Task 0: Introduction to UGAL

UGAL is an **adaptive** routing algorithm, which means that it decides to route minimally and non-minimally based on the congestion of the network. This is different with **oblivious** routing algorithms, such as minimal routing and Valiant, which always route minimally and non-minimally regardless of the network situation.

UGAL estimates the network congestion by multiplying the hop count and the queue occupancy. UGAL routes minimally if:

$$H_{min} \times q_{min} \leq H_{non} \times q_{non}$$

else, route non-minimally.
H_{min}, H_{non} is the minimal and non-minimal hop count; q_{min}, q_{non} is the queue occupancy at the minimal and non-minimal path, respectively.

For further information on UGAL, you can read the chapter 6 of *"Load-balanced Routing in Interconnection Networks"* thesis. The thesis can be downloaded in thesis.dvi (psu.edu).

For the tasks below, please run the simulations on a 32-router, 1024-node 1D Flattened Butterfly with single-cycle routes, 2 VCs, and 32-flit buffer depth per VC.

Task 1: Adding Positive Static Bias

Modify the UGAL algorithm to:

$$H_{min} \times q_{min} \leq H_{non} \times (q_{non} + b)$$

Where b is the bias value.

Questions

Try using any positive and negative bias value (please choose the bias values by yourself) and run the simulation on uniform random and adversarial traffic. What does the effect that the bias have on the performance?