**Homework 2**

**Due date: April 29th midnight 11:59pm**

**Question 1: please circle a single best answer**

1.1 For HTTP with non-persistent connections:

(a) each object suffers a delivery delay of one RTT

(b) each object suffers a delivery delay of two RTTs

(c) the server leaves the TCP connection open after sending a response

(d) the server opens a new TCP connection to send a response

1.2 From a UNCC computer, a student requests the page at URL http://www.ieee.org/. A bit later, another student requests the same page from another machine. Most probably, the URL of that second request will be resolved by

(a) the DNS server installed on the first student machine

(b) the DNS server installed on the second student machine

(c) the local DNS server of UNCC

(d) one of the root name servers

1.3 As a transport layer protocol DNS mostly uses:

(a) TCP because it is reliable

(b) UDP because it is reliable

(c) TCP because it is faster than UDP

(d) UDP because it has smaller overhead

(e) none of the above

1.4. The TCP:

(a) provides logical communication between hosts.

(b) provides bandwidth-guaranteed logical communication between processes.

(c) provides delay-guaranteed logical communication between processes.

(d) provides reliable logical communication between processes.

1.5. The UDP:

(a) provides bandwidth-guaranteed logical communication .

(b) provides delay-guaranteed logical communication .

(c) provides reliable logical communication between processes

(d) none of above

1.6. In the reliable data transfer protocol, the countdown timer:

(a) is used at the receiver

(b) is used at the sender

(c) is introduced to solve the problem of lossy channels

(d) both B and C

(e) all of the above

**Question 2 (HTTP):** Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?

**Question 3 (DNS):** What is the difference between recursive queries and iterative queries of DNS servers, in terms of the DNS performance (discuss this in terms of the number of messages needed and the corresponding delay)?

**Question 4 (Email):** When we retrieve emails from email servers, can we use SMTP? (Please justify your answers).

**Question 5 (TCP):** problem P37 (textbook chapter 3, scanned version is attached)

**Question 6 (Congestion Control)**: Consider sending a large file from one host to another over a TCP connection that has no loss.

1. Suppose the slow start threshold (ssthresh) is 8. Assuming approximately constant round-trip (RTT) times, how long does it take for ConWin to increase from 1 MSS to 5 MSS (assuming no loss events and constant RTT)?
2. Please draw the congestion window dynamics as RRT proceeds till 15th RTT. Initially, slow start threshold (ssthresh) is 8. Assume first, sender receives duplicate ACKs at 6th RTT, then, experiences timeout event at 10th RTT, and finally experience another timeout event at 12th round.