The scenario you must deal with is described below:

a. You work in a large warehouse operating in the e-commerce sector that stores a variety of different SKUs (Stock Keeping Units).

b. You receive a list of orders. You must generate the routes of the picker vehicles that will collect the ordered items from various locations in the warehouse and bring them to a central location for the order assembly.

c. The warehouse is using a scattered storage, or mixed-shelves, policy. Items of the same SKU are stored in different parts of the warehouse, as opposed to being kept in a single location. This policy allows for faster retrieval of ordered items, as it cuts the average travel time of picker vehicles collecting them.

d. You have a homogeneous fleet of 6 vehicles, with an item capacity of 300.

e. The vehicle routes start from, and return to, a central location in the warehouse (depot), represented by node {0}.

f. Each item (node) belongs exclusively to a single family (SKU).

g. Items (nodes) of the same family are of equal size, since they occupy the same capacity in the vehicles.

h. For each family (SKU), there is a predetermined number of required items that need to be collected by vehicles.

The problem calls for the construction of the cost-minimizing vehicle routes. All vehicle routes begin from and terminate at node {0}. Each node N = {1,2,…n} needs to be visited at most once. Not all nodes need to be visited, only the required number from each family. Finally, vehicle capacity constraints must be respected.

Instance File

In the provided instance file, the first line contains five integers: the total number of items (nodes), the number of families, the number of total required node visits, the vehicle capacity and the number of vehicles.

The second line (10 7 …) determines which items are assigned to every family. In our instance, the first ten (10) lines (excluding line 0 which is the depot) of the cost matrix represents the travel costs of the items belonging to the first family.

The next 7 lines represent the items of the second family etc. The third line (2 6 …) contains the family visit requirements. For example, for the first family, two (2) nodes must be visited. For the second family, six (6) nodes must be visited etc. The fourth line contains the size (expressed in the vehicle capacity units) of each node of every family. This means that items of the first family have a size of 28 units etc. The subsequent lines

contain the cost matrix of the node network, where the first node represents the depot and the remaining nodes represent the nodes (items).

Comments

- Also provided are a sample solution and a sol_checker.py file you may use to validate your solutions.
- Your submitted solutions must follow the same format as the one found in the sample solution txt file.
- If your code uses a random generator, one of the following seeds should be used (1, 2, 3, 4, 5).
- Your code should obtain the final solution reported within approx. 4 minutes of run time on a modern processor.