

Assignment 3

CS348; Max. Marks: 18

Note: Solve all problems on your own. Upload your solutions as a single pdf file to Moodle.
Approach the instructor for clarifications.

AS4 in Figure 1 has the following characteristics.

- All routers run OSPF as the interior gateway protocol (IGP). Recall that OSPF is a link-state routing protocol.
- Only the border routers connecting AS4 to neighbouring ASes run BGP, that is A, B, G, and J.
- Link weights are static and specified in the diagram.

State any assumptions that you make to solve the problems.

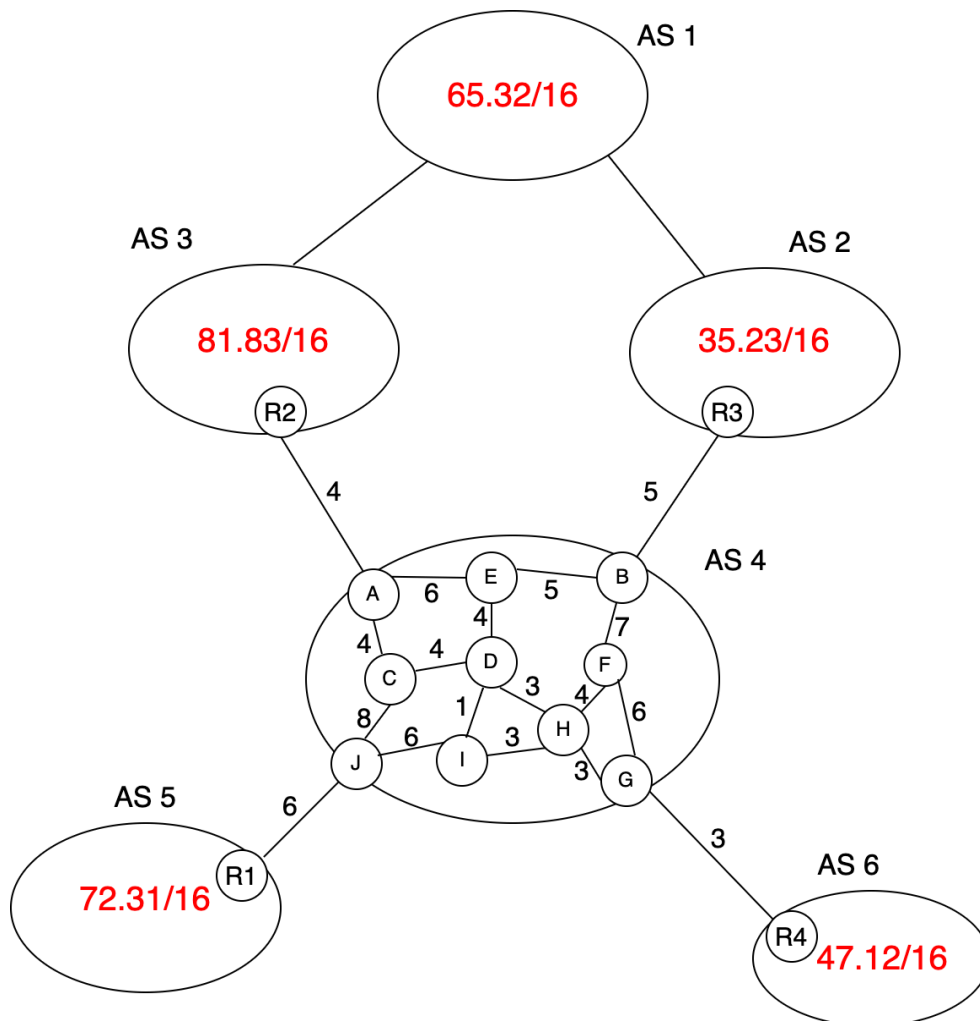


Figure 1: Routing topology

- 1) (8 marks) Using Dijkstra's algorithm, determine the shortest path from J to all other routers within AS4 as well as R1, R2, R3, R4. Give details of the different stages in creation of the routing tree using diagrams. Similarly determine the shortest path from G to all other routers, and show your working with diagrams.
- 2) (6 marks) Corresponding to each of the ASes is an IP-prefix as shown. R3 of AS2 advertises the paths [35.23/16 AS2], [65.32/16 AS2-AS1] and [81.83/16 AS2-AS1-AS3] to router B of AS4. R2 of AS3 advertises the paths [81.83/16 AS3], [65.32/16 AS3-AS1] and [35.23/16 AS3-AS1-AS2] to A of AS4. Suppose the administrator of AS4 has set LOCAL PREF to the same value for all BGP advertisements. Assume that the MED attribute has not been set in any of the advertisements.
 - a) (2 marks) State the BGP NEXT_HOP router that each BGP router (i.e. A, B, G, J) in AS4 eventually uses to send packets to destination prefix 81.83/16. Give the reasons for these choices. Recall that the NEXT_HOP router for a BGP advertisement is the router in the neighbouring AS which sent the corresponding advertisement to a router in AS4. Examples of these are R2, R3 etc.
 - b) (2 marks) Explain which NEXT_HOP router does each BGP router in AS4 use to send packets to destination prefix 35.23/16. Give reasons for these choices.
 - c) (2 marks) Explain which NEXT_HOP router does each BGP router in AS4 use to send packets to destination prefix 65.32/16. Give reasons for these choices.
- 3) (4 marks) Assume that Encapsulation is the solution used by AS4 for BGP-IGP interaction. Suppose a packet P1 is forwarded to J from R1 with destination 65.32.15.41.
 - a) (3 marks) Explain which router encapsulates P1 and which router eventually de-encapsulates it. Call the new packet formed after encapsulation P2. Explain which router the destination IP address of P2 corresponds to.
 - b) (1 marks) Give the path traversed by P2 within AS4.