Computer Laboratory Session 6

Aim

Optimal utilisation of a networks

Objectives

1. To find all shortest paths for a fleet
2. To maximise the flow using a railway system

Challenge – Fleet Optimisation

The Orange Shipping company wants to supply St. Louis in the West and Midwest from Los Angeles with oranges. They want to send all 6 Lorries to St. Louis such that the total travel time is minimised.
Note: Flow can only get into a node from a node with a lower number!

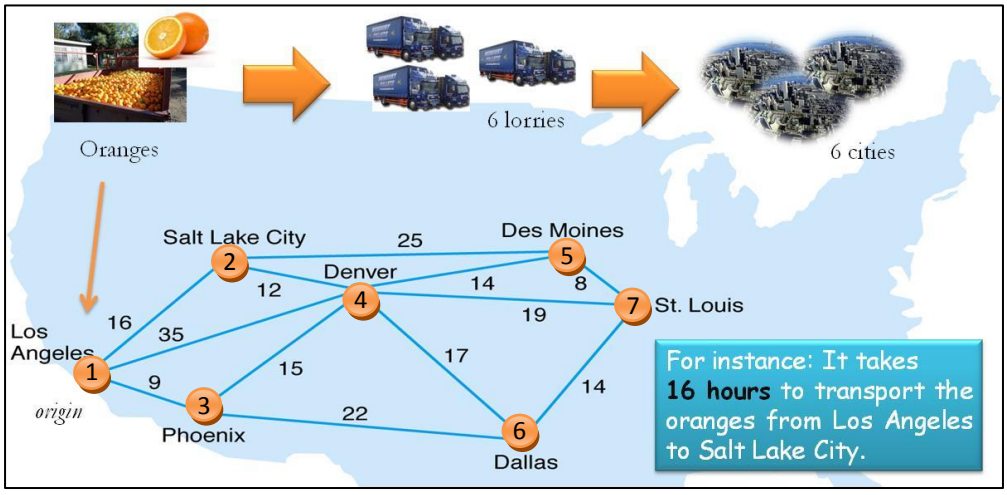

Figure 1 Network of Cities, Links and Travel Times.

Tasks

1. Add all edges (branches, links) plus flows (travel time) into Excel
   a. What is the maximum time? [Intermediate]
   b. What is the minimum time? [Advanced]
2. Provide arbitrary decision variables whether to use an edge
   a. What is the meaning of a decision variable?
   b. How many edges will be used? [Advanced]
3. Formulate the constraint for Los Angeles
   a. What decision variables are used?
   b. What statements (e.g. min, max) can you make about their sum? [Advanced]
4. Consider node two and the conditions it has to fulfill
   a. What are the incoming arcs?
   b. What are the outgoing arcs?
5. Formulate constraints for node 3, 4, 5 and 6 as before
6. Consider node 7 and formulate the constraint [Intermediate]

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Challenge – Network of railway system

The company Scott Tractor want to send as many rail road cars as possible from Manchester to Edinburgh. Each railway link has a capacity constraint of maximum allow number of railroad cards.

Note: The network is directed!

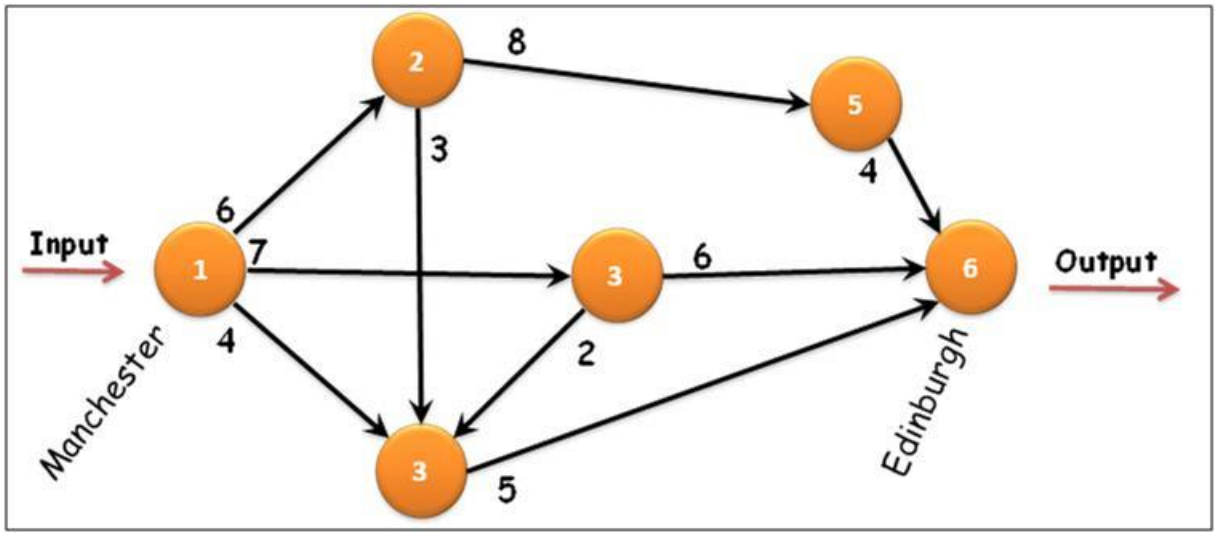

Figure 2 Network of railway system.

Tasks

7. Represent the above network in Excel
    a. Create table of arcs and flows
8. Formulate flow conservation constraints for all nodes
9. Formulate capacity constraints for all arcs
10. State objective
11. Solve prolem using the Excel Solve

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