

CO 602/CM 740: Fundamentals of Optimization

Problem Set 6

H. Wolkowicz

Fall 2011.

Handed out: 2011-Nov-2
Due: Thurs, 2011-Nov-10, by Midnight

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1 Finding a Feasible Solution for A Network Flow Problem

Show that a feasible solution to a capacitated network problem (if one exists) can be found by solving a maximum flow problem.

2 The Marriage Problem

A small village has n unmarried men, n unmarried women, and m marriage brokers. Each broker knows a subset of the men and women and can arrange up to b_i marriages between any pair of men and women that she knows. Assuming that marriages are heterosexual and that each person can get married at most once, we are interested in determining the maximum number of marriages that are possible. Show that the answer can be found by solving a maximum flow problem.

3 Nurse Scheduling

A hospital is trying to hold staff levels as low as possible while maintaining sufficient health services. The hospital has three departments:

1. the emergency room
2. neonatal intensive care nursery
3. orthopedics

The hospital has three work shifts with different requirements for staffing and it would like to identify the minimum number of nurses to satisfy the following three constraints:

1. The number of nurses for the three departments must be at least 13, 32, 22, respectively (over all the shifts).
2. The number of nurses for the three shifts must be at least 26, 24, 19, respectively (over all the departments).
3. The minimum and maximum number of nurses allocated to each department in a specific shift must satisfy the limits in the following Table

		Department		
		1	2	3
Shift	1	(6,8)	(11,12)	(7,12)
	2	(4,6)	(11,12)	(7,12)
	3	(2,4)	(10,12)	(5,7)

Model the scheduling as a *maximum flow* problem to find the minimum number of nurses to satisfy all the constraints. Solve the problem using MATLAB and linprog. (Hint: Use a set of three nodes for the departments and another set of three nodes for the shifts.)