CNT5106C Computer Networks, Fall 2014
Homework #4: On the Network Layer and IP Multicast
Assigned: Dec 2nd, 2014. Due date: Dec 12th, 2014 (11:55pm)

Q1. (2 points) Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not?

Q2. (6 points) Compare and contrast the advertisements used by RIP and OSPF.

Q3. (6 points) What is the 'rendezvous problem' in multicast? How can it be solved? (mention three main approaches/algorithms to the solution along with the protocols that use them)

Q4. (5 points) What is the difference between a group-shared tree and a source-based tree in the context of multicast routing?

Q5. (10 points) What are the differences between the targeted environments (potential number of group members etc.) for PIM-DM and PIM-SM? How does this lead to different protocol design?

Q6. (10 points) In several multicast routing protocols we use RPF check (reversed-path forwarding check). What is the purpose of such check? How does it work? What are the underlying assumptions this check relies on?

Q7. (11 points) IGMP provides membership information to the first hop router regarding the existence of receivers on a directly connected LAN.
(a) Why are group-specific query messages introduced in IGMPv2? Argue showing what a router does when it receives a 'leave' message from a host.
(b) The multicast host model does not define any interaction between the sources and IGMP. Do you see any problems with that? Explain. [Hint: Think of a case where there are no members for a group.]
(c) Suggest a simple modification to IGMP to solve the problem in (b).

Q8. (12 points) Soft state vs. hard state
PIM-SM uses a concept called 'soft-state' in its messaging protocol. This concept simply indicates that a join message (for example) is sent periodically by the downstream routers to the upstream router to refresh the join state. An alternative would be to use 'hard-state' messaging, in which an ack is sent for each message,

such that a join and a join-ack (2 messages) only need to be sent between an upstream and a downstream router on a link.

(a) Which protocol incurs less overhead on the network?

(b) Why are soft-state mechanisms sometimes preferred over hard-state mechanisms?

(c) *Extra:* Soft-state protocols incur more overhead on the network, especially when the number of states in the router (source-group pair state, for example) increases, as a state refresh needs to be sent upstream for every state at fixed periods. Obviously, this approach does not scale. Suggest an approach to alleviate this problem and discuss its advantages and disadvantages. [Hint: You may use variable timers].

Q9. (6 points) What is the timer-suppression mechanism, and why is it used? Mention at least two mechanisms for multicast routing (either in IGMP or multicast routing protocols) that use such a scheme.