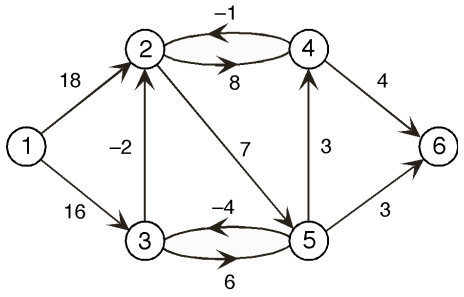
MthSc 814 **Assignment #3** Fall 2012

Due 10/27/11

1(a) Apply the **FIFO** label-correcting algorithm to find the shortest path tree rooted at node 1 in the network *G* below. Assume that the adjacency list of each node is processed by *increasing* head node. Show at each step LIST = [top, …, bottom], the distance labels, and the node being scanned. Upon termination, display the shortest path tree.

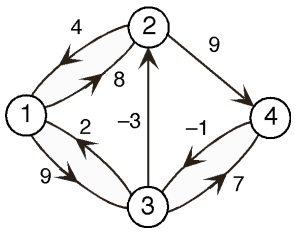
(b) Now apply **Pape's** label-correcting algorithm to find the shortest path tree rooted at node 1 in the same network *G*. Show the same information as specified in part (a).



2(a) Use the Floyd-Warshall algorithm to find all shortest paths in the network given below. Show both the distance label and the predecessor matrices (*D*, *pred*) at each step.

(b) Upon completion of the algorithm, use the final information to derive a shortest 1-4 path and also a shortest 4-1 path. Clearly show your reasoning.

(c) Now suppose that the length of arc (2,4) is changed to 2, which creates a negative length cycle. Carry out the required steps of the Floyd-Warshall algorithm, showing the *D*, *pred* matrices at each step. Document how and when the negative cycle is *detected*, and show how it can be *identified* from the generated information.



3. AMO, Problem 6.13. At each iteration, show the current flow **x**, the residual network $G(\mathbf{x})$, and the (*longest*) augmenting path selected. [Disregard instructions about decomposing the flow at each step.] Also, derive the minimum cut (set of *arcs*) produced by the labeling algorithm and verify that the max-flow min-cut theorem holds.