**EASTERN MEDITERRANEAN UNIVERSITY**



**Department of Industrial Engineering**

**IENG516 Network Flows**

**HOMEWORK 6 Spring 2016-17**

1. Find the shortest path from node 1 to all the nodes in the following network. Identify the shortest path tree obtained.

1

7

3

4

6

56

1

6

2

1

7

2

2

2

5

3

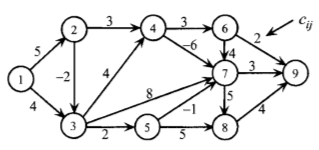
2

*cij*

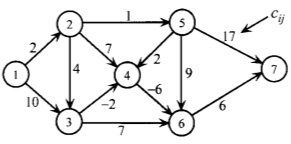
7

4

1. Show that at optimality of the shortest path problem *wi-wm* represent a lower bound on the cost of the shortest path from node *i* to node *m* for each *i*.
2. Find the shortest path from node 1 to every other node in the following network. Identify the shortest path tree obtained. Find the optimal solution of dual problem.



1. Find the shortest path from node 1 to all nodes for the following network using Dijkstra's algorithm as well as using the PSP algorithm. Identify the shortest path tree obtained. Now consider arc (6,3) with cost -7 instead of the current arc (3,6) with cost 7. Solve the problem again and find the negative cost circuit.



1. Suppose that you are to find the shortest simple path from node *1* to node *m* in a network that may contain negative cost circuits. Furthermore, suppose that you have obtained an optimal solution to the minimum cost flow problem on this network after designating *b1 = 1, bm = -1*, and *bi = 0* otherwise, and setting bounds on all the arcs *(i,j)* in the problem. How would you identify the simple path from *1* to *m* that has a flow of one unit in this solution? Why is this not necessarily the shortest simple path from *1* to *m*? Provide a mathematical formulation of the problem of determining a shortest simple path.
2. Find the minimal spanning tree for the following network. Write the dynamic mathematical linear programming of the problem.

2000

2

7

1100

1300

2200

800

5

1000

4

1

2600

7

1400

780

300

6

3

1300