CSC 435/524 Computer Networks

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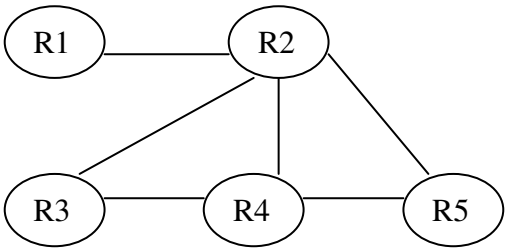
Module 5 - Routing Protocols

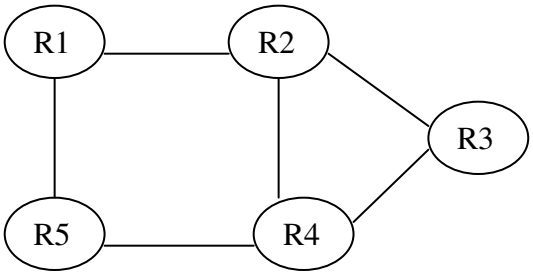
1) Consider an internetwork of routers R1, R2, R3, R4 and R5 as shown in the figures. Use the Distance Vector routing algorithm to compute the routing tables at each of the five routers in the internetwork. What is the diameter of the internetwork? Justify your answer.

- Assume the weight of each edge is 1.
- Assume time is slotted and each router sends its local routing table to all its neighboring routers at the beginning of each time slot.
- Break ties between routers in favor of the router with the lowest id
- You should show your work at each time slot, until there is no change in the routing table at each router.

(a)

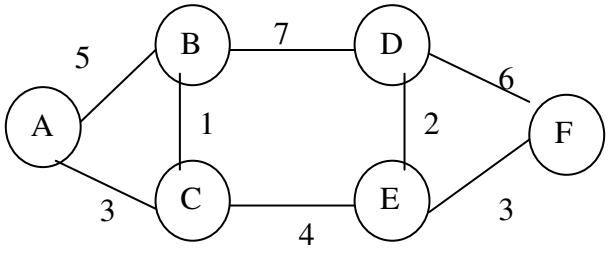


(b)

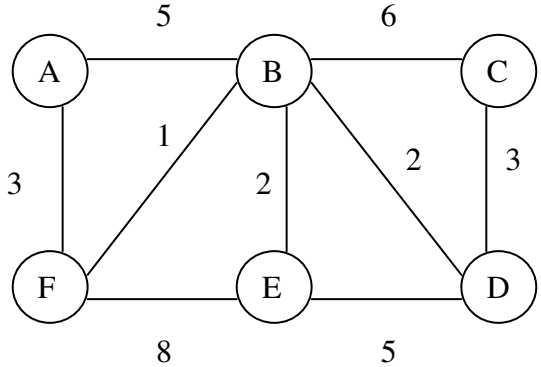


2) Run the Dijkstra algorithm for the **largest bottleneck path problem** on the following weighted network graphs assuming node A as the source node (starting node)

(a)



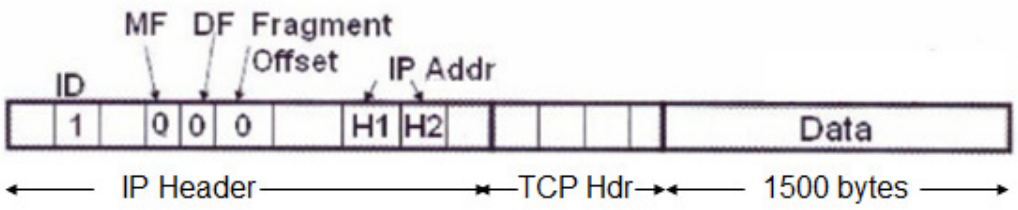
(b)



3) Assume a full 4-ary rooted multicast tree of height 7, where each intermediate node has exactly 4-children and the root node is at height 0. If all the leaf nodes of this tree are part of the multicast group and the root node is the sender, compute the number of link transmissions involved in multicasting vs. multiple unicasting.

Module 6 - Internet Layer

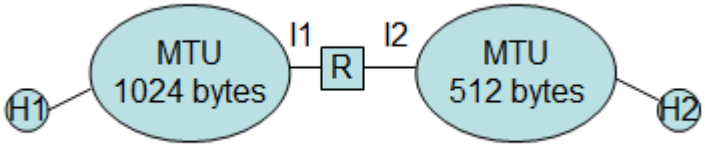
1) Consider fragmenting the IP datagram shown below. Show the structure of all the fragments of this datagram along with the values for the MF bit, DF bit, Offset field, the starting and ending byte number for the portion of actual data in each fragment. Assume the Maximum Transmission Unit (MTU) of the network is 512 bytes. Use the minimum size value for the IP header and TCP header.



2) Suppose an IP packet is fragmented into 10 fragments, each with a 1% (independent probability) of loss. With one transmission of all the 10 fragments, what is the probability of losing the whole packet due to the loss of a fragment? Also, what is the probability of loss of the whole packet if the packet is transmitted twice,

- assuming all fragments received must have been part of the same transmission?
- assuming any given fragment may have been part of either transmission?

3) Suppose a TCP message that contains 2048 bytes of data and 20 bytes of TCP header is passed to IP for delivery across two networks of the Internet (as shown below: i.e., from the source host to a router to the destination host). The MTU of the source and destination networks are 1024 bytes and 512 bytes respectively. Show the structure of all the fragments of this datagram along with the values for the MF bit, DF bit, Offset field, the starting and ending byte number for the portion of actual data in each fragment. Assume the IP headers and TCP header used are of the minimum size.



4) Suppose a router has built up the routing table shown in the following table. The router can deliver packets directly over interfaces 0 and 1, or it can forward packets to routers R1, R2 or R3.

Determine what the router does with a packet addressed to each of the following destinations:
(a) 148.110.17.131 (b) 148.110.16.18 (c) 212.40.163.90 (d) 212.40.163.17

Network Prefix/ Destination Network	Subnet Mask	Next Hop
148.110.16.0	255.255.255.128	Interface 0
148.110.16.128	255.255.255.128	Interface 1
148.110.17.0	255.255.255.128	R1
212.40.163.0	255.255.255.192	R2
<default>		R3