Homework solution #10, IEOR E3608 Intro. to Mathematical Programming

1. page 411, A6

   Node i=beginning of year i, i=1,2...7

   (Note: beginning of year 7=end of year 6)

   $c_{12} = 60, c_{13} = 90, c_{14} = 130, c_{15} = 190, c_{16} = 260, c_{23} = 60,$

   $c_{24} = 90, c_{25} = 130, c_{26} = 190, c_{27} = 260, c_{34} = 60, c_{35} = 90,$

   $c_{36} = 130, c_{37} = 190, c_{45} = 60, c_{46} = 90, c_{47} = 130, c_{56} = 60,$

   $c_{57} = 90, c_{67} = 60.$

2. page 412, A10

   For a networ with N nodes,1,2,...,N. We create a node 0 with net supply of N-1 units and create an arc (0,1).We give node 1 a net supply of 0 and nodes 2,3,...,N a net demand of 1. In the optimal solution for this transshipment problem, the single unit shipped from node 1 to node i will be shipped along the shortest path from node 1 to node i; if the single unit shipped from node 1 to node i in the "optimal solution" was not shipped along the shortest path from node 1 to node i, then by transferring this unit to the shortest path from node 1 to node i would give ua a better solution to the transshipment problem, thereby contradicting the assumed optimality of our current solution.

3. page 424, figure 22

   maximum flow=9. min cut set={2,4,si}. Capacity of cut=3+1+3+2=9.

   SEE FIGURE.

4. page 424, B12

   Construct a "supersource" that has arcs of infinite capacity leading to each real source. Also construct a "supersink" that has infinite capacity arcs leading from each real sink to the supersink.

5. page 424, B16

   There are 4 month-nodes and 3 project-nodes. All arcs from month i to project j have a capacity of 6. Project 1 has conection with month 1,2,3. Project 2 has connection with month 1,2,3,4. Project 3 has connection with month 1,2. Source node has arcs to all month-nodes with capacity 8. All project-nodes have arcs to sink node.

   All projects can be completed if and only if the maximum flow from source to sink equals 30.

6. page453, A3

$Node$	$NetOutflow$
$Detroit$	6500
$Dallas$	6000
$City1$	-5000
$City2$	-4000
$City3$	-3000
dummy	-500

All arcs from Detroit or Dallas to city 1, 2, 3 have a capacity of 2200. Other arcs have infinite capacity.

Arc	$ShippingCost$
$Detroit - city1$	2800
$Detroit - city2$	2600
$Detroit - city3$	2300
$Detroit -$ dummy	0
$Dallas - city1$	2300
$Dallas - city2$	2000
$Dallas - city3$	2000
$Dallas -$ dummy	0

7. page 459, B4

   (a) clearly MST has length 1+1=2.

   (b) See picture below.
   Length of MST=AD+DC+DB=3DC=$\sqrt{3} < 2$.

   SEE FIGURE

8. page 454, B7

   SEE FIGURE.