

## CS 542 – Computer Networks I – Fundamentals

### Fall 2020 – Homework 2 – 50 points

#### Submission guidelines:

- **Due date: Sunday, December 6<sup>th</sup>, 11:59 PM**
- Late submissions will **NOT** be accepted.
- Teamwork is allowed (max 3 students / team). Individual submissions are also OK
- **One submission per team only.**
- Please put down **your name, student ID on the front page**. If it is a team submission, put all student details.
- Submit soft copies in Blackboard. Electronic typed copies are only allowed. Not scanned copies of handwritten submissions are allowed.
- Submit **only PDF format** files. The doc format is not accepted.
- **Show the complete step by step solution for full credits. If there is no proper explanation and justification to your final answer, only partial credits are given, even though your answer is correct.**
- Please contact **Viswatej Kasapu (vkasapu@hawk.iit.edu)** if something is not clear but do **NOT** send partial solutions with inquiries "Is that what you expect?" This is a HW and your self-sufficiency is also a grading criterion.
- Please make sure you follow all the submission guidelines. **Submissions that does not follow above guidelines are given 0 points.** (Like if you submit doc format file, even your solutions are correct, you will be awarded 0 points)

1. Consider the following details of three hosts and a router with proxy ARP for them.

Node	IP Address	Physical Address
Host A	130.15.40.15	AA223344BB12
Host B	130.15.40.16	AA223344BB34
Host C	130.15.40.17	AA223344BB56
Router	130.15.40.18	AA223344BB78

Router received an ARP request for host B from a host (IP address: 115.8.9.56, Physical address: 346738ABCDE0). Give the ARP request and reply packet format filled with all necessary fields. (Consider the Ethernet as hardware type and IPv4 as protocol type) **(6 points)**

2. The sender A (IP address: 141.23.56.21, Physical address: A46EF45983AB) is a host and wants to send a packet to another host B (IP address: 114.5.7.89, Physical address: 457342ACAE32) on another network. The next-hop (router) for this destination in the sender's routing table is Router R1 (IP address: 141.23.56.24, Physical address: A46EF45983DE). Give me the ARP request packet format filled with all necessary fields

from sender A. (Consider the Ethernet as hardware type and IPv4 as protocol type) **(3 points)**

3. Consider a network where the hardware address length is 6 bytes, and the protocol address length is 4 bytes. A node in this network received an ARP packet where all bits from 145th to 192nd are 0s. Is that ARP packet a request or a reply? Explain your answer. **(2 points)**
4. In the ARP package, when a queue is created and packed is enqueued in it? **(2 points)**
5. Consider the updated cache table. After 110 seconds, the input module receives two ARP packets. These are the only two packets host received in the last 110 seconds. Give the updated cache table after these packets. Support your answer with an explanation. (Consider cache table is updated every 10 seconds). **(4 points)**

Packets received:

- An ARP reply from the host with IP address 19.1.7.82 and Physical address 4573E3242ACA
- An ARP reply from the host with IP address 220.55.5.7 and Physical address A46EF45983BC

<i>State</i>	<i>Queue</i>	<i>Attempt</i>	<i>Time-Out</i>	<i>Protocol Addr.</i>	<i>Hardware Addr.</i>
R	5		900	180.3.6.1	ACAE32457342
P	2	2		129.34.4.8	
P	14	5		201.11.56.7	
R	8		450	114.5.7.89	457342ACAE32
P	12	1		220.55.5.7	
F					
R	9		60	19.1.7.82	4573E3242ACA
P	18	3		188.11.8.71	

6. In an IP packet, the value of HLEN is 1110 in binary, and the value of the total length is 0000000110000000. How many bytes of data is this packet carrying? **(2 points)**
7. The total IP datagram length is 200 bytes, out of which the HLEN value is 1111, and the size of options in the header is 30 bytes. Is this example a valid datagram or not? Give your supporting reasons. **(3 points)**
8. A fragment has arrived with the first few hexadecimal digits, as shown below:

4500282800012367.....

This is the second fragment. How many bytes of data does this fragment contain? What is the third fragment offset? **(4 points)**

9. A packet has arrived with a D bit value of 0 and an M bit value of 0, and fragmentation offset value to zero. Is this packet the first fragment, last fragment, middle fragment, or the only fragment? **(2 points)**
10. An IP packet has arrived with the first few hexadecimal digits, as shown below:

460000400001000023.....

The initial 'Time to Live' value in the hexadecimal format is AB. How many hops have this packet already traveled? How many hops can this packet before being dropped? **(3 points)**

11. When Fragmentation Module sends an 'ICMP' error message in an IP package? **(2 points)**
12. The IP datagram was fragmented. The first fragment contains bytes 0 to 399. The total amount of data(not including the header) in the datagram is 2500 bytes. Each fragment has only a base header. How many fragments are needed to send this datagram? **(3 points)**
13. A client has received a UDP datagram. The corresponding port number has been found in the control block table but there is no queue number. Is it possible? Why? **(2 points)**
14. The TCP sliding window values of rwnd and cwnd are 16 and 10, respectively. The previous acknowledgment number was 203. A segment with the acknowledgment number 207 and the rwnd of 8 has just been received. Draw a diagram showing the window before and after. Assume that the cwnd hasn't changed. **(4 points)**
15. Given the following TCP header dump in the hexadecimal format, give your answers in the decimal format. **(5 points)**

02950071 00000001 00000000 500209AB 00000000

- (i) What is the source port number?
- (ii) What is the sequence number?
- (iii) What is the header length?
- (iv) Which bits are set in the control field and what does it mean?
- (v) What is the window size?

16. The UDP header in the hexadecimal format is 0913 000D 00AE E247. **(3 points)**
- i) What is the source port number?
- ii) What is the destination port number?
- iii) What is the total length of the user datagram?