**COE 444 - Internetwork Design and Management**
**Fall 2005 (Term 051)**

# Homework 6

Date: Tuesday, November 29, 2005

**Q1.** Given a network with six nodes, labelled 0 to 5, with node 0 being the central backbone node. The cost of having a link between any two nodes is as indicated in the following cost matrix.

| | **0** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| **0** | 0 | 7 | 8 | 11 | 14 | 17 |
| **1** | 7 | 0 | 6 | 5 | 10 | 12 |
| **2** | 8 | 6 | 0 | 10 | 7 | 14 |
| **3** | 11 | 5 | 10 | 0 | 8 | 8 |
| **4** | 14 | 10 | 7 | 8 | 0 | 9 |
| **5** | 17 | 12 | 14 | 8 | 9 | 0 |

Each of the nodes 1 -to- 5 generates 1 unit of flow to the backbone node. Only one type of link is available which can accommodate a maximum of 3 flow units.

**a.** Find a minimum cost feasible spanning tree using Kruskal's algorithm.

**b.** Find a minimum cost feasible spanning tree using Prim's algorithm.

**c.** Find a minimum cost feasible spanning tree using Esau-Williams' algorithm.

**d.** Discuss and compare the trees obtained with the above algorithms.

***Note: For all algorithms you should show all the steps.***

**Q2.** We would like to construct a minimum cost spanning tree connecting six workgroup switches to the main backbone switch (relay number 1). The flows from the various workgroup switches to the backbone are as follows:

| **Node Number** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Flow in Mbps** | - | 10 | 15 | 5 | 15 | 10 |

Assume that there is a design constraint to have the flow on any link not to exceed 25 Mbps, and that the link costs are as follows:

| | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **1** | - | 2 | 20 | 19 | 3 | 3 |
| **2** | 2 | - | 8 | - | - | - |
| **3** | 20 | 8 | - | 19 | - | - |
| **4** | 19 | - | 19 | - | 4 | - |
| **5** | 3 | - | - | 4 | - | 1 |
| **6** | 3 | - | - | - | 1 | - |

**a.** Use Kruskal's algorithm to construct a minimum cost feasible spanning tree.

**b.** Use Prim's algorithm to construct a minimum cost feasible spanning tree.

**c.** Use Esau-William's algorithm to construct a minimum cost feasible spanning tree.

**d.** Compare the cost of the trees obtained by the three heuristics. In your opinion, which heuristic is better? (You must justify your answer)

***Note: For all algorithms you should show all the steps.***