CS 3873: Net-Centric Computing

Assignment #: Assignment Title (if any) Total: 13.5

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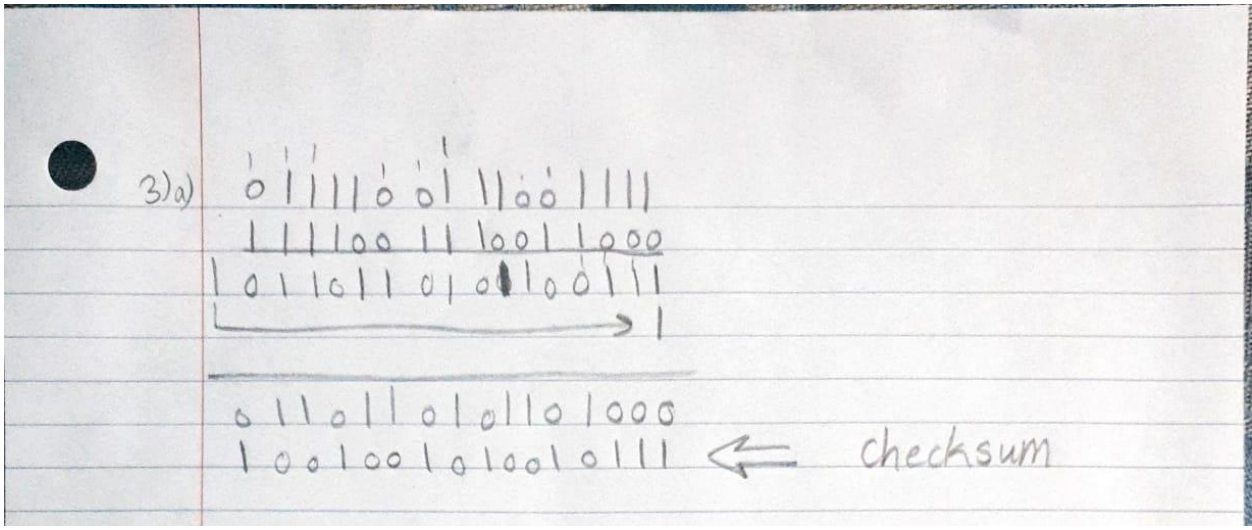
[Mandatory] Declaration: “I warrant that this is my own work.”

Signed by Mahmoud Moustafa

[Optional] “I hereby give my permission for this work to be used (with my name and identifying information removed) for UNB Faculty of Computer Science program accreditation purposes.”

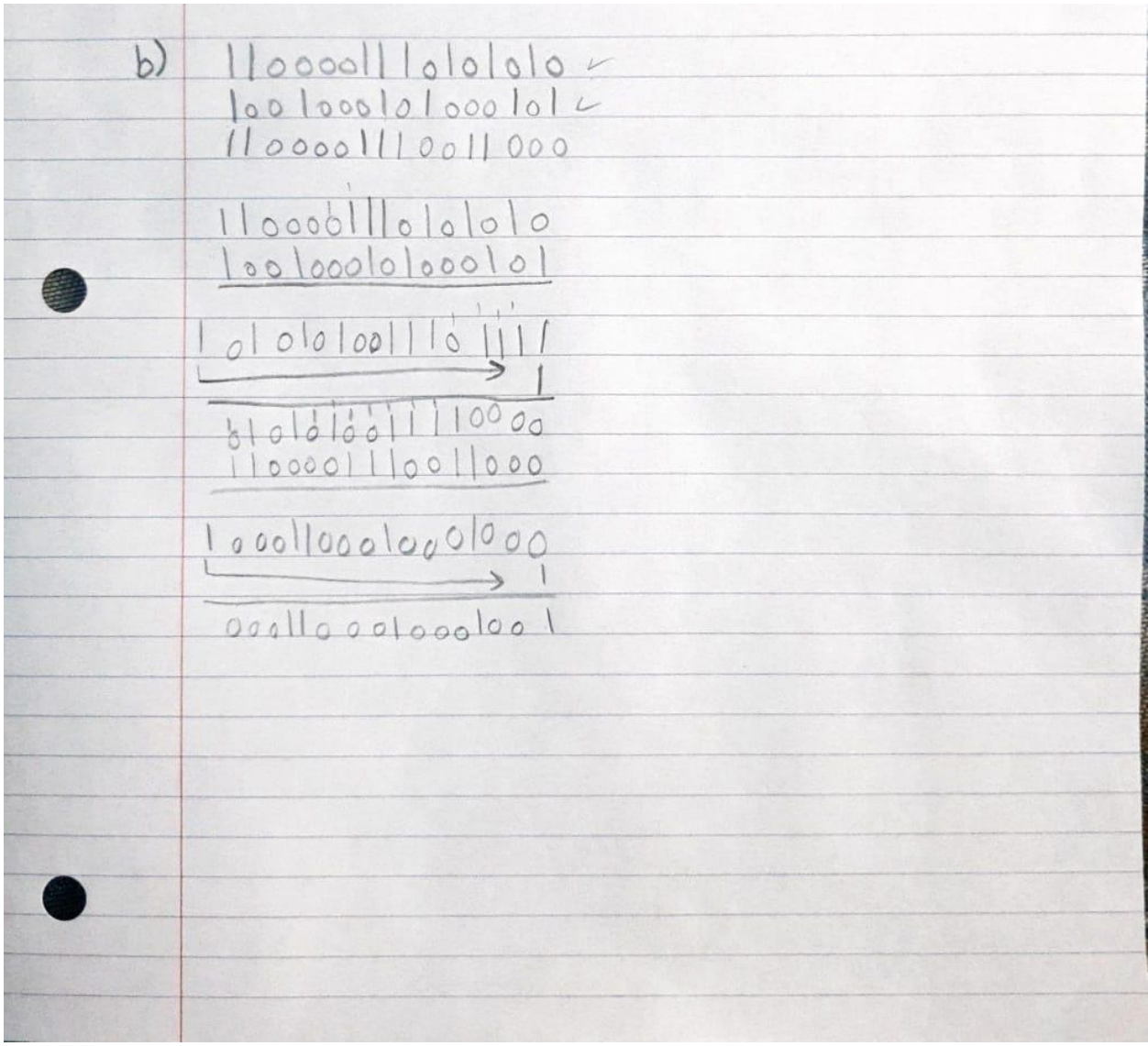
Signed by _____

1. (2 points) True or false?
    a. Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send to Host A. Host B will not send acknowledgements to Host A because Host B cannot piggyback the acknowledgements on data.
    Answer: False
    b. Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.
    Answer: True
    c. Suppose Host A is sending a large file to Host B over a TCP connection. If the sequence number for a segment of this connection is m, then the sequence number of the subsequent segment will necessarily be m+1.
    Answer: False
    d. Suppose that Host A sends one segment with sequence number 38 and 4 bytes of data over a TCP connection to Host B. In this same segment the acknowledgement number is not necessarily 42.
    Answer: False -0.5
2. (1 point) A process in Host C has a UDP socket with port number 5120. Host A and B each send a UDP segment to Host C with destination port number 5120. Will both of these segments be directed to the same socket at Host C? How will the process at Host C know that these two segments originated from two different hosts?
    Answer: Yes, they both will be directed to the same socket at Host C. The process at Host C know that these two segments originated from two different hosts using source IP addresses.
3. (5 points)
    a. Suppose you have the following packet with the bits: 01111001 11001111 and 11110011 10011000. What is the Internet checksum of this packet?
    Answer:



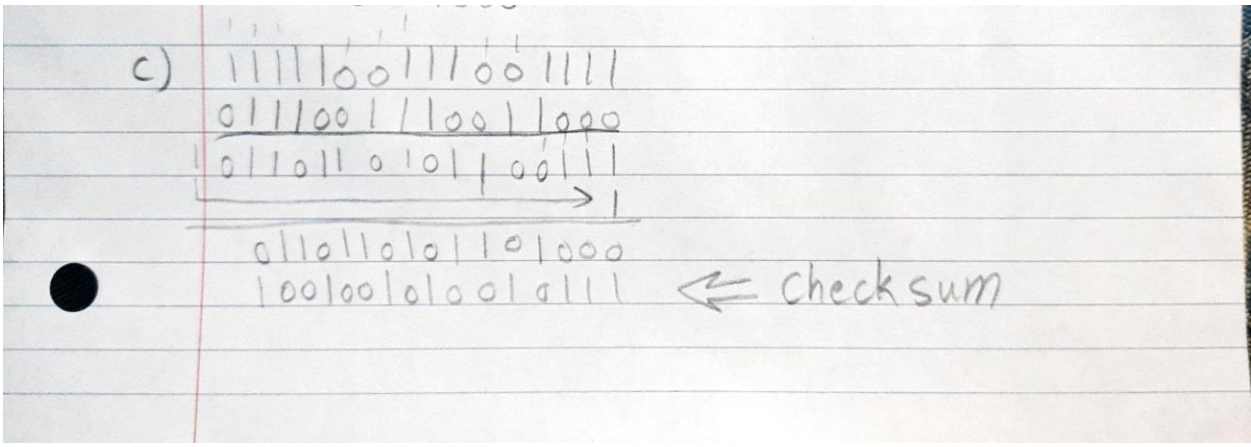
b. Suppose you have the following packet with the bits: 11000011 10101010, 10010001 01000101 and 11000011 10011000. What is the Internet checksum of this packet? -1: you need to flip all bits in the last step

Answer:



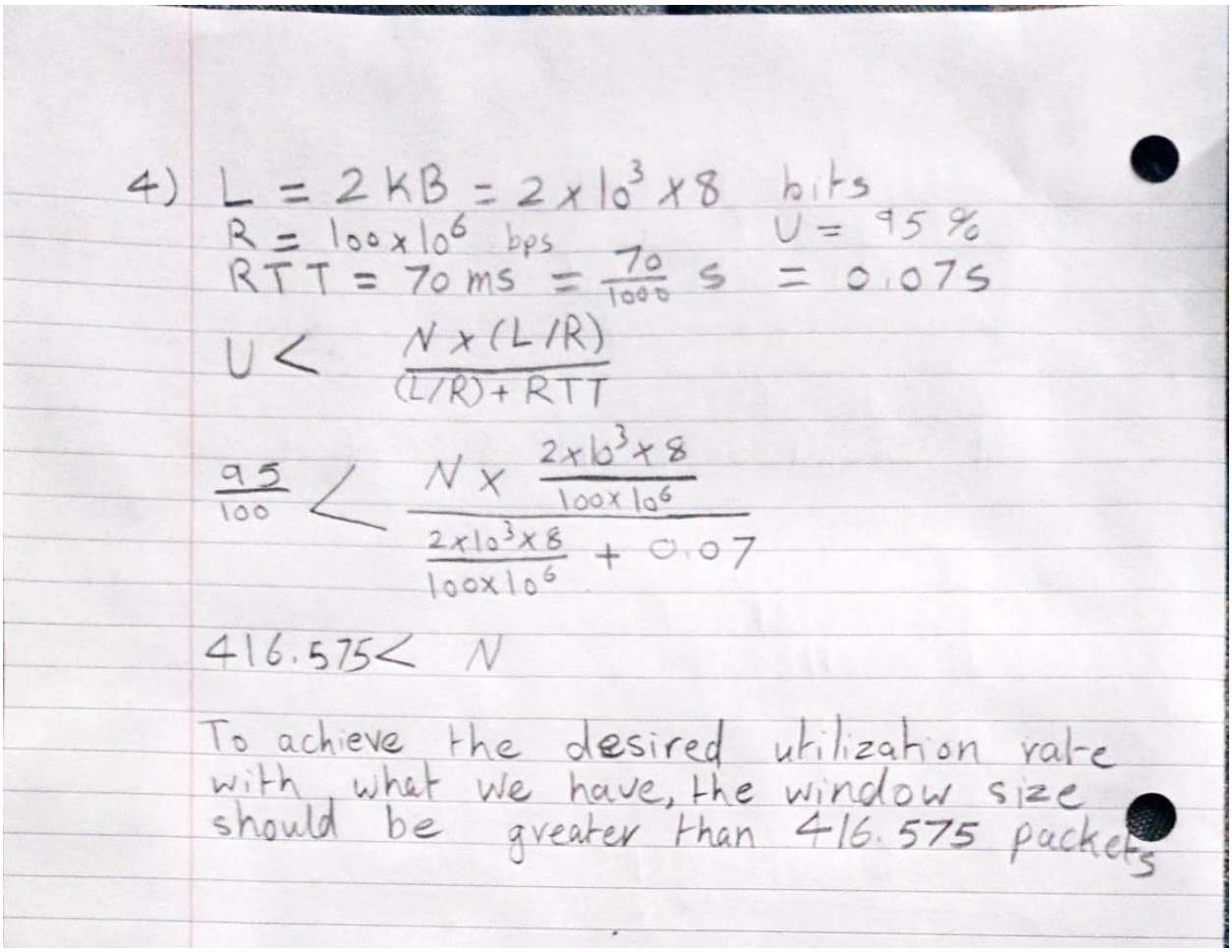
c. For the packet in a), give an example where one bit is flipped in each of the two 16-bit words and yet the checksum doesn't change.

Answer: The first bit on the left (in this example)



4. (2 points) Consider a cross-country example where a host in East Coast is connected with another host in West Coast by a channel with a transmission rate of 100 Mbps. The round-trip delay between these two end systems is approximately 70 ms. How big could the window size have to be for the utilization over this channel to be greater than 95%? Suppose that the size of a packet is 2 KB, including both header fields and data.

   Answer



5. (3 points) Suppose that three measured SampleRTT values (see Section 3.5.3) are 110 ms, 120 ms, and 90 ms. Compute the EstimatedRTT after each of these SampleRTT values is obtained, using a value of $\alpha = 0.125$ and assuming that the value of EstimatedRTT was 100 ms just before the first sample was obtained. Compute also the DevRTT after each sample is obtained, assuming a value of $\beta = 0.25$ and assuming the value of DevRTT was 5 ms just before the first sample was obtained. Last, compute the TCP TimeoutInterval after each of these samples is obtained.
   Answer:

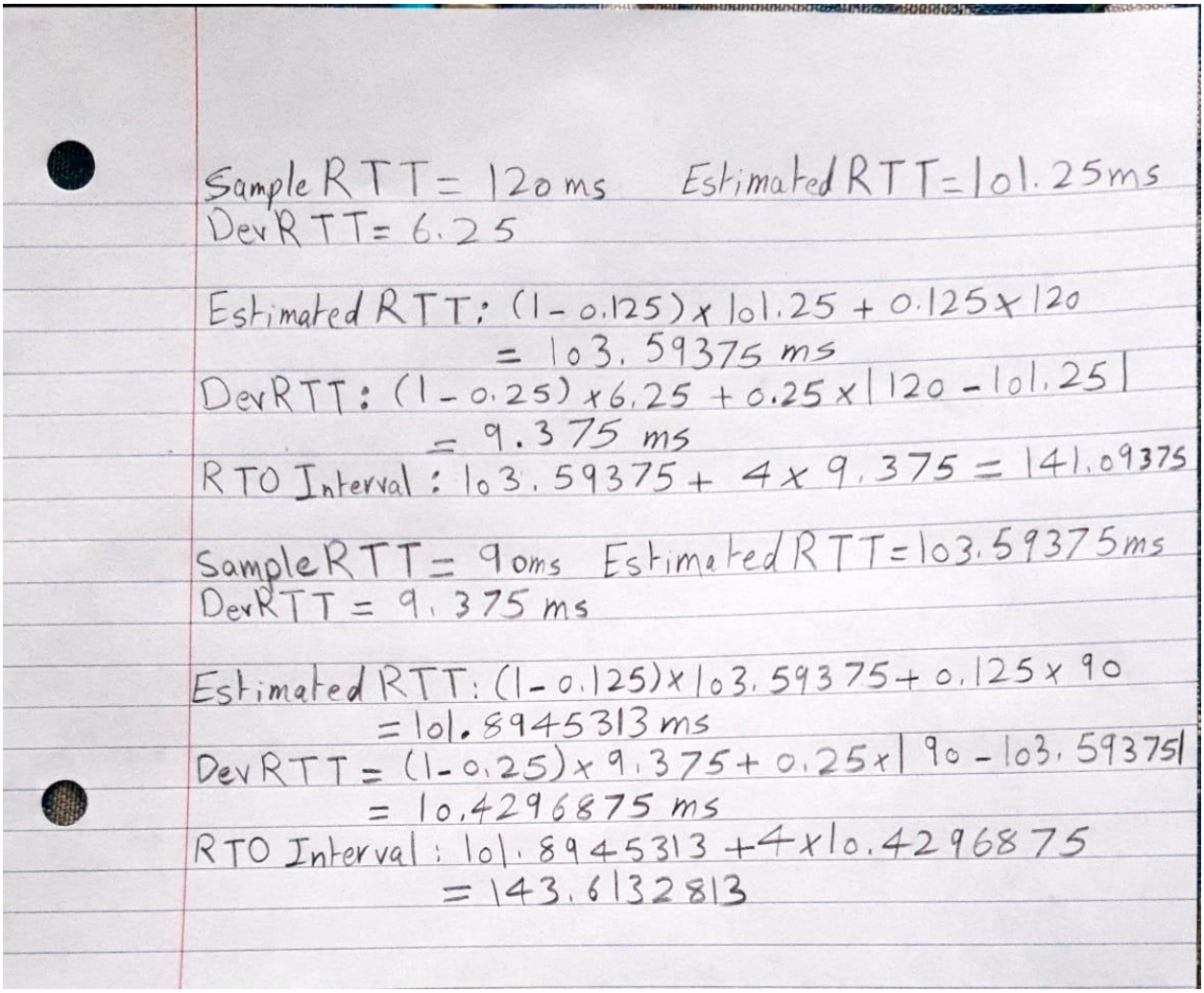
5) $\alpha = 0.125$ $\beta = 0.25$ SampleRTT = 110 ms
Estimated RTT = 100 ms DevRTT = 5 ms
Time Out Interval = $100 + 4 \times 5 = 120$ ms
Estimated RTT $\leftarrow (1-\alpha) \times$ Estimated RTT $+ \alpha \times$ SampleRTT
DevRTT $\leftarrow (1-\beta) \times$ DevRTT $+ \beta \times |$SampleRTT $-$ Estimated RTT$|$

TCP Timeout Interval = Estimated RTT + 4 x DevRTT

Estimated RTT: $(1-0.125) \times 100 + 0.125 \times 110 = 101.25$ ms

DevRTT: $(1-0.25) \times 5 + 0.25 \times |110 - 100| = 6.25$ ms

Timeout Interval = $101.25 + 4 \times 6.25 = 126.25$



6. (2 points) Host A and B are communicating over a TCP connection, and host B has already received from A all bytes up through byte #126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgement whenever it receives a segment from Host A.
    a. In the second segment sent from A to B, what are the sequence number, the source port number, and the destination port number?
    Answer: Sequence number = 127+80 = 207, source port number = 302, destination port number = 80.
    b. If the first segment arrives before the second segment, in the acknowledgement of the first arriving segment, what are the acknowledgement number, the source port number, and the destination port number?
    Answer: Acknowledgement number = 207, source port number = 80 , destination port number = 302

c. If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, what is the acknowledgement number?
Answer: 127

d. Suppose the two segments sent by A arrive in order at B. The 1st acknowledgement is lost and the 2nd acknowledgement arrives after the 1st timeout interval. Draw a timing diagram showing these segments and all other segments and acknowledgements sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgement that you add, provide the acknowledgement number.
Answer: