

College of Computer Sciences and Engineering

Information and Computer Science Department

ICS 343: Fundamentals of Computer Networks (3-3-4)

Quiz#2

Name:

ID:

Question 1 (UDP)

1.1. The Following is the content of a UDP header in hexadecimal format:

CB8400D001C001B

- a) [5 Points] What is the source port number? **CB84 in Hex**
- b) [5 Points] What is the destination port number? **000D**
- c) [5 Points] What is the total length of the user datagram in bytes?
001C = 28 Bytes
- d) [5 Points] What is the length of the data? **The length of the data is the total length of the user datagram minus the length of the header (Always 8 bytes). $28-8 = 20$ bytes**

Answer is provided in page 738 of the textbook.

1.2. [3x5 Points] Describe three typical applications that can benefit more from the services of UDP than from those of TCP.

Answer is provided in page 743 of the textbook under the subsection: *Typical Applications*

- 1.3. [5 Points] Compare between Connectionless and Connection-Oriented services in terms of delay/overhead while establishing a connection.

The overhead to establish a connection in connection-oriented services is higher than it is in connectionless services. More packets need to be exchanged in the former than the latter, resulting in more delay in connection-oriented services.

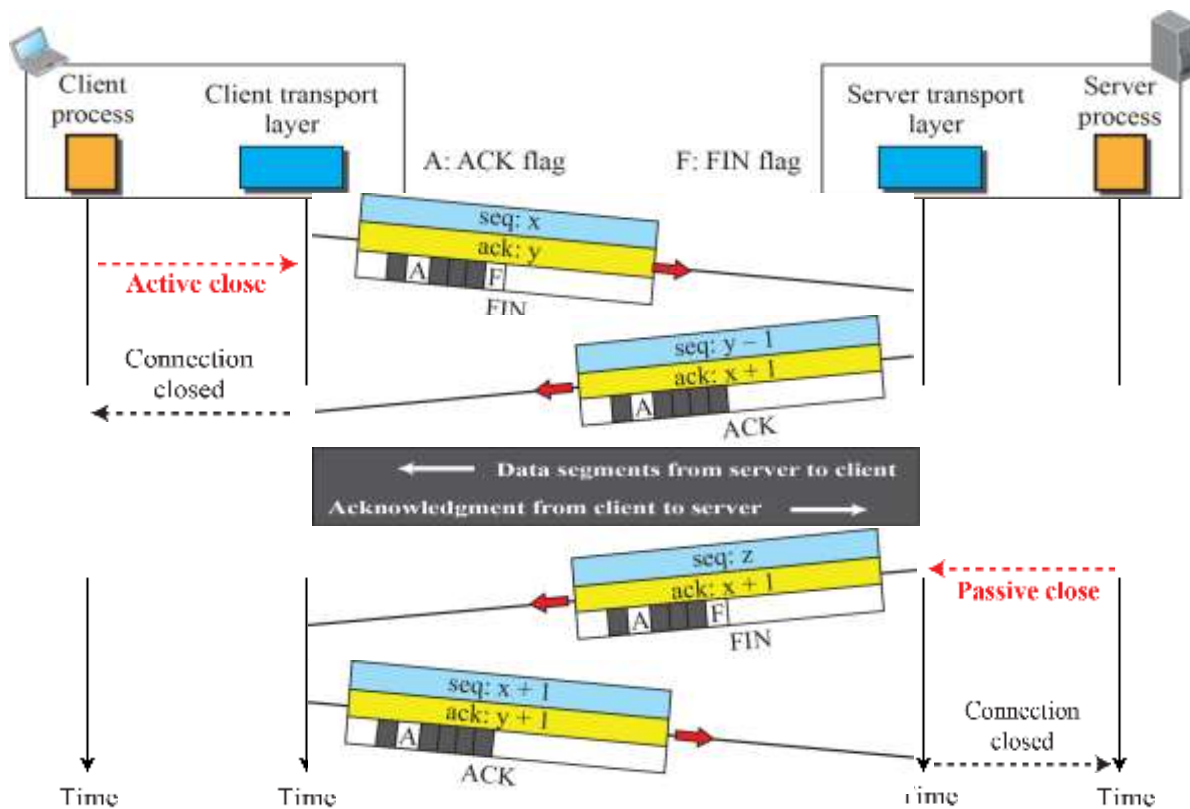
Answer is provided in page 741 of the textbook under the subsection: *UDP Features*

Question 2 (TCP)

2.1. In TCP; one option for connection termination is the four-way handshaking with **half-close** option.

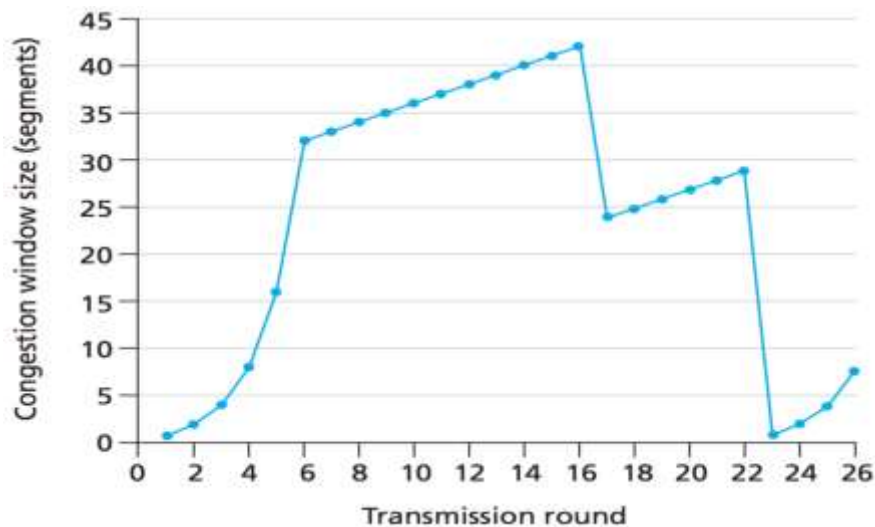
- a) [5 Points] Explain a scenario where this option is implemented.
- b) [10 Points] What segments are exchanged during this four-way procedure? show your answer on the figure below:

Half-close is explained in page 755 and Figure 24.13 of the textbook.



2.2. Assuming TCP Reno is the protocol experiencing the behavior shown below:

- [5 Points] Identify the intervals of time when TCP slow start (SS) is operating.
- [5 Points] Identify the intervals of time when TCP congestion avoidance (CA) is operating.
- [10 Points] After the 16th transmission round, is segment loss detected by a 3-duplicate ACK or by a timeout? Justify your answer.
- [10 Points] After the 22nd transmission round, is segment loss detected by a 3-duplicate ACK or by a timeout? Justify your answer.
- [10 Points] What is the initial value of **ssThreshold** at the first transmission round? Explain your answer.



- Rounds 1-6 and 23-26.**
- Rounds 6-16 and 17-22.**
- After the 16th transmission round, packet loss is recognized by a triple duplicate ACK. If there was a timeout, the *CWND* size would have dropped to 1 according to TCP Reno.**
- Timeout. Justification is similar to part (c)**
- The threshold is initially 32 (31, 33 and 34 are also accepted answers!)**

2.3. [5 Points] In TCP, if the value of HLEN is 0111, how many bytes of options are included in the segment?

Binary 0111 = 8. This means that the header length is $8 * 4 = 32$ bytes.

Since the minimum TCP Header Length (HLEN) is 20 Bytes, then the options = $32 - 20 = 12$ Bytes.

HLEN is explained in pages 748,749 and Figure 24.7 of the textbook.

2.4. [10 Points] According to TCP's Slow Start congestion control algorithm, Explain the meaning of and the inter-relation between the following terms:

- ~~MMS~~ MSS
- CWND
- SStresh

- **MSS is a value negotiated during the connection establishment.**
- **In Slow Start (SS), CWND starts always as 1 MSS in Bytes. But is incremented by 1 for each successful ACK (if ACK arrives, $CWND = CWND + 1$).**
- **This incrementation continues exponentially until CWND reaches the slow start threshold (SStresh), where the SS phase ends and TCP moves to Congestion Avoidance (CA) phase. Here: CWND size increases linearly by 1 for each (group) of successful ACKs.**
- **Also, if a Timeout or 3dupACK occurs during (SS), then new $SStresh = CWND/2$, and new $CWND = 1$.**

Answer is provided in page 778 of the textbook under the subsection: *Congestion Policies*