

Math 3401 (Ng/Spring 2009) Assignment 9 (last one ☺) NOT due, but must know how to do these for finals
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- Under what conditions will a *minimum cost network flow* problem, (*MCNF*), always yield at least an optimal solution with integer values for all its flows, if an optimal solution exists? Why? Justify your answer.
- Given an instance of the (*MCNF*) with capacity on a directed graph $G = (V, A)$; c_{ij} , the unit cost of flow on every arc $(i, j) \in A$; b_k , the net supply on every vertex $v \in V$; and u_{ij} , the capacities of flow on every arc $(i, j) \in A$, we eventually want to find an assignment of flow x_{ij} on every arc $(i, j) \in A$ such that all demands are satisfied and all supplies are exhausted and to do so at minimum total cost.

Figure 1 shows an instance of the (*MCNF*) with capacity.

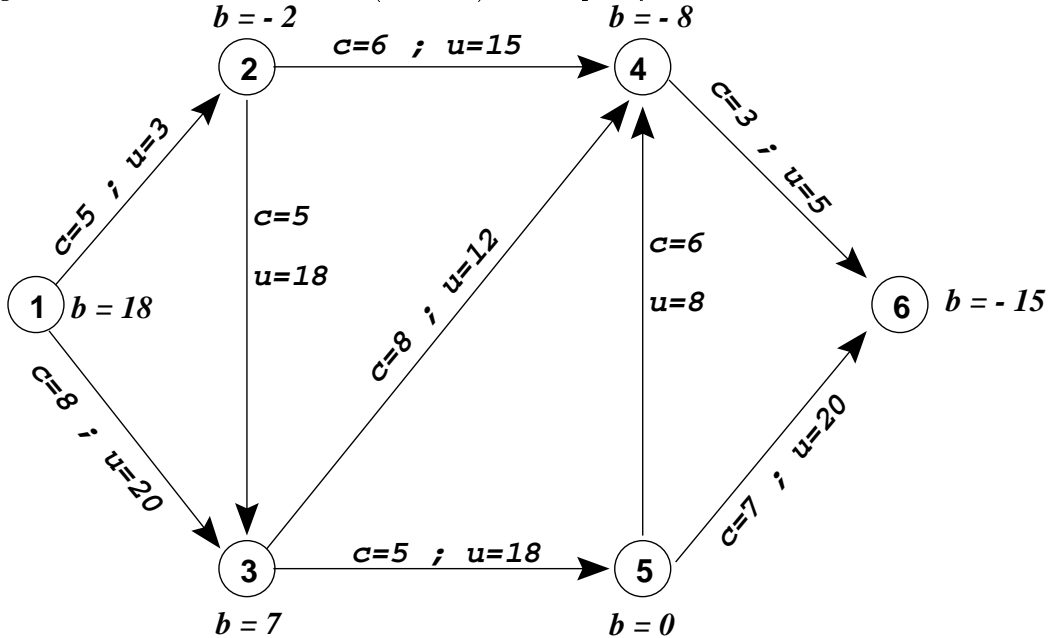


Figure 1 : An instance of Capacitated MCNF: $G = (V, A)$; $c_{ij}, u_{ij}, \forall (i, j) \in A; b_k, \forall k \in V$

- Transform the above MCNF with capacity into a MCNF without capacity. Show the new directed graph and all the information needed for the MCNF without capacity.
- Set up the *LP* model of the MCNF without capacity.
- Solve the MCNF *without capacity* using TORA by solving the the *LP* model of the MCNF without capacity.
- Translate the optimal solution for the MCNF without capacity into an optimal solution for the original problem, MCNF with capacity. Show what the optimal solution looks like in the original problem

Note: optimal solution means both optimal solution point and optimal value.