CEE 598 TRAFFIC SIMULATION AND MODELLING

Assignment 1

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1.Transportation problem:

Cities 1 and 2 have 100K and 200K passengers per year, respectively. Airports 1 and 2 can accept a demand of 150K and 150K passengers per year, respectively. The city-to-airport driving times are listed at right. Please formulate the linear programming problem and solve it using GAMS Solver.

This is the Transportation problem following network flow model in which following terms are defined as follows:
$a(i)$: the demand of city i, $i \in \{1,2\}$
$b(j)$: the capacity of airport j, $j \in \{1,2\}$
$c(i,j)$: the driving time from city i to airport j
(i,j): the passengers traveling from city i to airport j
z: the total travel cost
So, the Transportation problem is formulated as follows:

$$\min \sum_{i,j} \{x(i,j) \times c(i,j)\} \qquad (1)$$

Subject to

$$\sum_{j} x(i,j) = a(i), \forall i \qquad (2)$$

$$\sum_{i} x(i,j) = b(j), \forall i \qquad (3)$$

$$x(i,j) \geq 0$$

In the expression 1 we will minimize the transportation cost. Expression 2 states that the passengers travelling from city I to airport j is equal to the total demand of the cities 1 & 2. Expression 3 indicates that the passengers travelling to airport is equal to the capacity of the airport.

As we can see that the above equations are linear so we will use GAMS solver for solving this linear optimization problem.

2. Shortest path problem (you can assume the link length as 1 as a default value and try different values as a sensitivity test)

In this network model distance c_{ij} is associated with each arc in which path from a particular origin (source) to a particular destination (sink) that has the shortest total distance is computed. The formulation of shortest path problem is as follows:

Minimize

$$\sum_{ij \in A} w_{ij} x_{ij}$$

Subject to

$$\sum_{j} x_{ij} - \sum_{j} x_{ji} = \begin{cases} 1, & \text{if } i = s; \\ -1, & \text{if } i = t; \\ 0, & \text{otherwise.} \end{cases}$$

$$x \geq 0$$

In the above expression we are simply sending one unit of flow from the source to the sink at minimum cost. At the source, there is a net supply of one unit; at the sink, there is a net demand of one unit; and at all other nodes there is no net inflow or outflow.

The above problem is also solved using GAMS solver.