CMSC 417-0101 Computer Networks **Spring 2001**

Mid-Term Exam

Closed book and notes; In class *Thursday, March 15*

⊕ *Do not forget to write your name on the first page. Initial each subsequent page.*
⊕ *Be* **neat** *and* **precise**. **I will not grade answers I cannot read.**
⊕ *You should draw simple figures if you think it will make your answers clearer.*
⊕ *Good luck and remember, brevity is the soul of wit*

- All problems are mandatory
- I cannot stress this point enough: **Be precise**. If you have written something incorrect along with the correct answer, you should **not** expect to get all the points. I will grade based upon what you **wrote**, not what you **meant**.
- Maximum possible points: 50.

Name: _____

Problem	Points
1	
2	
3	
4	
5	
Total	

1. Routing

(a) Consider a node x running the distance vector protocol. The current best known route from x to z goes through y and has cost $C_{x \to z}$. Suppose x gets an update from neighbor a for a route to z, where the update contains the cost $C_{a \to z}$ as the cost from a to z. Under *precisely* what conditions would x use this new route to z? Use the notation $C_{u \to v}$ to denote cost from u to v. (1 point)

(b) *Link state protocols converge faster than distance vector protocols.* Why? (2 points)

(c) What is "poison-reverse"? (2 points)

(d) Assume a network in which each node can compute Dijkstra's algorithm. Describe the other mechanism required to implement link state routing. (2 points)

(e) State one problem CIDR solves. Construct an example showing how CIDR changes IP route lookup. (3 points)

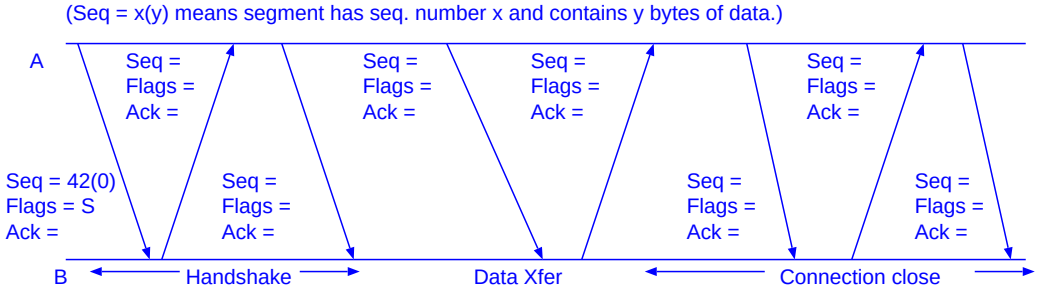
2. TCP and UDP

(a) What is the demux. key for TCP and UDP? What functionality is provided by UDP? (2 points)

(b) What is the difference between flow control and congestion control? What fields in the TCP header is used for each? (2 points)

(c) Why is the TCP `TIME-WAIT` state needed? What happens if a host gets a `SYN` segment for a connection in `TIME-WAIT` state? (2 points)

(d) Fill in the TCP flags and sequence numbers on the space-time diagram below. Assume two data segments were sent with 10 bytes of data each and that data was not sent till the three-way handshake was complete. (4 points)



3. IP details, Multicast

(a) Consider the IP network shown in Figure 1 with two hosts and two routers. The link level MTUs are as given in the figure. The TCP layer MSS (maximum segment size) at host A is configured to be 2500 bytes (i.e. TCP will send up to a 2500 bytes in a single "segment" to IP). The IP at each node layer is properly configured, i.e. each IP implementation can send the link MTU sized datagrams (obviously modulo link-level headers). Assume (1) no data loss; (2) each layer

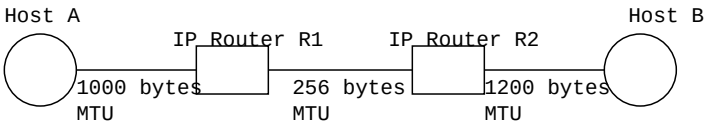


Figure 1: IP network (link MTUs shown in figure)

(application, TCP, IP) *always* sends the maximum sized packet/segment it can send; and (3) all the link-layer headers are 10 bytes in length.

i. List the IP datagrams that host A sends when an application sends a single 1800 byte message from host A to host B using TCP. You only need to list the IP source, IP destination, IP identification (use $i_0, i_1, \ldots$ as needed for id. numbers), IP flags (DF, MF only), and IP datagram length. Hint: Both the IP and TCP headers are 20 bytes each. (4 points)

ii. For the same 1800 byte TCP segment from host A, list the datagrams and their IP identification numbers that host B receives. (1 point)

(b) Consider subnetting the class B net 128.8, such that we create a subnet of 126 hosts starting from the address 128.8.127.0. What is the address for this *network*? What should be the network mask and broadcast address for hosts on this subnet be set to? (2 points)

(c) How are sets of receivers in IP multicast addressed? Precisely explain the difference between *reverse-path broadcast* and *reverse-path multicast*.

4. Congestion Control and Reliability

(a) Describe the terms *Fast recovery* and *Fast retransmit*. When are they applicable? (5 points)

(b) Is it possible to create a reliability protocol using only negative acknowledgements? Why not? (2 points)

(c) Assume we use 2-bit sequence numbers. How large can the sender window be if the $RWS = SWS$? Construct an example with a larger sender window that causes the protocol to fail. (3 points)

5. Domain Name System

(a) What is a *resource record*? Fully name four resource record *types*. (2 points)

(b) What is a DNS *zone*? Why and how are they used? (2 points)

(c) What is an authoritative answer for a DNS query? Describe a class of queries that *always* result in an authoritative answer. (2 points)

(d) Suppose you are the administrator of a "server farm" consisting of 100 different machines to which millions of users connect to. (How) could you use DNS to (at a coarse-grain) map requests evenly to different servers? State precisely a condition under which your solution will *not* work, i.e. the "load-balancing" will cause the application program to fault. (4 points)