

## First Third-Term Exam

*Open book and notes; In class**Monday, October 3rd*

- ⊕ *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. Distance Vector (DV) Routing

- (a) Give a small example where Split Horizon with Poisoned Reverse does not count to infinity (but regular DV does). Be precise and clear about your notation. (4 points)

- (b) Consider a general topology with unit link cost and assume that DV is run (synchronously) at each node. Synchronously means that each node sends its neighbors updates exactly at the same time, and further assume that no messages are lost and that no nodes fail. (Note: This is the exact version of the algorithm we discussed in class). As usual, assume that the algorithm starts with each node knowing of the link cost only to its neighbor. Give a proof sketch (or disprove) the following statement: *After  $k$  iterations, node  $n$  will know the shortest distance to all nodes which are at most  $k$  hops away from it.* (6 points)

## 2. Link State (LS) Routing

(a) Assume a star network (a set of nodes,  $1 \dots n$  all with one link connected to a center node  $c$ ) running LS routing. In this network, which nodes will generate LS packets? To whom are these packets sent to, and when? (2 points)

(b) Why are packet sequence numbers needed for reliable flooding?(4 points)

(c) Does link state routing converge faster than DV? Why/Why not? (4 points)

3. IP (RFC 791) Addressing, Fragmentation

- (a) Class C networks have 110 as their starting prefix, and 8 bits for identifying hosts. How many class C networks were there (explain how you derived your bound). (1 point)
- (b) A transport protocol on top of IP generates a segment of size 2000. The link out of the local host can only send packets of size 1000 (excluding the link level header). Fill in the following header fields for the packets sent out of the local host. (3 points)

Dg. ID	DF	MF	Offset	Datagram Size
5				

- (c) Suppose I want to send a large number of packets to a site in Europe, and I want to ensure that the packets do not get fragmented. Outline a procedure by which I can determine what the maximum sized IP datagram I can send is. Explain roughly how many packets I need to send before I can determine the maximum datagram size.(4 points)

- (d) I start my transfer (to Europe) and my packets still get fragmented. What happened? (2 points)

#### 4. Subnets

(a) Are subnets useful for controlling the growth of routing tables in backbone routers? Why/Why not? (2 points)

(b) How does IP forwarding need to be updated to account for subnets?(3 points)

(c) Suppose the address 128.8.0.0/22 is allocated to you. Divide this space into two subnets of equal size. For each subnet, identify the subnet ID and the subnet broadcast address. (4 points)

5. CIDR, BGP

(a) How does CIDR help with address allocation efficiency? Explain with an example. (3 points)

(b) What is “early exit” routing? How does it affect path lengths on the Internet? (2 points)

(c) Company X (AS 51512) has been allocated address block 200.0.16/20 from ISP A (AS 209) which owns the entire block 200.0/16. Company X has a backup Internet connection from ISP B (AS 332). Company X wants all of its packets to be routed through ISP A unless its link to ISP A is down. Suppose you are in some distant AS and can see advertisements from ISP A and ISP B. Describe a reasonable set of advertisements (from ISP A and ISP B to the rest of the world) that you might see that would implement the policy stated above. Explain why each ISP advertises the prefixes and AS numbers that they do. (5 points)