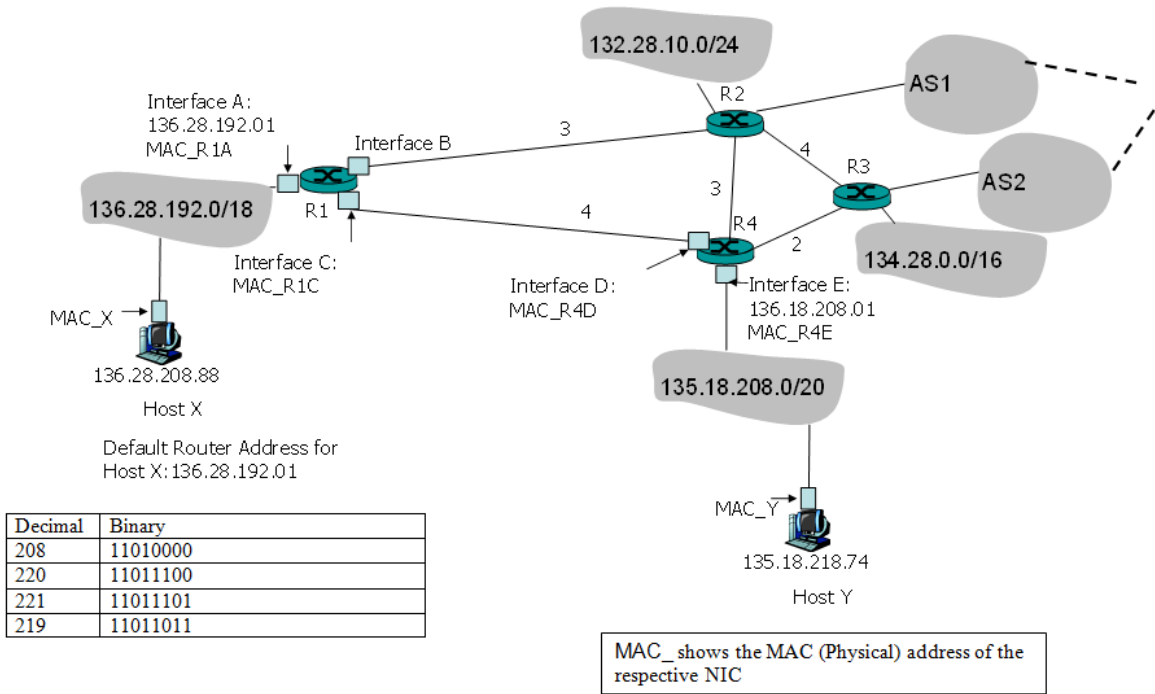


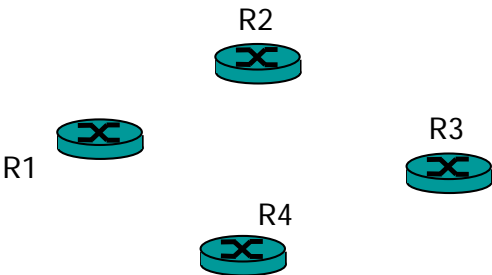
Q. Consider the topology in the figure below. You can use the given decimal/ binary conversions in your answers. All subnets are implemented with shared medium Ethernet as the Data Link Layer.



Routers R1, R2, R3 and R4 constitute Autonomus Aystem AS0. R2 and R3 are border gateways to Autonomous systems AS1 and AS2 respectively. The intra-as routing algorithm in AS0 is OSPF. Assume that initially all link state advertisements are flooded in AS0 and R1 is informed about the link costs, border gateway routers and the intra-as subnets that are reachable by R2, R3 and R4.

- a) Run Dijkstra’s algorithm for router R1. Show the steps of Dijkstra’s algorithm in the table and complete the resulting shortest path tree for R1 in the given plot.

| N’ | D(R2), p(R2) | D(R3), p(R3) | D(R4), p(R4) |
|----|-----------------|-----------------|-----------------|
| R1 | | | |
| | | | |
| | | | |
| | | | |



Assume that R2 and R3 receive BGP reachability advertisements via external BGP sessions which inform that subnet 135.18.220.0/22 is reachable via AS1 and AS2 respectively. AS0 follows a hot-potato routing policy for destinations in other Autonomous systems. R1 has 3 interfaces Interface A, Interface B, Interface C.

- i) Fill in the following routing table for R1. Indicate which respective routing protocols (OSPF,BGP or both) are used to construct each entry.

| Network address/subnet mask | Outgoing Interface (A,B or C) | Used routing protocol (OSPF,BGP or both) |
|-----------------------------|-------------------------------|--|
| 136.28.192.0/18 | A | Own subnet |
| 132.28.10.0/24 | | |
| 135.18.208.0/20 | | |
| 134.28.0.0/16 | | |
| 135.18.220.0/22 | | |

- ii) How did you select the outgoing interface for 135.18.220.0/22.?
- iii) Router R1 receives an IP packet with destination address 135.18.221.64. Which outgoing interface is selected by R1 for this packet? Explain how this interface is selected.
- iv) Router R1 receives an IP packet with destination address 135.18.219.16. Which outgoing interface is selected by R1 for this packet? Explain how this interface is selected.

b) Host X wants to send an IP packet to Host Y.

Assume:

- R1 knows the Link Layer Physical address of Interface D of R4.
- Other than the above information, ARP caches of all related network devices are empty.

Fill in the following table that shows the steps until Host Y receives the IP packet.

For ARP packets Indicate the type (request/reply) and relevant IP (protocol) addresses.

| Sending Node | Type of outgoing Data Link Layer Frame: ARP request/ ARP reply/ Ethernet | Source MAC address of outgoing Link Layer Frame from the Sending Node | Destination MAC address of outgoing Link Layer Frame from the Sending Node | For ARP packets: S: IP (protocol) address of the sender D: IP (protocol) address of the target |
|--------------|---|---|--|--|
| | | | | For Ethernet packets: S: Source IP address of the enclosed datagram D: Destination IP address of the enclosed datagram |
| Host X | | | | S: |
| | | | | D: |
| | | | | S: |
| | | | | D: |
| | | | | S: |
| | | | | D: |
| | | | | S: |
| | | | | D: |
| | | | | S: |
| | | | | D: |
| | | | | S: |
| | | | | D: |
| | | | | S: |
| | | | | D: |

Q. Consider the topology below.

A professor attaches her laptop for the first time to METU EEE Dept. Network to browse www.eee.metu.edu.tr. Fill in the following table that sequentially explains the events for receiving the base html file. **Do not** fill in the table entries marked with a X. The lower protocol layer details are listed only one way and once.

| Sending (Processing) node | Destination Node(s) | Protocol Name | Protocol Layer | Explanation |
|---------------------------|---------------------|---------------|----------------|--|
| Client Host | | | Application | |
| Client Host | X | | Transport | X |
| Client Host | | | Network | X |
| Client Host | | Ethernet | | X |
| | Broadcast | | Application | |
| Client Host | | | Application | Client needs the IP adress of www.eee.metu.edu.tr |
| Client Host | X | UDP | | X |
| Client Host | | IP | Network | X |
| Client Host | | ARP | Data Link | |
| | | | | |
| Client Host | | | Data Link | X |
| | Client Host | | Application | |
| Client Host | METU EEE Server | | Transport | |
| | | | Transport | |
| Client Host | METU EEE Server | | Application | Send the request for the web page |
| METU EEE Server | | | Application | |

