TECHNISCHE UNIVERSITÄT BERLIN
Fakultät IV – Elektrotechnik und Informatik
Fachgebiet Intelligente Netze
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8th Assignment: Network Protocols and Architectures, WS 20/21

Question 1: $(10 + 10 + 10 = 30$ points) *Routing Protocols*

(a) Explain the terms Interior Gateway Protocol (IGP) and Exterior Gateway Protocol (EGP) and distinguish them in terms of their purpose.

(b) Explain the routing mechanisms Link State and Distance Vector by describing the underlying principles and how these principles work.

(c) Classify the routing protocols RIP, BGP, OSPF, IGRP, and ISIS in terms of their protocol family from (a) and the applied mechanism from (b).

Question 2: $(5 + 5 + 5 + 5 = 20$ points) *Intra- vs. Inter-AS routing: concepts*

(a) Consider intra- and inter-AS routing. Where do policies play a role in selecting between different possible routes, and where not? Justify briefly.

(b) Intra-AS routes are optimized towards little delay. In your opinion, is it a good idea to use congestion at the interface as a metric to achieve that goal? Briefly justify your answer.

(c) How does BGP – as a member of the path-vector protocol family – attempt to bypass the problem of routing loops?

(d) The de-facto standard for inter-AS routing is BGP. Why is it difficult to introduce alternatives to BGP or switch completely to a different protocol that is incompatible with BGP?

Question 3: $(5 + 5 + 10 + 5 = 25$ points) *Intra- vs. Inter-AS routing: weights*

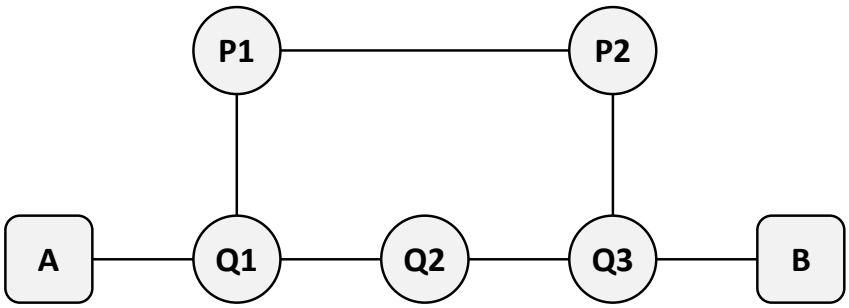

Figure 1: Intra-AS setup

Consider the topology shown in Figure 1. All edges have a weight of 3. An intra-AS routing protocol is used.

(a) Identify the cost-optimal route from A to B. What is the cost?

(b) Suppose that the edge weight between Q2 and Q3 increases to 8. Given this case, state the cost-optimal route from A to B now. What is the cost?

Assume that after this change, the routing has converged. Which path will a packet actually take between A and B?

Please turn!

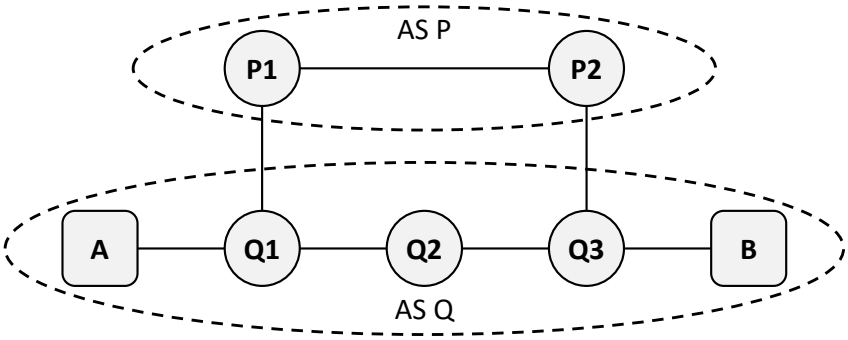

Figure 2: Inter-AS (BGP) setup

As shown in Figure 2, the network is now split into two autonomous systems (ASes). BGP is used as routing protocol between those autonomous systems, and the two ASes are peers.

(c) The edge weight between Q2 and Q3 is still 8. Which path will a packet from A to B take? Explain why. What is the cost?

(d) Supposing that the link between Q2 and Q3 fails, how can packets be routed from A to B in this case? Explain why.

Question 4: (25 points) *Dijkstra's Algorithm*

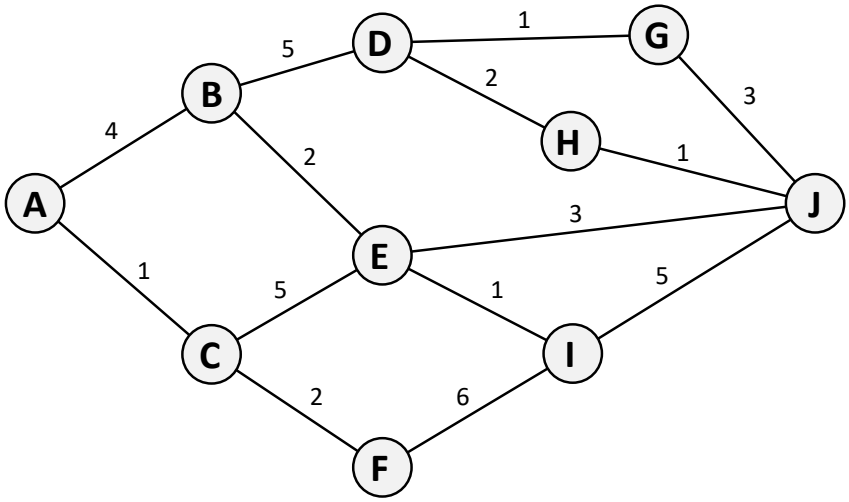

Figure 3: Network with nodes and link costs used for Dijkstras algorithm

Consider the network shown in Figure 3. It consists of several interconnected routers. The numbers next to the edges denote the link costs. All edges are bidirectional. Use the Dijkstras algorithm to compute the shortest paths from Router D to all other nodes in the network. Your table must have the same structure as the one discussed in the lecture (Routing - Slide 17).

Due Date: Wednesday, January 20th, 2021 11.59 pm (end of day)

- **As PDF files (no MS Office or OpenOffice files)**, uploaded via ISIS: `https://isis.tu-berlin.de/course/view.php?id=21979`
- Put the names and Student ID numbers (Matrikelnummer) of **all** your group members **and** the tutorial slot on your solution!