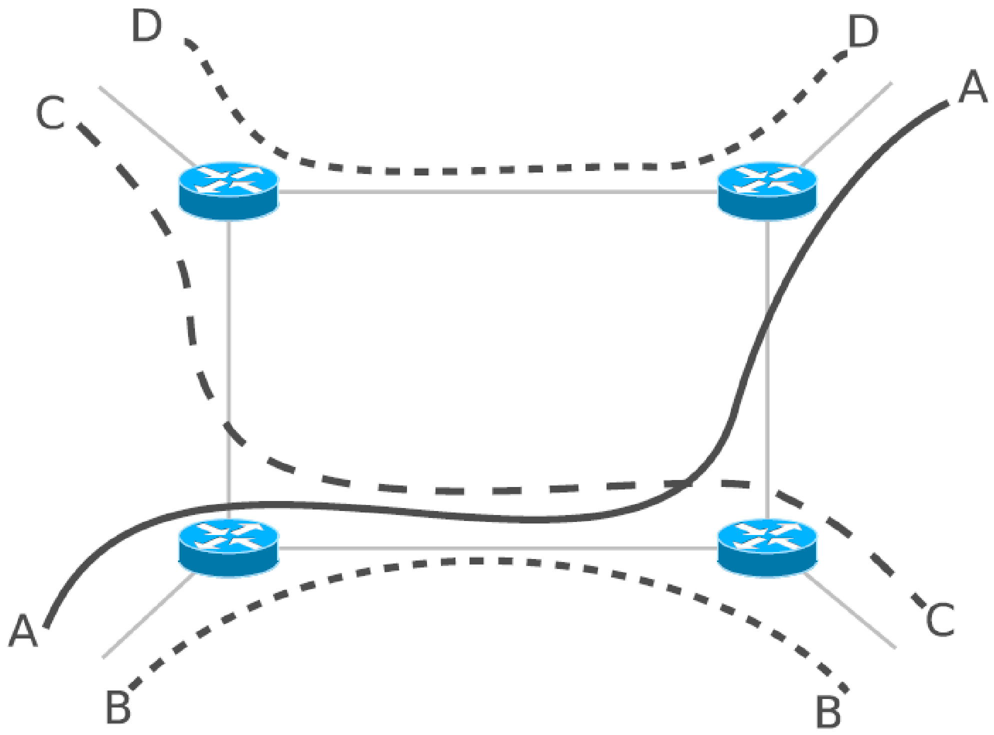
B:

C:

D:

Question 4c)

Assume now that the TCP flow D has the bandwidth of 50 Mbit/s instead of 100 Mbit/s. Both endpoints still exchange data using all bandwidth available to them. Given this change, estimate the new average transmission rate for each flow (A, B, C, D).



A:

B:

C:

D: 50 mbit (Set by question!)

Question 4c)

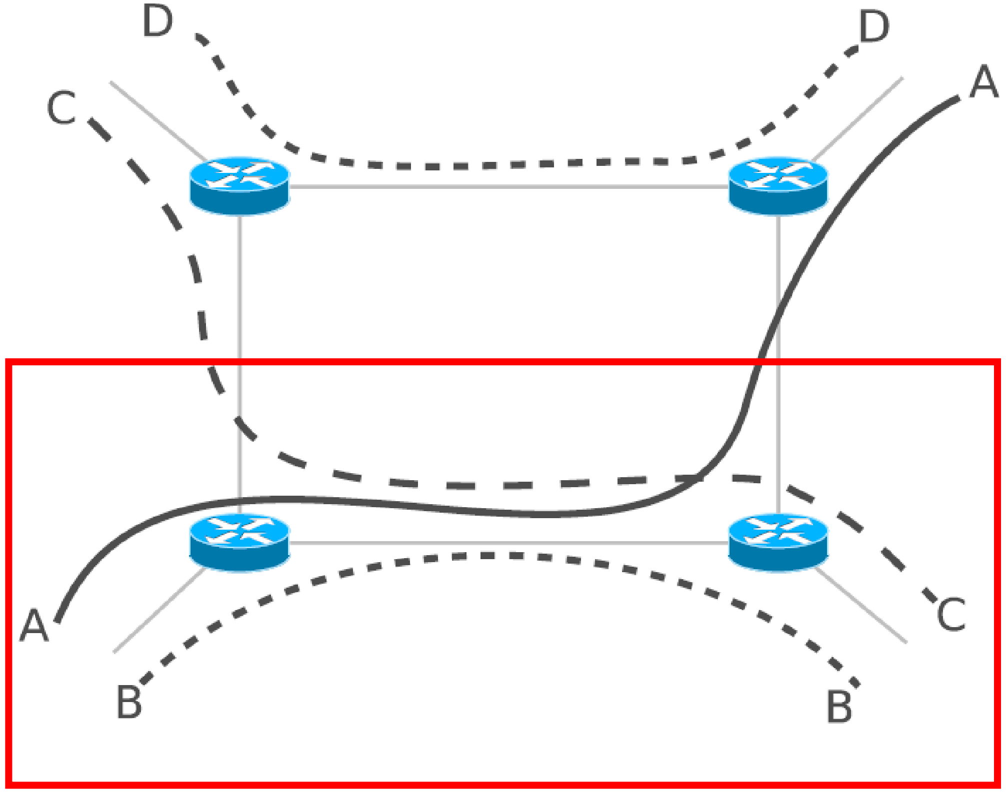
Assume now that the TCP flow D has the bandwidth of 50 Mbit/s instead of 100 Mbit/s. Both endpoints still exchange data using all bandwidth available to them. Given this change, estimate the new average transmission rate for each flow (A, B, C, D).

A: 1/3 * 100 mbit (Sharing with B/C)

B: 1/3 * 100 mbit (Sharing with A/C)

C:

D: 50 mbit



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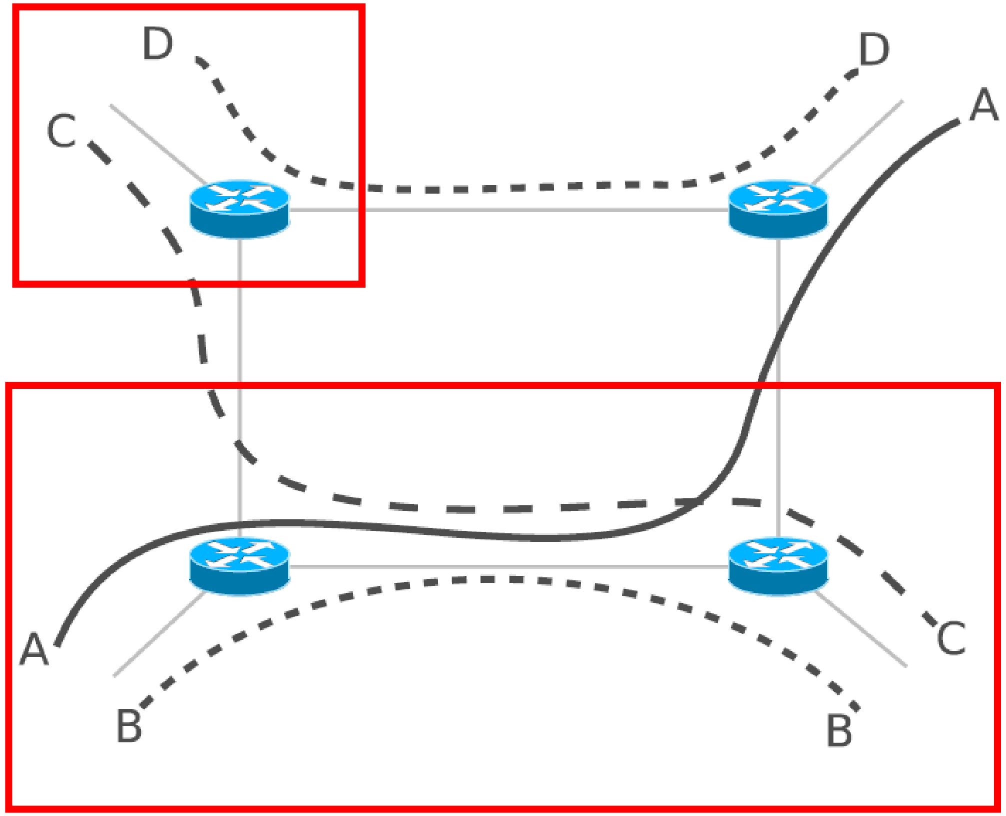
Assume now that the TCP flow D has the bandwidth of 50 Mbit/s instead of 100 Mbit/s. Both endpoints still exchange data using all bandwidth available to them. Given this change, estimate the new average transmission rate for each flow (A, B, C, D).

A: 1/3 * 100 mbit (Sharing with B/C)

B: 1/3 * 100 mbit (Sharing with A/C)

C: 1/3 * 100 mbit (Sharing with A/B)

D: 50 mbit



Question 4c)

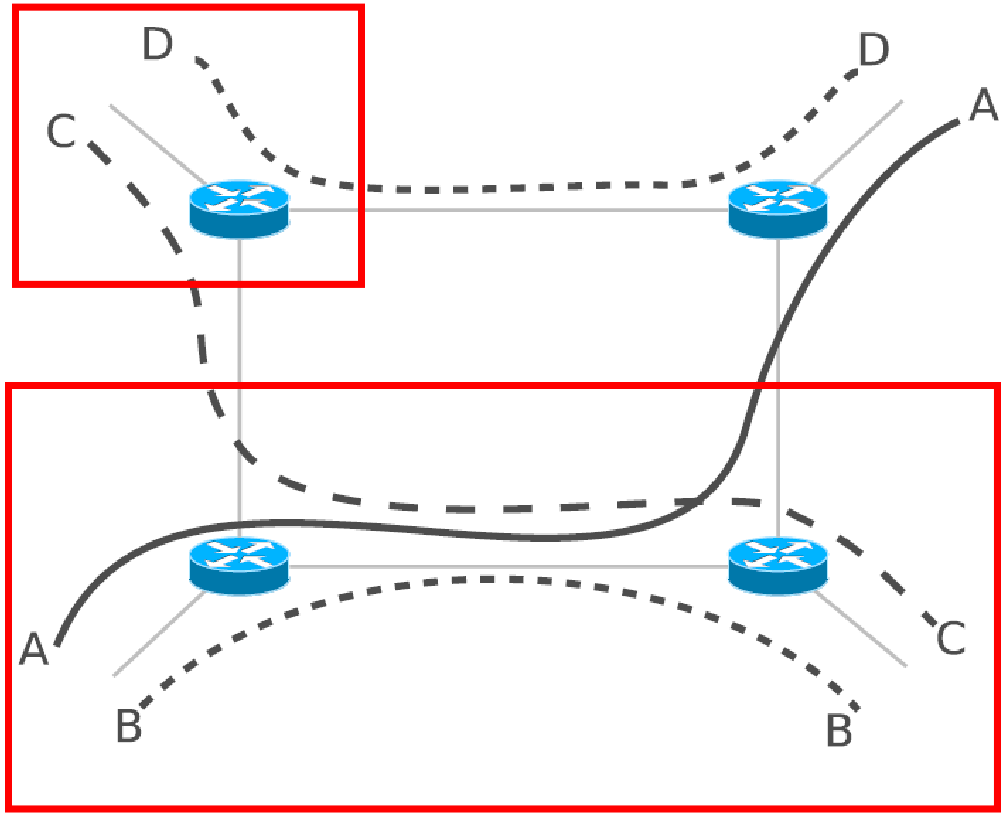
Assume now that the TCP flow D has the bandwidth of 50 Mbit/s instead of 100 Mbit/s. Both endpoints still exchange data using all bandwidth available to them. Given this change, estimate the new average transmission rate for each flow (A, B, C, D).

A: 1/3 * 100 mbit (Sharing with B/C)

B: 1/3 * 100 mbit (Sharing with A/C)

C: 1/3 * 100 mbit (Sharing with A/B)

D: 50 mbit (2/3 * 100 mbit available!)



Questions?