CS 609: Software Defined Networks and Network Function Virtualization
Autumn 2023-24, IIT Dharwad

Mid-semester Exam
September 18, 2023
2:30 PM onwards

Total Marks: 25

Submission Guidelines: Name the Python files after your roll number and the suffix `Q1`, `Q2`, `Q3a`, and `Q3b`, respectively, and submit it on Google Classroom.

Q1. [*10 marks*] Consider a connected random network of 100 switches. Assume a link propagation speed of 2×10^8 m/s, control traffic from each switch to controller with an average arrival rate of 10 PACKET-IN messages per second, and an average controller processing capacity of 100 PACKET-IN messages per second.

Develop a Gurobi-based optimization model in Python to find the minimum count of controllers required for this network and their locations, and switch-controller mappings to minimize the end-to-end control latency (comprising switch-controller + inter-controller + controller processing).

Name the Python file after your roll number and the suffix `Q1`, and submit it on Google Classroom.

Q2. [*5 marks*] Write a Python script to
- launch Mininet
- with topology as shown in Figure 1, including
  - custom links (10 Mbps, 5ms delay, 1% loss, 1000 packet queue)
  - custom hosts (0.5 CPU divided uniformly across all hosts)
- measure (and print) latency and bandwidth between every pair of hosts

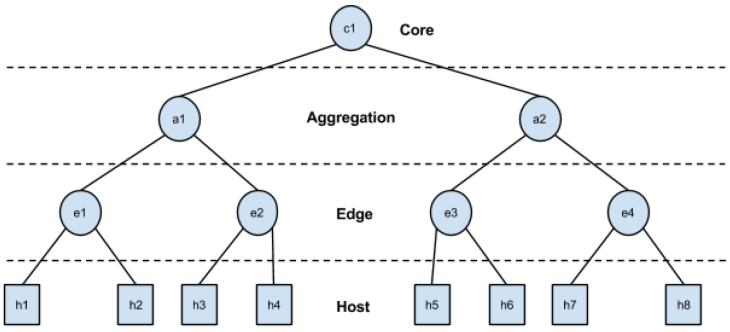

Figure 1: Datacenter Topology

Name the Python file after your roll number and the suffix `Q2a`, and submit it on Google Classroom.

Q3.

(a) [*5 marks*] Develop a RYU controller application that will discover the network topology, pre-compute the shortest path between every node pair, and proactively update the flow tables of all switches across the network.

(b) [5 marks] For any single-link failure, your application should be able to re-compute the shortest paths, and update the flow tables in the relevant switches.