Computer Facilities and Network Management
BUS3150

Tutorial - Week 12

Objective of this tutorial:
The objective of this tutorial is to strengthen the conceptual understanding of the material covered in the lecture by reflecting on the material in small groups. The tutor will provide feedback to enhance your understanding and diminish misunderstandings, if any.

How to participate in the tutorial:
Form groups of four to five students in each and discuss the answers for the following reflective questions with the group members. After spending about ten minutes for each question, discussing with group members, discuss your solutions with the tutor and other groups. The tutor will provide feedback on your solutions.

Question 1 - For each of the switching networks (circuit, virtual circuit and datagram), determine the type of delay that will occur when two stations use the networks to perform data transfer.

> **Circuit Switching:** *Delay prior to data transfer for call (route) establishment. No delay at the nodes (the term nodes refer to switching devices that provide communication).*

> **Virtual Circuit:** *Delay prior to data transfer for route establishment. Increase in delivery delay time during busy traffic; Less time required at the nodes for making routing decision as the route is determined when VC is created.*

> **Datagram:** *Delay at the nodes; delay due to re-ordering packets at the destination.*

Question 2 - In packet switching, what is the significance of packet size and transmission time?

Question 3 - Determine the type of switching network suitable for the following situations:

(a) Voice communication.

> *Circuit switching (for example, public switched telephone network). This provides a dedicated capacity with minimum end-to-end delay. While, packet switching is becoming popular in this field, it is still too early.*

(b) Interactive applications run for extended period of time.

> *Packet switching (either Datagram or Virtual Circuit service). We don't want to dedicate capacity for such applications (i.e., not Circuit Switching).*

(c) A transfer of a large file.

> *Packet switching using virtual circuit. The virtual circuit will be more efficient than datagram for long duration connections.*

Question 4 - Figure 1 shows a simple network configuration. Figure 2 shows node N4 from this network using isolated adaptive routing. In this scheme, routing decision are based on the information available at the node in which routing takes place. For a packet headed for node i, the outgoing link is chosen such that $Q + B_i$ is minimised. Q represents the queue size of an outgoing link while B_i is the bias for destination node i. Note that each square at the node shows a single packet in the respective queues.
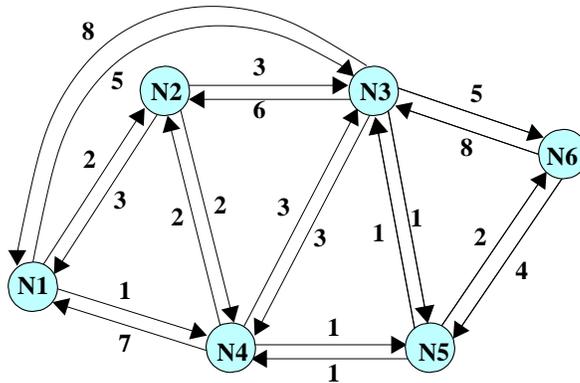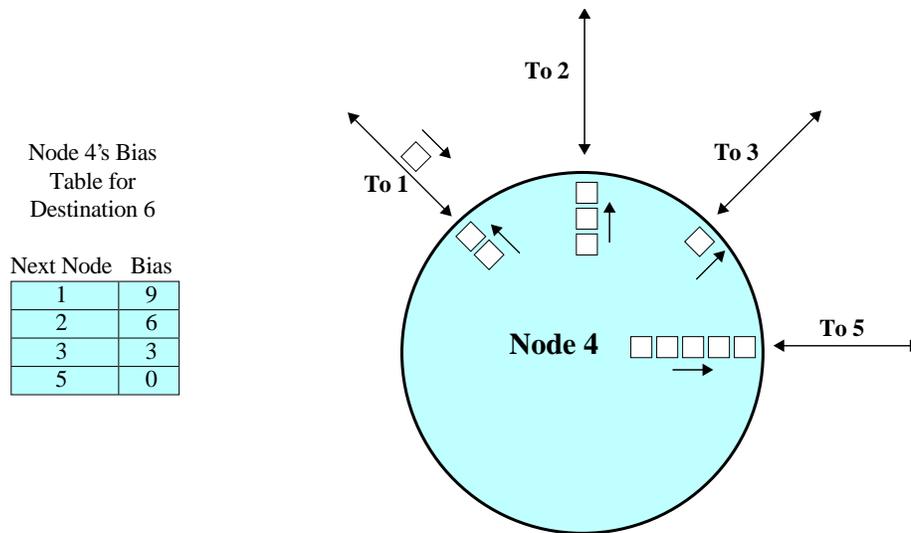

Figure 1: Example network configuration.

Figure 2: Example of an isolated adaptive routing node.

(a) Given the node status shown in Figure 2, what will be the chosen outgoing link for a packet leaving node 4 to destination 6?

- *Need to calculate the link costs using $Q + B_i$ to get from 4 to 6.*
  - *Using port 1: $2 + 9 = 11$*
  - *Using port 2: $3 + 6 = 9$*
  - *Using port 3: $1 + 3 = 4$*
  - *Using port 5: $5 + 0 = 5$*
- *Therefore port 3 has the minimum cost.*

(b) After a while, the queue size of link 4-5 is reduced to 3. What will be the chosen outgoing link for a packet leaving node 4 to destination 6 now?

The new cost for port 5 will now be $Q + B_i = 3 + 0 = 3$. This will become the new minimum. Therefore port 5 will be used.

Question 5 - Consider the network shown in Figure 3, consisting of two regions with only two links, **A** and **B**, which connect the two regions together. Assume that a situation develops in which most of the traffic between the regions is on link **A**. This will cause the link delay on **A** to be significant, and at the next opportunity, this delay value will be reported to all other nodes. Assume that the nodes use a distributive adaptive routing scheme.
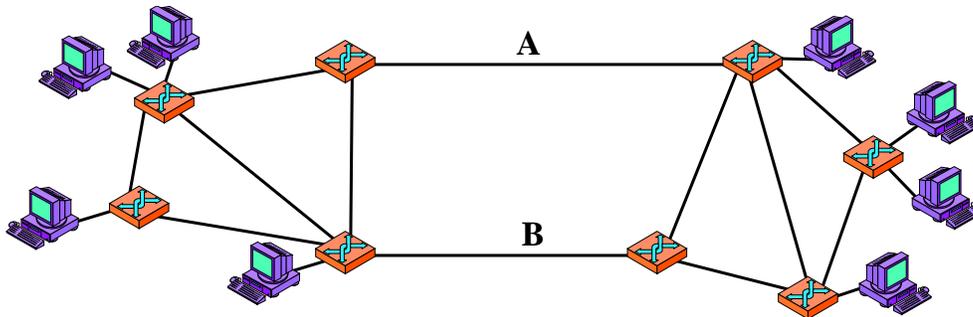

Figure 3: Simple network with links **A** and **B**.

(a) What will be the traffic pattern of this network within the next several minutes, or possible hours?

*Traffic will shift to link **B**. However, if all nodes start shifting their traffic to link **B**, then link **B** will become congested. The adaptive routing scheme will notify all nodes of this congestion and then nodes will then start prioritising link **A** again. This will cause oscillation between link **A** and link **B**.*

(b) The situation that will developed in the part **(a)** of this Question is undesirable. Elaborate on this.

Each link will alternate between congested and under utilised. The average throughput and delay for the link, and therefore network, will not be optimal.