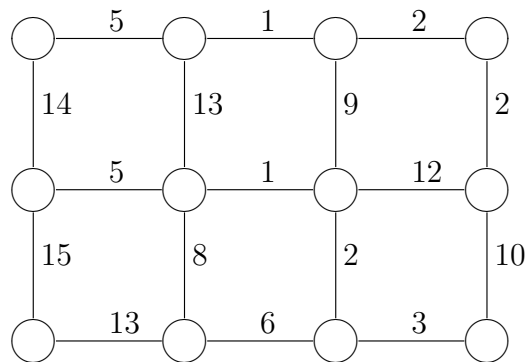


620-362 Applied Operations Research

ASSIGNMENT 3

This assignment is due at 5pm on Friday 31st October 2008. It is to be completed
INDIVIDUALLY.

1. **10 marks** Find a minimum spanning tree in the following network using BOTH Prim's and Kruskal's Algorithms. Show all steps in the algorithm.



2. **10 marks** Solve the following system of difference equations or prove it has no solution using the Label-Correcting Algorithm with a Queue as described in lectures:

$$x_1 - x_5 \leq -2$$

$$x_2 - x_1 \leq -3$$

$$x_3 - x_2 \leq 12$$

$$x_4 - x_3 \leq -1$$

$$x_5 - x_4 \leq -4$$

$$x_2 - x_5 \leq -1$$

$$x_1 - x_3 \leq -2$$

3. **30 marks** For each of Dijkstra's Algorithm, The Reaching Algorithm and Label-Correcting with a Queue:

- Describe the networks for which the algorithm is applicable.
- Draw a directed network with 5-7 nodes for which the algorithm can find a shortest path. Your network should be such that as few of the other methods as possible are able to solve it.
- Find the shortest path in your network, showing all steps in the algorithm.

4. **20 marks** You have been employed by PilloSoft, a company which manufactures pillows, to help with their supply chain management. The Melbourne warehouse has the following predicted demands for pillows:

Month	August	September	October	November	December
Demand	3500	4000	3000	4500	5500

The Melbourne Warehouse have 1000 pillows in stock at the start of the planning period and are required to have 1000 pillows at the end of December.

It costs PilloSoft \$1 for each month a pillow is in stock. The first 4000 pillows produced in a month cost \$10 each to manufacture at the warehouse. If required, PilloSoft can produce up to an extra 1000 pillows at \$12 each using overtime labour.

- Formulate the PilloSoft problem as a network flow problem, stating any assumptions made. Be sure to specify costs and bound for each arc as well as inflows for each node.
- Show a feasible flow through the network and state its cost.
- Write down the LP formulation of your network flow problem.

5. **10 marks** PilloSoft, happy with your work so far, ask you to extend your model. They have a new option for obtaining pillows, they are able to ship up to 5000 pillows down from their Sydney warehouse. Because of the costs, they are unwilling to ship any amount less than 1500 pillows in any given month. Shipping costs PilloSoft \$8 per pillow. Ignoring costs incurred at Sydney, reformulate the network flow problem to take this into account.