

Midterm Exam II (Problems and Answers)

CSE4175: Introduction to Computer Networks

Dept. of Computer Science and Engineering

Spring 2013

Name: _____

Student Number: _____

Total points 100

Problem 1: (15 points) Socket Programming

Describe the TCP Socket identifier.

Answer: the tuple (source IP address, source port number, destination IP address, destination port number)

Problem 2: (15 points) UDP

Describe the advantages that you can get from using UDP.

Answer:

Why is there a UDP?

- ☐ no connection establishment (which can add delay)
- ☐ simple: no connection state at sender, receiver
 - cf. TCP maintains connection state: rcv and sender buffers, congestion-control parameters, seq. and ACK numbers.
- ☐ small segment header
- ☐ no congestion control: UDP can travel as fast as desired

Problem 3: (15 points) TCP

Describe how the sequence number of a TCP segment is determined.

Answer:

- ☐ **Initial seq. number:**
 - In practice, both sides of a TCP connection **randomly** choose an initial seq. number
- ☐ **Sequence number of a segment:**
 - the byte-stream number of the **first byte** in the segment (n, n+1000, ...)

문제	점수
1	
2	
3	
4	
5	
6	
합계	

Problem 4: (15 points) RTT

Describe how to estimate RTT to be used for the timeout interval computation in the TCP congestion control.

Answer:

Q: how to estimate RTT?

- **SampleRTT**: measured time from segment transmission until ACK receipt
 - ignore retransmissions: see Karn's algorithm (later)
- **SampleRTT** will vary, want estimated RTT "smoother"
 - average several recent measurements, not just current **SampleRTT**

$$\text{EstimatedRTT} = (1 - \alpha) \cdot \text{EstimatedRTT} + \alpha \cdot \text{SampleRTT}$$

- influence of past sample decreases exponentially fast

$$\begin{aligned} \text{EstimatedRTT}(K+1) &= (1 - \alpha) \cdot \text{EstimatedRTT}(K) + \alpha \cdot \text{SampleRTT}(K+1) \\ &= (1 - \alpha)^{K+1} \cdot \text{SampleRTT}(0) + (1 - \alpha)^K \alpha \cdot \text{SampleRTT}(1) + \dots \\ &\quad + \alpha \cdot \text{SampleRTT}(K+1) \end{aligned}$$

Problem 5: (20 points) TCP segment header

Describe the usages of the flag, ECE (ECN-Echo), of the header part of the TCP segment.

Answer:

- TCP Header
 - To support ECN, two new flags are added
 - **ECN-Echo (ECE)** flag:
 - used by the data receiver to inform the data sender that a CE packet has been received (an IP packet with ECN field value of 11)
 - **Congestion Window Reduced (CWR)** flag:
 - used by the data sender to inform the data receiver that the sender's congestion window has been reduced.

Problem 6: (20 points) ICMP

Describe the ICMP protocol.

Answer:

ICMP: Internet Control Message Protocol

- used by hosts, routers, gateways to communicate network-level information
 - error reporting: unreachable host, network, port, protocol
 - echo request/reply (used by ping)
 - discover identity of routers
- network-layer "above" IP:
 - ICMP msgs carried in IP datagrams
- ICMP message: type, code plus first 8 bytes of IP datagram causing error

Type	Code	description
0	0	echo reply (pong)
3	0	dest. network unreachable
3	1	dest host unreachable
3	2	dest protocol unreachable
3	3	dest port unreachable
3	6	dest network unknown
3	7	dest host unknown
4	0	source quench (congestion control - not used)
8	0	echo request (ping)
9	0	router advertisement
10	0	router solicitation
11	0	TTL expired
12	0	bad IP header