**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**CS235/335 Test #2**

1. Briefly describe how traceroute works.

*Traceroute works by sending packets to a destination with the “Time To Live” (TTL) field of the IP packet header set to 1. When the packet arrives at its first hop on the way to its destination, its TTL is set to 0, and an ICMP packet is sent to the sender. The ICMP packet contains the IP address of the first hop. The procedure is repeated, with the TTL set to 2. This provides the sender the IP address of the second hp. The program continues with this process, incrementing TTL at each iteration, and obtaining the next hop along a path to the destination until finally, the destination IP is reached.*

1. Suppose we are on an IPv4 network that uses 8 of its bits to determine the **host** part of the IP address. The IP address of the machine we are using is 161.115.0.0.
   1. What is the CIDR network address or our network?

*There are a total of 32-bits in an IPv4 address, so if 8 are consumed by the host part of the address, 24 bits are left for the network part of the address. CIDR notation specifies the number of bits in the network part of the address after a slash: 161.115.0.0/24*

* 1. What is the subnet mask for our network (in dot-decimal notation)?

*The subnet mask contains 1’s for bits corresponding to the network part of the address, and 0’s for bits corresponding to the host part of the address. 24 1’s followed by 8 bits in dotted-decimal notation we have:*

*255.255.255.0*

1. Why are packets fragmented? How is fragmenting handled in IPv4 versus IPv6?

*Packets are fragmented under IPv4 when the packet size exceeds the MTU (Maximum Transmission Unit) for a link over which the packet must travel. Packets are reconstructed when they arrive at their final destination. Ipv6 does not allow fragmentation, and instead issues an ICMP message when a packet is too large to traverse a link.*

1. What is the purpose of ICMP? Would you consider ICMP a higher or lower-level protocol than IP? Why?

*ICMP is used by hosts and routers to communicate network-layer information to each other. This is most typically error reporting, but also includes things like ping reply and router advertisements. ICMP messages are carried inside IP datagrams and delivered to the ICMP layer from the network layer, thus ICMP is a higher-level protocol.*

1. Suppose that a sender with a sending window size of 5 segments sends segments 1,2,3,4, and 5. For the purposes of this question, assume that time-outs only occur after all possible sends and acks have reached their destinations. Segment number 3 is lost during transmission.
   1. What other segment(s) **might** be sent before segment 3 times-out?
      1. Under selective repeat? Explain your answer.

*Segments 6 and 7 can also be sent because when the acknowledgements for segments 1 and 2 are received, the sender window shifts to the right to include these segments.*

* + 1. Under go-back n? Explain your answer.

*Segments 6 and 7 can also be sent because when the acknowledgements for segments 1 and 2 are received, the sender window shifts to the right to include these segments.*

* 1. What segments will **certainly** be resent ?
     1. Under selective repeat? Explain your answer.

*Segment 3 will be resent. Under selective repeat, segments 4 and 5 can be received out-of-order. Only segment 3 needs to be resent.*

* + 1. Under go-back n ? Explain your answer.

*Under go-back-n, the receiver will reject any segments other than the one that is expected. When 3 is lost, 4 and 5 are rejected upon arrival. All three segments must be resent.*

* 1. Suppose instead that all the segments arrive at the receiver safely, but the acknowledgement for segment 3 is lost? What segment(s) will **certainly** have to be resent.
     1. Under selective repeat? Explain your answer.

*Acknowledgements are not cumulative under selective repeat, so segment 3 will have to be resent. However, acknowledgements 4 and 5 can be received out-of-order, so only segment 3 must be resent.*

* + 1. Under go-back n? Explain your answer.

*Acknowledgement is cumulative under go-back-n, so when the ack for segment 4 arrives at the sender it can assume that segment 3 must have arrived safely as well. Because go-back-n will only accept the segment it is expecting, we know that if 4 was received safely, that 3 must have also been received safely.*

1. Define or describe each of the terms:
   1. Transmission speed

*Transmission speed is the speed at which data can be pushed onto a link.*

* 1. Propagation Delay

*Propagation delay is the time required for the data to reach its destination after it has been pushed onto a link.*

* 1. Congestion Control

*Congestion control is a mechanism used to respond to and reduce network congestion.*

* 1. Flow Control

*Flow control is a mechanism used to prevent a sender from overwhelming a receiver with more data than the receiver can handle. Flow control is concerned with preventing a receiver from being overwhelmed, in contrast to congestion control which is concerned with preventing the network from being overwhelmed*.

* 1. Count to Infinity

*The count to infinity problem is a problem that occurs in the distance vector routing algorithm when a previous existing route becomes unavailable or increases in cost and routers actually attempt to use routes that route through themselves – creating routing loops. Cost estimates about such routes increase at each iteration of the algorithm causing a “count to infinity.” Poisoned Reverse can be used to reduce, but not eliminate this problem*.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Working Node | Path length and next hop from B | Path length and next hop from C | Path length and next hop from D | Path length and next hop from E | Path length and next hop from F | Path length and next hop from G |
| A |  | 5,A | 1,A | 4,A |  |  |
| D | 10,D |  |  |  | 2.5, D |  |
| F |  |  |  |  |  | 9.5, F |
| E |  |  |  |  |  | 5, E |
| C | 7,C |  |  |  |  |  |
| G |  |  |  |  |  |  |
| B |  |  |  |  |  |  |

1. Use Dijkstra’s shortest path algorithm to determine the routing table for router “A” in the sample network below. Fill-in the table so that it lists all the working nodes in the order they were made permanent, and shows all the changes to tentative path lengths in the appropriate columns. 1

|  |  |
| --- | --- |
| Destination | Next Hop |
| B | C |
| C | C |
| D | D |
| E | E |
| F | D |
| G | E |

2 5 1

1 2

Draw the minimum spanning tree that can be derived from this result. Fill-in the forwarding (routing) table for node A.

Draw the minimum spanning tree that can be derived from this result. Fill-in the forwarding (routing) table for node A.

9 7

1.5