Lab 7

Objectives:

- gain insights into routing dynamics

Prerequisites and Links:

- Week 8, 9 and 10 Lectures
- Relevant Parts of Chapter 4 and Chapter 5 of the textbook
- Introduction to Tools of the Trade
- Basic understanding of Linux. A good resource is here but there are several other resources online.
- Introduction to ns-2 from Labs 4 and 5.
- tp_routing.tcl

Questions to be marked: Questions 2, 3, and 4.

- Each lab comprises of a number of exercises. Not all the exercises for each lab are marked. Only those marked with (*) and written in bold will be marked.
- We expect the students to go through as much of the lab exercises as they can at home and come to the lab ready.
- Please attend your allocated lab and show/explain the answers of the marked exercises to your tutor.
- If lab exercise involves diagrams or plots, you require to show them to the tutor as well.
- Please make sure you **sign the marking form** once the tutor marked your lab. Signing this form implies that you agreed on the mark you received.
- There are 7 labs during this course. For each student, the 5 best performing labs will contribute to your final lab mark.

Marks: 4 marks

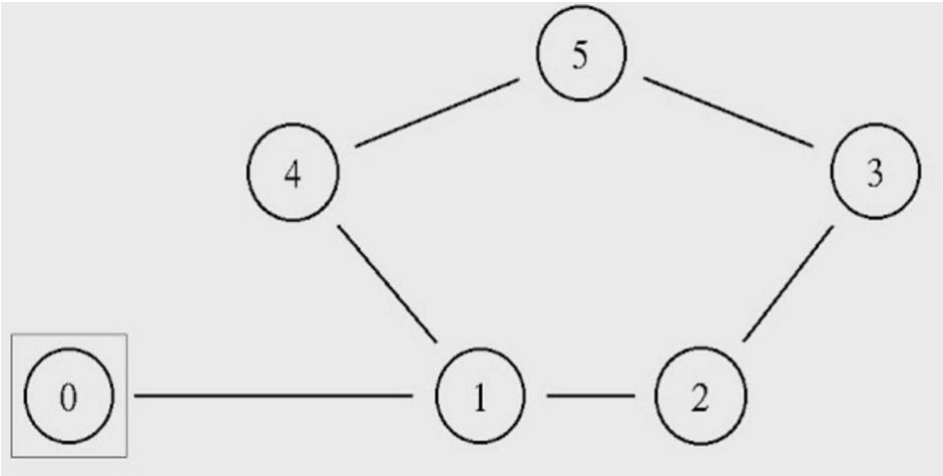
Understanding the Impact of Network Dynamics on Routing

In this exercise, we will observe how routing protocols react when network conditions change (e.g., a network link fails) using a ns-2 simulation.

Important Note:

The provided scripts (for ns-2) have been tested on CSE Linux machines. They may not work on your personal machine even if you have installed ns-2. As such, we suggest that you work on a CSE machine to complete these lab exercises. You can do so by going to a lab in person or via ssh.

The provided script, tp_routing.tcl takes no arguments and generates the network topology shown in the figure below.



You can run the simulation with the following command:

```
$ns tp_routing.tcl
```

Step 1: Run the script and observe the NAM window output.

Question 1. Which nodes communicate with which other nodes? Which route do the packets follow? Does it change over time?

Note: You can also answer the above question by examining the simulation setting in the script file.

Step 2: Modify the script by adding the following two lines just before the command $ ns at 0.5 "$cbr0 start" (i.e. line 70):

```
$ns rtmodel-at 1.0 down $n1 $n4
$ns rtmodel-at 1.2 up $n1 $n4
```

Step 3: Rerun the simulation and observe the NAM window output.

NOTE: Ignore the NAM syntax warnings on the terminal. These will not affect the simulation.

(*) Question 2: What happens at time 1.0 and at time 1.2? Does the route between the communicating node change as a result of that? (1 mark)

Step 4: The nodes in the simulation above use a static routing protocol (i.e., preferred routes do not change over time). We are going to change that, so that they use a Distance-Vector routing protocol. Modify the script and add the following line before the definition of the finish procedure (this is a couple of lines below where you added the two lines in Step 2).

```
$ns rtproto DV
```

Step 5: Rerun the simulation and observe the NAM window output.

(*) Question 3: How does the network react to the changes that take place at time 1.0 and time 1.2? (1 mark)

Step 6: Remove the two lines that you had added to the script in Step 2 and add the following line instead:

```
$ns cost $n1 $n4 3
```

Step 7: Rerun the simulation and observe the NAM window output.

(*) Question 4: How does this change affect the routing? Explain why. (2 marks)

Step 8: Replace the line added in Step 6 with the following line:

```
$ns cost $n1 $n4 2
```

and uncomment the following line, which is located right after the finish procedure definition (line 26):

```
Node set multiPath_ 1
```

Step 9: Rerun the simulation and observe the NAM window output.

Question 5: Describe what happens and deduce the effect of the line you just uncommented.