Please print out this form (two-sided, if you can) and write your answers *legibly* in the spaces provided. If you can't write legibly, type.

1. Suppose a host receives an IGMP query packet at time *T* that includes a `MAX RESPONSE TIME` field with a value of 120, what is the latest time at which *A* can respond to the query?

   As per RFC 2236, MAX RESPONSE TIME is in units of 1/10th of a second. Hence, as value of 120 implies that A must responds within 12 seconds.

2. How does a switch that does IGMP snooping determine which ports connect to routers, and which connect to hosts?

   As per RFC 4541, there are multiple possible mechanisms for a switch that does IGMP snooping to determine which ports are connected to multicast routers. The RFC lists the following three options:

   ```
   a) This list should be built by the snooping switch sending
      Multicast Router Solicitation messages as described in IGMP
      Multicast Router Discovery [MRDISC].  It may also snoop
      Multicast Router Advertisement messages sent by and to other
      nodes.

   b) The arrival port for IGMP Queries (sent by multicast routers)
      where the source address is not 0.0.0.0.

      The 0.0.0.0 address represents a special case where the switch
      is proxying IGMP Queries for faster network convergence, but is
      not itself the Querier.  The switch does not use its own IP
      address (even if it has one), because this would cause the
      Queries to be seen as coming from a newly elected Querier.  The
      0.0.0.0 address is used to indicate that the Query packets are
      NOT from a multicast router.

   c) Ports explicitly configured by management to be IGMP-forwarding
      ports, in addition to or instead of any of the above methods to
      detect router ports.
   ```

3. In PIM, what is the role of the RP? Can two different multicast addresses use they same RP? Do they have to? What is the role of the DR? Can a subnet have more than one?

The RP or Rendez-vous Point is meant to build a shared tree that will be used to distribute multicast packets addressed a particular multicast address.

The same RP can serve more than one multicast group, though it is common to have multiple RPs to achieve better load-balancing in the network.

The Designated Router of a subnet issues JOIN messages towards the corresponding RP when receiving membership reports indicating interest for a multicast group. If there are multiple multicast routers on a subnet, only one of them is elected as the DR. Having multiple DRs would result in multiple copies of multicast packets being delivered to the subnet.