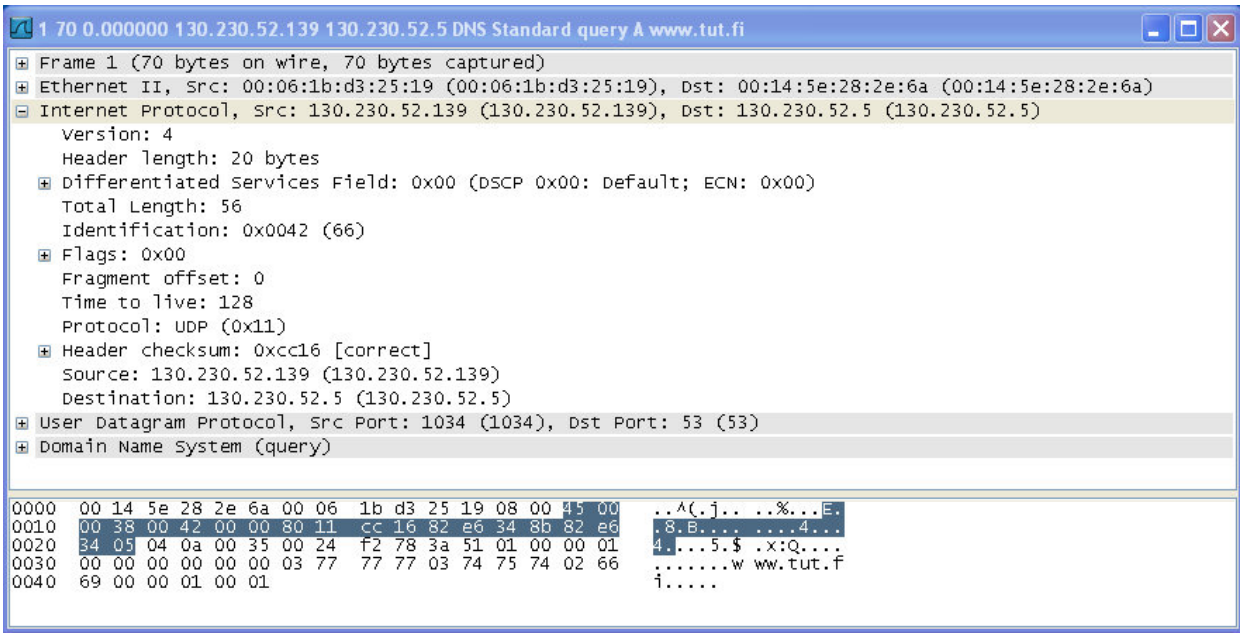
Error detection - the IP header checksum algorithm

The exercise to perform

Print out this worksheet. It can be applied to any IP packet to assist manual emulation of the header checksum calculation, just as IP itself would perform it. Apply the worksheet to the second packet in the "dns.pcap" file. ~~It came from Roman Dunaytsev on his website. The site is excellent.~~ There, take a quick look in particular at the "Teaching" link generally. dns.pcap is available within this zip file.

dns.pcap is a Wireshark trace file containing 2 packets (a dns request/reply sequence). Below the exercise has been performed on the first packet, to serve as a model for your applying it to the second. Here's the first packet:



Here is the checksum exercise performed for this packet:

	all the 16-bit words in the header	cumulative 1's complement sum	
R1	4500	4500	
R2	0038	4538	
R3	0042	457A	
R4	0000	457A	
R5	8011	C58B	
R6	~~CC16~~ 0000	C58B	
R7	82E6	14871 -> 4872	
R8	348B	7CFD	
R9	82E6	FFE3	1's complement of result
R10	3405	133E8 -> 33E9	CC16
	C1	C2	C3

After printing out the worksheet, fill in its blanks with values from the second packet so as to derive the checksum for the second packet. (Get the second packet's contents by viewing the packet in Wireshark.) You may wish to use a hexadecimal calculator, such as the calculator accessory found in Windows (switch it into "Scientific" mode via the "View" menu in order to surface its hexadecimal capability). Remember that IP uses one's complement addition, where if a sum entails a carry outside the width of the values being summed the carried 1 is not discarded but added back into the remaining digits of the sum. For example above, 3405 was added to FFE3, yielding 133E8. The 1 that was carried outside the 4-digit width is added back into the remaining digits, 33E8, so 33E9 becomes the sum.

Submit your answers to the questions below following these preparation and submittal instructions (you will use ftp to deposit your answer file in your "assignments" subdirectory on the server.). **Please name your file "error.txt".** I will grade these using an automated script, so the format of the answer is critical to intelligibility, as is the case (lower) of the filename

Answer these questions:

1. The number of occasions in the calculation process where there is a "carry" and resultant 1's-complement carry-bit add-back is:
a. 1
b. 2
c. 3
d. 4
e. 5

2. The value calculated in cell R4/C2 is:
a. 4548
b. 0000
c. A204
d. 2216
e. D901
f. A4FC

3. The value calculated in cell R5/C2 is:
a. 4548
b. 0000
c. A204
d. 2216
e. D901
f. A4FC

4. The value calculated in cell R6/C2 is:
a. 4548
b. 0000
c. A204
d. 2216
e. D901
f. A4FC

5. The value calculated in cell R7/C2 is:
a. 4548
b. 0000
c. A204
d. 2216
e. D901
f. A4FC

6. The value calculated in cell R8/C2 is:
a. 4548
b. 0000
c. A204
d. 2216
e. D901
f. A4FC