

## Problem 1

Below is an IP packet captured by Wireshark. Bytes are shown in HEX mode, grouped by 4 HEX digits. We know that this packet is using IPv4 with no option field.

```
-- 00 00 1e
a7 f8 00 00
ff 11 -- --
ac 1f 09 ee
80 61 80 01
d4 2d 00 35
00 0a -- --
61 61
```

1. What should be the HEX value for the first blank (line 1)?
2. What should be the HEX value for the second blank (two HEX digits, line 3)?
3. What should be the HEX value for the third blank (two HEX digits, line 7)?
4. What is the transport layer protocol carried in this IP packet? How do you know that?
5. What is the payload carried in the transport layer protocol you identified?

Write your solution to Problem 1 in this box

1. Version = 4

IHL = 5

answer = 45

2.  $(0400) + (001e) + (a7f8) + (0000) + (ff11) = (1ab27)$

$(0001) + (ab27) = a299$

$ab28 = 1010\ 1011\ 0010\ 1000$

$\sim ab28 = 0101\ 0100\ 1101\ 0111 = 5d\ 66$

answer = 5d 66

3. Pseudo Header + UDP header + UDP data =

$ac1f + 09ee + 8061 + 8001 + 0011 + 000a = 0xec59$

$\sim 0xec59 = 13\ a6$

4. The transport layer protocol is UDP. Line 3, the second 8bit HEX word (11) signifies protocol. 11 is for UDP, 06 for TCP.

5. Payload = 61 61 = a a in ASCII

## Problem 2

Assume that the pipeline sizes for the Go-back-N and TCP (no delayed ACKs) protocols are large enough such that 5 consecutive data segments and their corresponding ACKs can be received (if not lost in the channel) by the receiving host (Host B) and the sending host (Host A) respectively. Suppose Host A sends 5 data segments to Host B, and the 2nd segment (sent from A) is lost. This loss is then detected by the protocol-specific means and the protocol invokes recovery actions. In the end, all 5 data segments are correctly received by Host B.

1. In case of Go-back-N, how many segments has Host A sent in total and how many ACKs has Host B sent in total?
2. In case of TCP (no delayed ACKs), how many segments has Host A sent in total and how many ACKs has Host B sent in total?
3. If the timeout value happen to be set to 10 RTT, which of the protocol successfully delivers all five data segments in shortest time interval and give estimate of this time?

Write your solution to Problem 2 in this box

1. A sends 9 segments - 1,2,3,4,5,2,3,4,5

B sends 8 ACKS - 1,1,1,1,2,3,4,5

2. A sends 6 segments - 1,2,3,4,5,2

B sends 5 ACKS - 2,2,2,2,6

3. TCP. Total Time = 3RTT

### Problem 3

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 acknowledgment whenever it receives a segment from Host A.

- In the second segment sent from Host A to B, what are the sequence number, source port number, and destination port number?
- If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?
- If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?

Write your solution to Problem 3 in this box

**1. Sequence number = 207**

**Port Number = 302**

**Destination Port Number = 80**

**2. Acknowledgement Number = 207**

**Source Port Number = 80**

**Destination Port Number = 302**

**3. Acknowledgment Number = 127**

## Problem 4

What are the three charms in *Harry Potter* that corresponds to our three project names? What are their effects, respectively?

1. Accio (Project 1)
2. Confundo (Project 2)
3. Riddikulus (Project 3)

Write your solution to Problem 4 in this box

1. Brings an object pointed at by the wand to you
2. Confuse person and bewitch an object
3. used to banish Boggarts. . It causes the creature to change into a form the user considers hilarious since Boggarts are defeated by laughter. It makes a noise like a whipcrack.