Computer Networks
2nd Year, 1st Semester

Tutorial 8 - TCP

1. IP is responsible for _____ communication while TCP is responsible for _____ communication.

   a) host-to-host; process-to-process
   b) process-to-process; Host-to-host
   c) process-to-process; network-to-network
   d) network-to-network; process-to-process

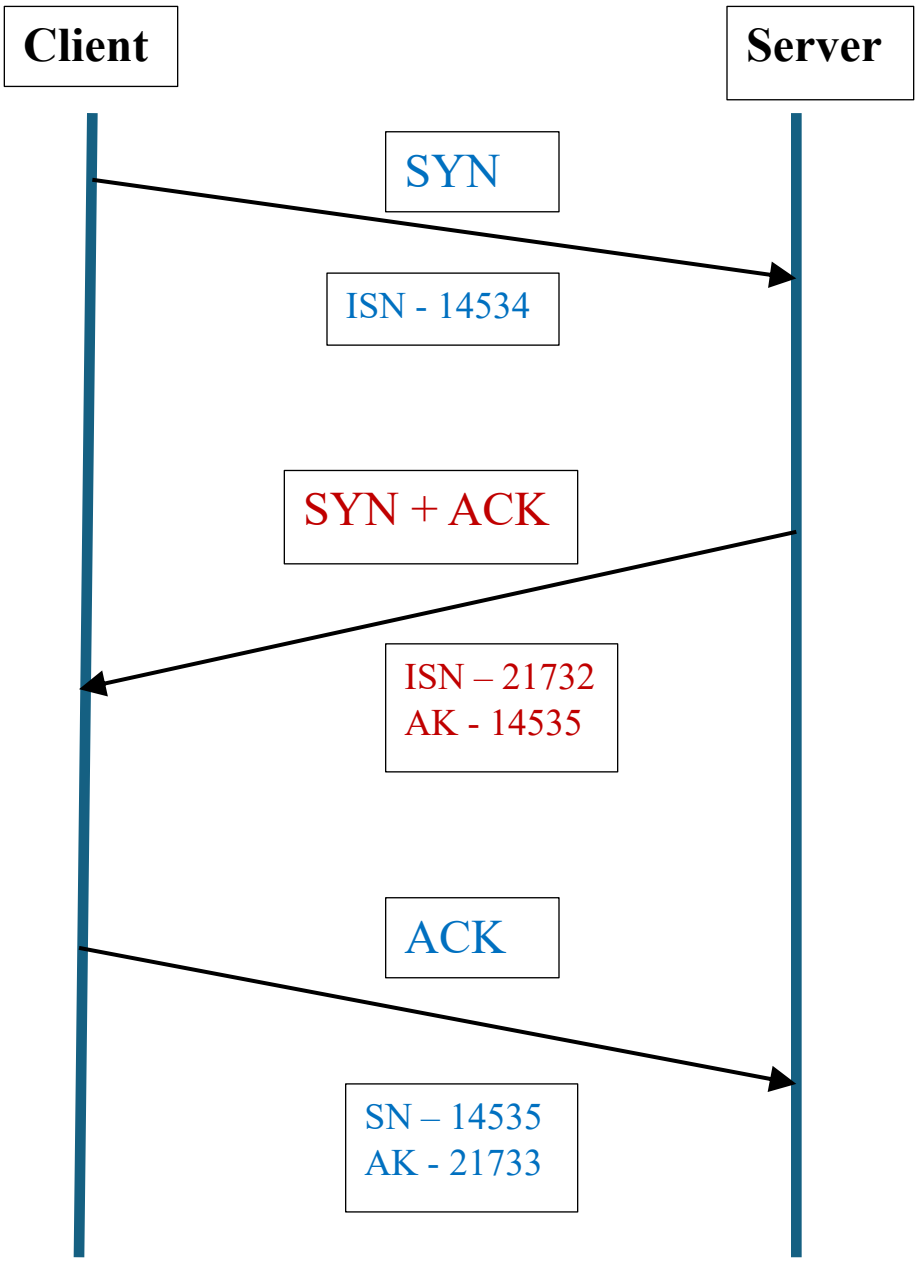
2. A host can be identified by _____ while a program can be identified by _____.

   a) An IP address; a port number
   b) A port number; an IP address
   c) An IP address; a host address
   d) An IP address; a well-known port

3. The _____ address **uniquely** identifies a running application program.

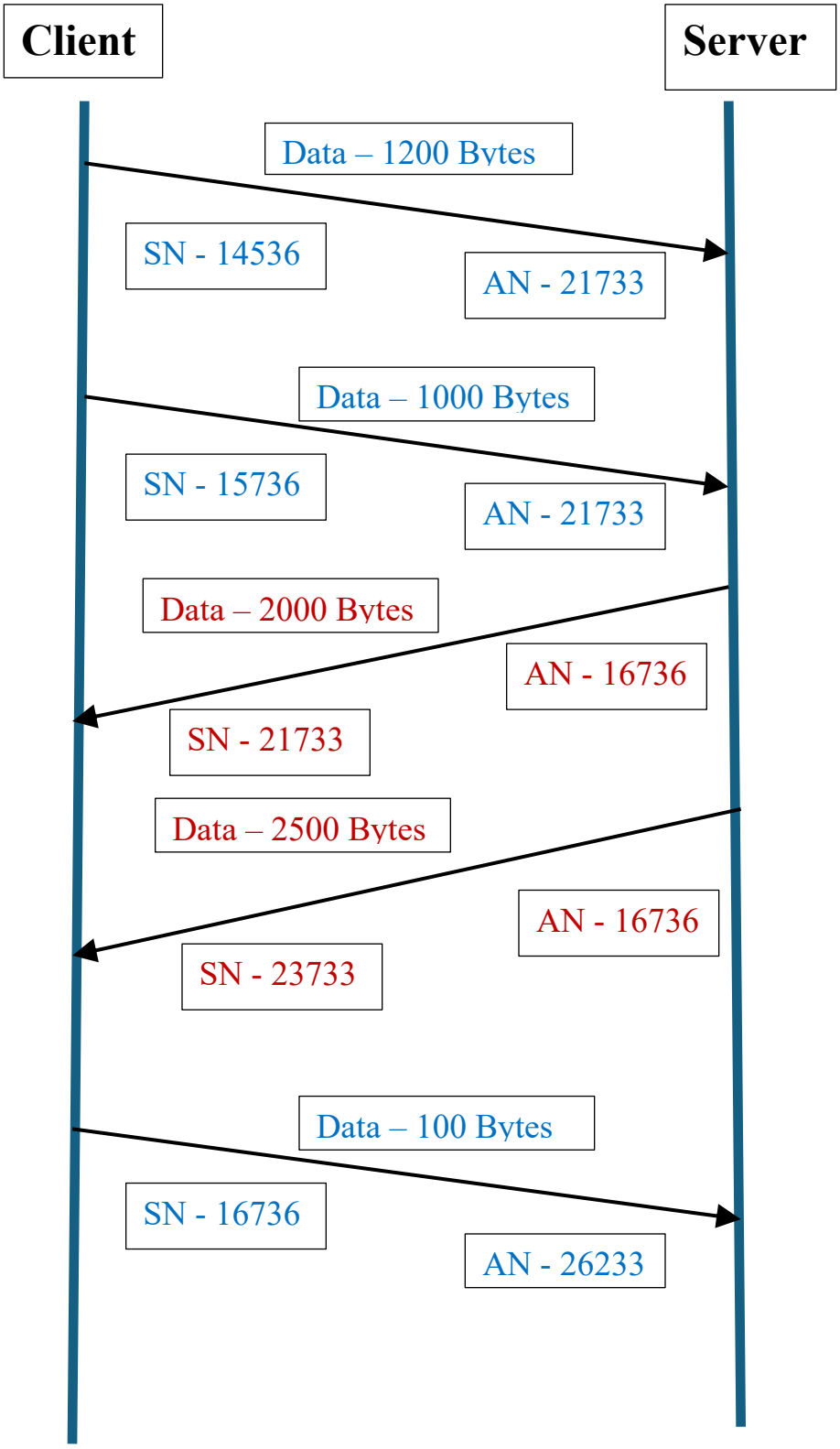
   a) IP address
   b) Host
   c) NIC
   d) Socket [IP Address : Port Number]

4. A TCP client opens a connection with a server using an initial sequence number (ISN) of 14534. The server opens the connection with an ISN of 21732. Show the three TCP segments during the connection establishment. State the sequence number and the acknowledgement number as well.

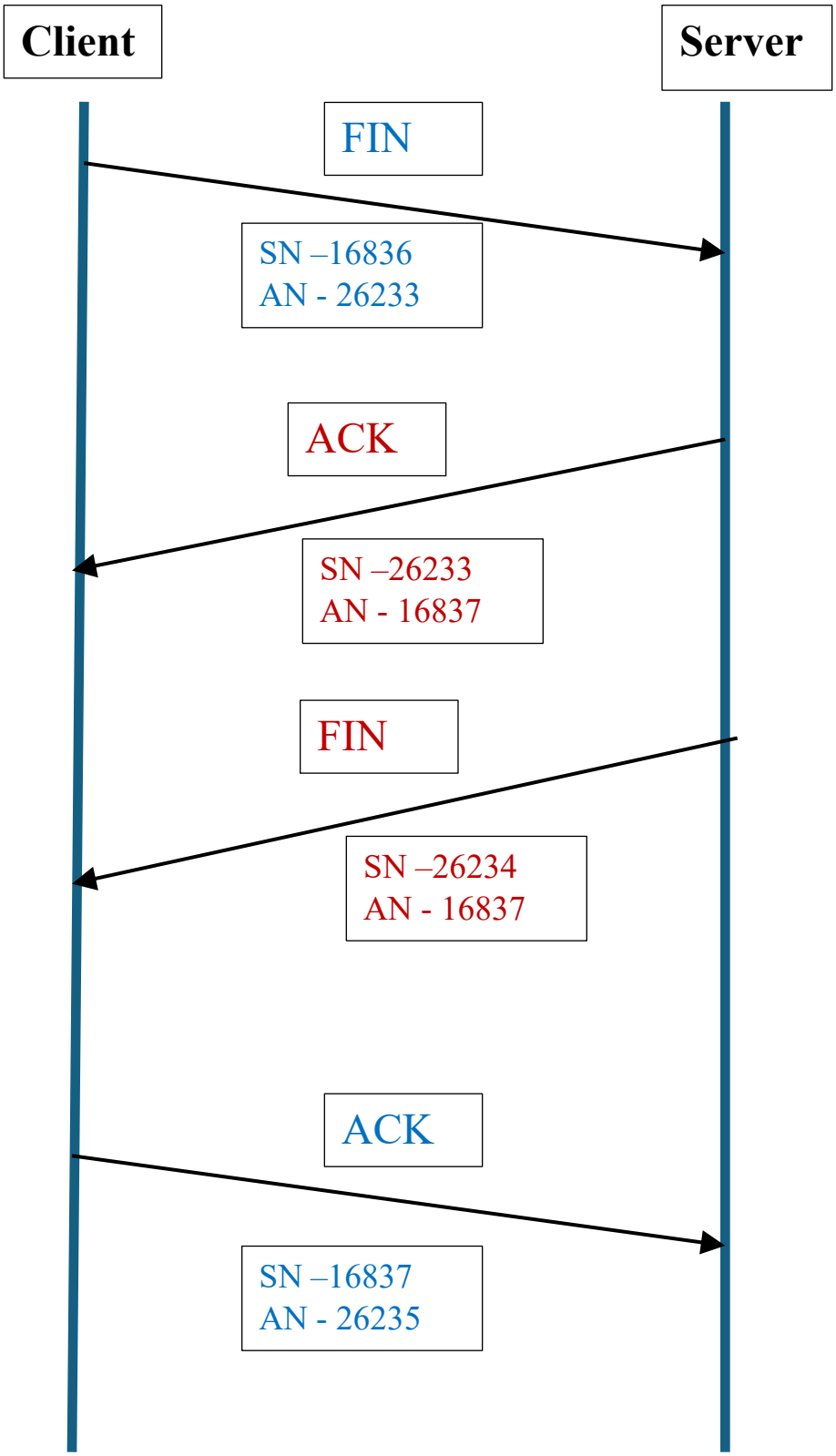


5. Following the previous exercise, show how the following segments are sent by the client and the server. State the sequence number and the acknowledgement number.

Client	Server
1200 Bytes	
1000 Bytes	
	2000 Bytes
	2500 Bytes
100 Bytes	



6. Following the previous exercise, show the segments transferred during the connection termination. State the sequence number and the acknowledgement number as well.



7. Following the previous exercise, assuming that the server is a Telnet server, show the entries for the header of the 'FIN' TCP segment that is transmitted from the client. Length of the TCP header is 32 Bytes. Fill the checksum field with 0s.

8. Is 'piggybacking' used in any of the segments transferred in question no.7, 8 or 9? Write the sequence numbers of the segments where piggybacking is used.

9. Which two fields are necessary to indicate that the data in a particular segment is urgent?
   a) Urgent flag
   b) Urgent pointer

10. Describe the Retransmission timer and the Keepalive timer.

11. TCP sends a segment at 5:30:20. It receives the acknowledgement at 5:30:25. What is the new value for RTT if the previous RTT was 4 seconds?

Setting RTT	=	0.9 * Previous RTT + 0.1 * Current RTT
	=	0.9 * 4 + 0.1 * (5:30:25 – 5:30:20)
	=	0.9 * 4 + 0.1 * 5
	=	3.6 + 0.5
	=	4.1 seconds

Retransmission Timer = 2 * RTT
= 2 * 4.1 seconds
= 8.2 seconds

12. A client uses, TCP to send data to a server. The data is 16 Bytes. Calculate the efficiency of transmission at the data link layer (ratio of useful bytes to total bytes). Assume no options for the IP header and use Ethernet at the data link layer.

Efficiency of transmission	=	useful bytes / total bytes
	=	16 / (16 + 20 + 20 + 26)
	=	16 / 82
	=	0.195

Note: 16 (actual data) + 20 (TCP header) + 20 (IP header) + 26 (Ethernet header and trailer)

13. A TCP connection is using a window size of 10000 bytes and the previous acknowledgement number was 22001. It receives a segment with acknowledge number 24001. Draw a diagram including the window size.

Current window size is 8000 bytes (10000 bytes – 2000 bytes)

14. What timer is used to handle the zero window-size advertisement? Explain.

15. Give an example to show how TCP overcomes the problems with corrupted segments, out-of-order segments and duplicate segments.

16. Show how a client process goes through the different states as it establishes a connection with a server and exchanges data from the start point.

17. Show how a server process goes through the different states as it establishes a connection with a client and exchanges data from the start point.

18. Show how a client process goes through the different states as it terminates the connection with a server.

19. Show how a server process goes through the different states as it terminates the connection with a client.