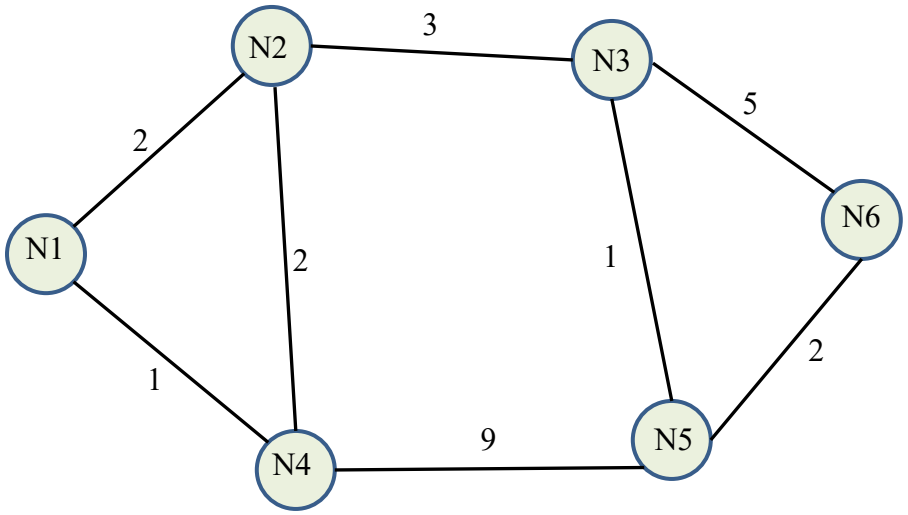
ECGR-4187/5187 Data Communications & Networking-II
Fall 2018 Project-1
Evaluation of Adaptive Routing using Dijkstra's (Due: Friday 11/30/2018)

OBJECTIVE:

Apply Dijkstra's algorithm to a network with adaptive link costs, to evaluate the effect of adaptation rate on network stability and performance.

PROCEDURE:

1. Download a C code for the Dijkstra's algorithm from the course website. This program calculates the least cost paths for a sample 7-node network. Now apply the program to the network shown in the Figure below and obtain the routing table using the program. Assume that link costs are the same in both directions.



2. Next, develop a program that can be used to evaluate the effect of adaptive routing that changes the link cost based on the current load on the link. Develop your own code to go through successive steps of link-cost adaptation in a loop as follows:

   (a) **Initialization:** Define a link cost matrix $cost(i,j) = W(i,j)$, where $W(i,j)$ represents the initial link costs from node i to j as shown in the above figure.

   (b) **Least cost routing:** Apply Dijkstra's algorithm to obtain the least-cost routes of all nodes to node 1 in the given network using the cost matrix $cost(i,j)$.

   (c) **Link load computation:** For the set of routes obtained in (b), calculate the number of transmissions on each link $L(i,j)$, assuming that each node transmits one unit of data to be forwarded to node 1 (N1).

   (d) **Cost adaptation:** Adapt the link costs as follows, where p is a variable parameter:

   $$cost(i,j) = (1-p) \times cost(i,j) + p \times (W(i,j) + 5 \times L(i,j))$$

   (e) **Repeat:** Repeats steps (b)-(d), in each step obtaining the following outputs:

      i. Number of transmission on links 3-2 and 5-4.

      ii. Calculated costs on links 3-2 and 5-4.

(f) The above steps should be repeated for a sufficient number of times until a stable pattern is observed for each of the following values of $p = 0.2, 0.4, 0.6, 0.8, 1.0$.

(g) Report your observations and discuss the results on the effect of adaptive routing as above in regard to stability and performance.

3. ECGR-5187 students: also perform the following

   (a) Plot the total number of transmissions in the network

   (b) Can you suggest additional adaptation ideas to improve stability and performance?

   (c) How would you need to change your code if the link costs were not symmetrical, i.e. $cost(i,j) \neq cost(j,i)$ [No need to develop the code, but write the changes needed.]

4. Project Report: Write a report on the experiments performed, results obtained, and your conclusions from the above results. Try to be analytical, i.e. explain the results well.

GUIDELINES: This project must be performed individually be each student. Any kind of copying will be punished. You may be asked to demonstrate that you have developed the program(s) yourself and obtained your own results, you understand the results, and developed your own conclusions.