C&O 370
HOMEWORK 3

Due: Monday, October 30

Reading

Chapter 8	(pp. 310-326)	Network Models
Chvatal	(pp. 291-299)	Transshipment Problem/(pp. 367-378) Maximum Flow Problem

Problems

3.1 [25]

A mathematics class is partitioned into 20 teams of students. Each team is required to produce an applied research project based upon one of eight given problems. The instructor stipulates that at most three teams may work on the same problem and that every problem must be done by at least one of the teams. Each team submits a ranking of the eight problems, giving a "1" to the most desirable, a "2" to the next most desirable and, finally, an "8" to the least desirable. Thus, large ranking numbers indicate *undesirability*.

(a) Develop a model for determining how the instructor should assign problems to teams so as to minimize the sum of the ranking numbers of the assigned problems. Draw and label the appropriate network.

(b) Describe how your model from part (a) would change if the objective was to minimize the maximum ranking number of an assigned problem.

3.2 [25]

On a given morning, 26 patients arrive at Heal-Fast Hospital. Before being admitted for treatment, each patient is first classified into one of 7 treatment groups according to the type of treatment he/she requires. Patients assigned to a given treatment group can be treated only in certain designated units from among the set (a, b, c, d, e, f). The number of available spaces in these units is 5,5,4,4,4,4, respectively. The treatment group classification and designated units data are as follows:

Number of Incoming Patients	Treatment Group	Designated Units
5	1	c, f
3	2	b, c
2	3	a, e
5	4	b, c, d
2	5	a, d
5	6	b, d, f
4	7	a, c, e

(a) Develop a model for determining how the hospital should assign these patients to allowable designated units so as to maximize the total number who can be admitted for treatment.

(b) Solve your model from part (a), and verify the optimality of your solution.

Case Study #2
[50]
A manufacturer of nuclear reactor components has a monthly production capacity of 100 components in each of the months January, February and March and a demand of 70,90 and 90 components for delivery at the end of January, February and March, respectively. The plant is required to produce a minimum of 50 components in each of the months of January and February and may store in inventory a maximum of 30 components in each of the months February and March.

Unit production costs, in ($\$ \times 100$)/component, for January, February and March are 4,7 and 4, respectively. If February's demand is not met on time, then any shortage can be made up from March's capacity at a cost of 6($\$ \times 100$)/component. Inventory-holding cost is 2($\$ \times 100$)/component in both February and March. In Feburary, there is a penalty cost of 2($\$ \times 100$)/component for unused production capacity.

You have been asked by the manufacturer to develop and solve a model for determining a production schedule which meets these demands and minimizes total cost. Total cost is the sum of production, inventory-holding and penalty (for unused production capacity) costs.

The manufacturer would also like to know how to solve similar problems using GAMS. A carefully labeled network might help the manufacturer understand your model.