CSC 361: Computer Communication and Networks

(Spring 2016, April 1, 2016)

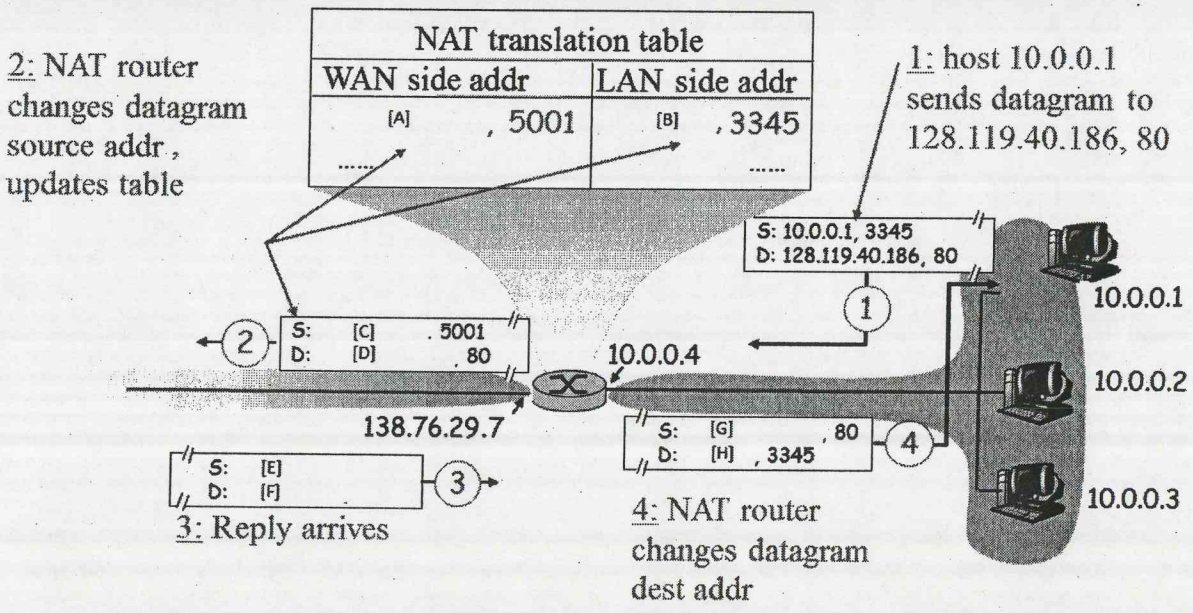
Exam 3

Student Name:
Student ID:

Closed-book exam. A calculator without any communication function is allowed. Please read all questions [marks] on all the **three** pages first. **Duration: 50 minutes**

1. 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. Fill the IP addresses in the places marked with [A], [B], [C], [D], [E], [F], [G], [H], respectively. **[4]**

[A]: 138.76.29.7
[B]: 10.0.0.1
[C]: 138.76.29.7
[D]: 128.119.40.186
[E]: 128.119.40.186
[F]: 138.76.29.7
[G]: 128.119.40.186
[H]: 10.0.0.1



2. Assume that on a 5 Mbps Ethernet, the cable length is 300 meters. Assume that the signal propagation speed is 2*10^8 meters per second. What is the minimum frame length (rounded up to a power of 2)? Show your calculation steps **[2]**

$$\frac{\text{length of frame}}{\text{transmission speed}} \geq 2 \cdot \frac{\text{length of cable}}{\text{propagation speed}}$$

$$\text{length of frame} \geq 2 * \frac{300\,m}{2 \times 10^8\,m/s} \cdot 5 \times 10^6\,b/s$$

$$\geq 15 \text{ bits} \quad \text{round up} \quad 16 \text{ bits}$$

[Note that the above calculation has only theoretical meaning]

3. On a 10 Mbps Ethernet, what is the maximum frame rate for 512 byte frames? Show your calculation steps. Hint: you need to consider the 8-byte preamble and the inter-frame-gap (IFG) equivalent to 12 Bytes. **[2]**

8B + 12B + 512B = 532B per frame = 4256 b/f

preamble IFG Frame

$$\frac{10 \times 10^6\,\frac{b}{s}}{4256\,b/f} = 2349.6\,f/s$$

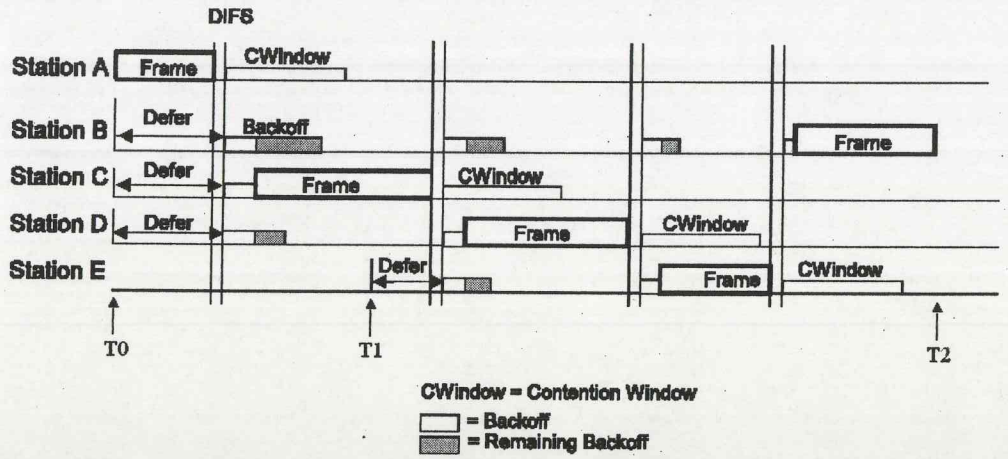
4. Suppose that R is the maximum rate, in frames per second, for Ethernet frames of size N bytes ($64 \leq N \leq 759$). Consider the maximum rate R', in frames per second, for frames of size 2N. Is R' less than, equal to, or greater than R/2? **[3]**

Circle only one: Less than **Equal to** **Greater Than**

Note:

Because each frame requires a preamble & an IFG, sending a pair of N-byte frames requires 20 bytes more than for a single 2N-byte frame. Thus, R' is larger than $R/2$.

5. In the following example of the DCF operation of IEEE 802.11, calculate the throughput of the network during the period of time between T0 to T2. Assume that the size of the frames is the same: 2000 bits. Assume that the channel speed is 2 Mbps. Assume that DIFS is equal to 5 μs. Assume that the initial backoff values of stations B, C, D are 100 μs, 50 μs, 70 μs respectively. Assume that the backoff value of station E at point T1 is 40 μs. Hint: throughput = (total number bits in the frames transmitted from T0 to T2) / (the duration from T0 to T2) **[4]**



Time for sending a Frame:

$$\frac{2000\ b}{2 \times 10^6\ b/s} = 1000\ \mu s$$

The duration time from T_0 to T_2:

$5 \times 1000\ \mu s + 100\ \mu s + 4 * DIFS$

$= 5000\mu s + 100\ \mu s + 20\ \mu s = 5120\ \mu s$

$$\text{Throughput} = \frac{2000 * 5\ \text{bits}}{5120\ \mu s} \approx 1.95\ \text{Mbps}$$

___THE END ___