COMP9334 Revision Problems for Week 9A

Chun Tung Chou

April 8, 2019

1. In this question, you will formulate an integer programming problem for the *controller placement problem* in software defined networking (SDN). We briefly discussed this problem in the beginning of the lecture in Week 10, see pages 2-3 of the lecture notes for that week.

   In SDN, there are two types of "boxes": (1) Simple packet switches; and (2) Controllers. At each node of the network, there is a simple packet switch. However, we do not need to have a controller at each network node. We only need to place controllers at some of the network nodes, and one controller can be used to control multiple switches. Since a controller needs to communicate with those switches that it controls, the communication delay between a controller and a switch under its control must not be too big.

   For the controller placement problem, you are given:

   - A network (N, E) where N is the set of nodes and E is the set of edges. There is a simple packet switch at each node in N. We assume there are n nodes and they are indexed by $1, 2, ..., n$.

   - The commuication delay d_{ij} between nodes i and j in the network, for all $i, j \in N$. This means that if a controller is placed at node i, then the communication delay between this controller and a switch at node j is d_{ij}.

   - The maximum allowable delay D between a controller and the switches that it controls.

   The requirements are:

   - Each switch must be controlled by a controller.

   - The delay between a controller and any switch that it controls cannot exceed D.

   Formulate an integer programming to minimise the number of controllers required subject to the above requirements.