# CSc 361: Computer Communication and Networks (10:30-11:20 am, Nov 10, 2023)

Midterm Exam 2

Name: Student ID:

Closed-book exam. Nevertheless, a letter-sized, double-sided cheat sheet is allowed. Please read all questions [marks] on all the **three** pages first. **Duration: 50 minutes**

1. Please answer if the following statements are true or false. **Just answer true or false.**

F (a) In Classless InterDomain Routing (CIDR), the subnet portion of an IP address must be no longer than 24 bits, because the host portion of an IP address needs at least 8 bits. [3]

F (b) The minimum length of an IP header is 20 bytes, but the maximum length of an IP header can be 65,535 bytes depending on the size of its options. [3]

T (c) Assume that a client is communicating with a server and we capture the traffic at the client with Wireshark. Using the captured traffic, we cannot estimate the server-client-server round-trip time. [3]

F (d) In link state routing, a router periodically exchanges link state packets (LSP) with its neighbouring routers. [3]

F (e) At the network layer, an intermediate router should reassemble fragments if the MTU of the router's next-hop link is big enough.[3]

F (f) At the network layer, the functions of the control plane and the functions of the data plane must be implemented at the same router. [3]

T (g) The CIDR notation cannot be used directly in the destination IP address field of an IP header. [3]

F (h) Assume that a client is assigned a private IP and a server is assigned a public IP. The path from the client to the server cannot include two NAT devices, because otherwise the server cannot send datagrams back to the client. [3]

2. Assume that the host 10.0.0.1 behind a NAT tries to establish a TCP connection to a remote host 128.119.40.186, as shown in the following figure.

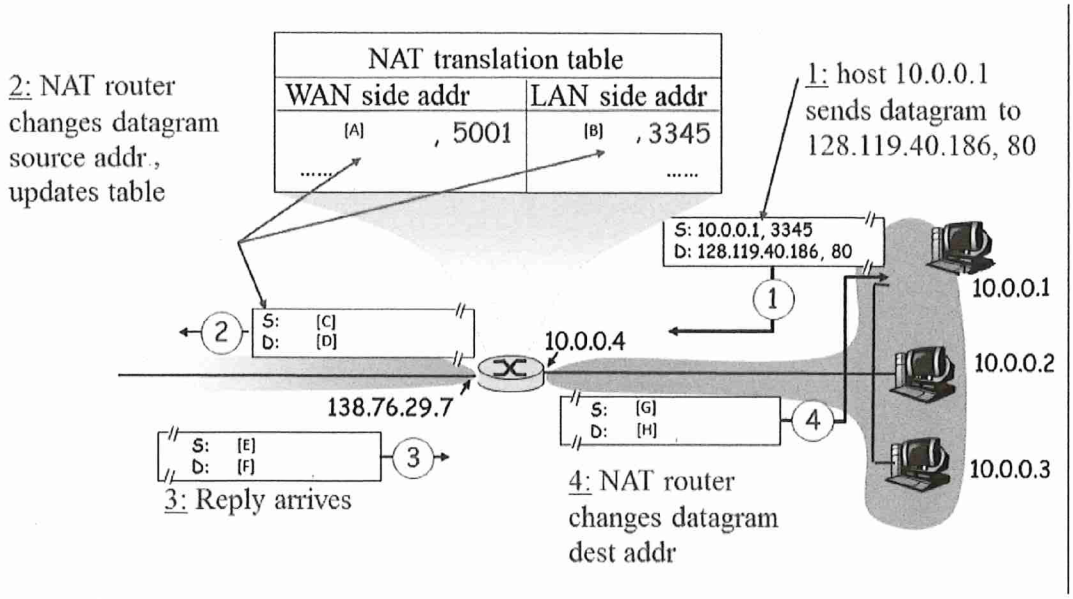


Figure 1: NAT

Fill the IP addresses in the places marked with [A] and [B]. Fill the IP addresses and the port numbers in the places marked with [C], [D], [E], [F], [G], [H]. [30]

[A] (IP address) [3]: 138.76.29.7

[B] (IP address) [3]: 10.0.0.1

[C] (IP address, port number) [4]: 138.76.29.7, 5001

[D] (IP address, port number) [4]: 128.119.40.186, 80

[E] (IP address, port number) [4]: 128.119.40.186, 80

[F] (IP address, port number) [4]: 138.76.29.7, 5001

[G] (IP address, port number) [4]: 128.119.40.186, 80

[H] (IP address, port number) [4]: 10.0.0.1, 3345

3. The following question is on how TCP estimates RTT and DevRTT. Suppose that two sequentially measured *SampleRTT* values are 108 *ms* and 122 *ms*, respectively. Use $\alpha = 0.6$ and $\beta = 0.6$. Assume that the value of *EstimatedRTT* was 103 *ms* just before the first of these samples was obtained. Assume that the value of *DevRTT* was 6 ms just before the first of these samples was obtained. In each of the following blanks, **only an integer number is allowed.** Round to the nearest integer (e.g., 4.5 is rounded to 5, 4.4 is rounded to 4). **For each question below, use the integer value in the first blank when you calculate the value in the second blank.** [20]

- After the first *SampleRTT* value is obtained, the value of *EstimatedRTT* is updated to ( 106 ) *ms*. After the second *SampleRTT* value is obtained, the value of *EstimatedRTT* is updated to ( 116 ) *ms*.

$0.6 * 108 + 0.4 * 103 = 106$

$0.6 * 122 + 0.4 * 106 = 116$

- After the first *SampleRTT* value is obtained, the value of *DevRTT* is updated to ( 5 ) *ms*. After the second *SampleRTT* value is obtained, the value of *DevRTT* is updated to ( 12 ) *ms*.

$0.6 * |108-103| + 0.4 * 6 = 5$

$0.6 * |122-106| + 0.4 * 5 = 12$

4. Suppose that Host A is connected to a router R1, and R1 is connected to Host B. Suppose that a payload (payload from the viewpoint of the IP layer) of 1300 byes is passed to the IP layer at Host A for delivery to Host B. Assume that the size of the IP header is 20 bytes. Assume that the MTU of the link between Host A and R1 is 800 bytes, and the MTU of the link between R1 and Host B is 1500 bytes. Clearly, this datagram needs to be fragmented in order to deliver over the link between Host A and R1. Show the total length field, the MF field, and the Fragment offset field of the IP header of the packets transmitted over the link between Host A and R1. [18]

Table 1: Fragmentation

| Fragment # | Total Length | MF | Fragment Offset |
|---|---|---|---|
| First | 796 | 1 | 0 |
| Second | 544 | 0 | 97 |

5. The following figure shows a scenario where a TCP connection recovers from an old duplicate SYN. What are the two errors in this figure? [8]

```
    TCP A                                                TCP B
1.  CLOSED                                               LISTEN
2.  SYN-SENT    --> <SEQ=100><CTL=SYN>                    ...
3.  (duplicate) ... <SEQ=90><CTL=SYN>                    --> SYN-RECEIVED
4.  SYN-SENT    <-- <SEQ=300><ACK=91><CTL=SYN,ACK>       <-- SYN-RECEIVED
5.  SYN-SENT    --> <SEQ=91><CTL=RST>                    --> SYN-RECEIVED

6.              ... <SEQ=100><CTL=SYN>                   --> SYN-RECEIVED
7.  SYN-SENT    <-- <SEQ=400><ACK=101><CTL=SYN,ACK>      <-- SYN-RECEIVED
8.  ESTABLISHED --> <SEQ=101><ACK=400><CTL=ACK>          --> ESTABLISHED
```

LISTEN

ACK=401

Figure 2: Recovery from old duplicate SYN.