

ISyE 3103 Supply Chain Modeling: Logistics

Summer 2011

Homework 9

Issued: July 20, 2011

Due: July 27, 2011

This assignment is worth 50 points and you are to complete it individually.

Multiple Vehicle Routing

McNish is a chain of supermarkets located in Scotland. You have been hired on as a logistics manager for the firm, and your job entails building vehicle routes for the dedicated truckload services that serve supermarket locations from McNish-operated distribution centers. Suppose you are now looking at a distribution problem from the Aberdeen DC. On a given day, McNish must serve 12 supermarkets from Aberdeen located in Banchory, Clova, Cornhill, Dufftown (where Homer Simpson vacations...), Fyvie, Huntly, Newbyth, Newmill, Peterhead, Strichen, Towie, and Turriff. Each supermarket requests a given number of pallets of goods from the DC, given in the table below:

Supermarket	ID	Pallets
Banchory	(B)	9
Clova	(CL)	7
Cornhill	(CO)	5
Dufftown	(D)	4
Fyvie	(F)	8
Huntly	(H)	8
Newbyth	(NB)	7
Newmill	(NM)	6
Peterhead	(P)	6
Strichen	(S)	6
Towie	(TO)	4
Turriff	(TU)	6

In your contract with the truckload carrier, you can request vehicles each with a capacity of 30 pallets.

1. Suppose that your contract with the truckload carrier specifies that for each truck you request each day, you will pay 400 pounds sterling (the British unit of currency). Therefore, you decide to simply minimize the number of trucks you require to perform

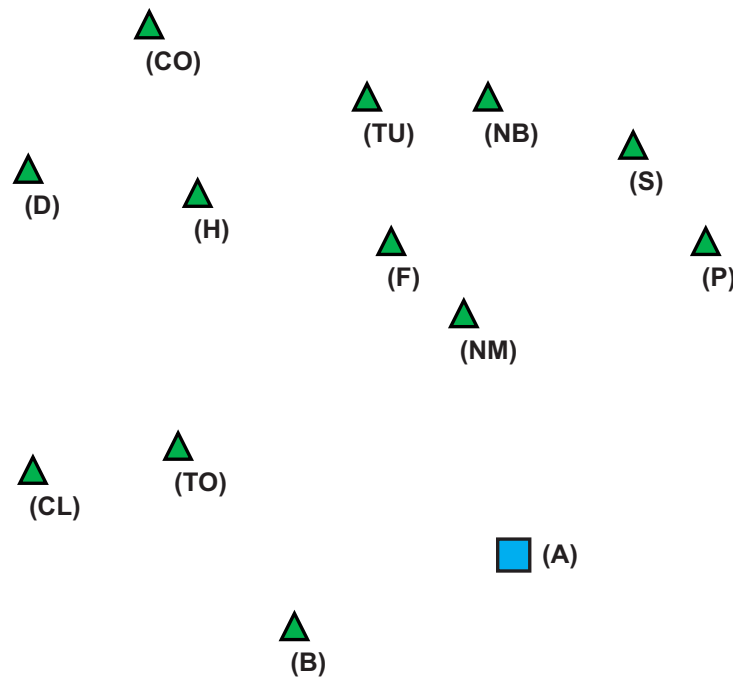


Figure 1: Geographic locations of McNish supermarkets and DC.

- all of the work each day. Use the best-fit decreasing bin packing heuristic to group the supermarkets into vehicle sets. How many vehicles do you require? Why might this solution be infeasible, given that all deliveries might need to be made within a 5 hour period?
2. Suppose instead you wish to develop a solution that is more likely to be feasible. Suppose you have used a minimum-cost path procedure to determine the minimum travel time paths between all pairs of supermarkets, and between the distribution center and all supermarkets. Your results are summarized in the two tables on the next page.
 - (a) Use the sweep heuristic to generate a set of VRP tours. Perform the sweep clockwise starting at Banchory. Use any TSP heuristic to generate the tours for the different trucks. Draw the tours on Figure 2, and report the total times for each tour and the overall total over all tours. Also report how many pallets each truck will deliver.
 - (b) Use the Clarke-Wright heuristic to generate a set of routes. Draw the resulting tours on Figure 3, and report the total times for each tour and the overall total over all tours. Also report how many pallets each truck will deliver.
 - (c) Are these solutions feasible, if each vehicle has 5 hours to complete its tour?

	(A)	(B)	(CL)	(CO)	(D)	(F)	(H)
Aberdeen (A)	0	34	74	89	87	51	65
Banchory (B)	34	0	58	96	87	63	72
Clova (CL)	74	58	0	56	42	70	31
Cornhill (CO)	89	96	56	0	43	42	27
Dufftown (D)	87	87	42	43	0	65	26
Fyvie (F)	51	63	70	42	65	0	43
Huntly (H)	65	72	31	27	26	43	0
Newbyth (NB)	70	90	80	38	74	27	51
Newmill (NM)	37	44	61	68	67	28	44
Peterhead (P)	58	88	117	80	113	63	90
Strichen (S)	62	92	97	52	91	43	68
Towie (TO)	67	54	19	61	47	75	36
Turriff (TU)	67	79	64	27	58	16	35

Table 1: Travel times between cities: Part I

	(NB)	(NM)	(P)	(S)	(TO)	(TU)
Aberdeen (A)	70	37	58	62	67	67
Banchory (B)	90	44	88	92	54	79
Clova (CL)	80	61	117	97	19	64
Cornhill (CO)	38	68	80	52	61	27
Dufftown (D)	74	67	113	91	47	58
Fyvie (F)	27	28	63	43	75	16
Huntly (H)	51	44	90	68	36	35
Newbyth (NB)	0	54	49	21	84	18
Newmill (NM)	54	0	63	57	63	44
Peterhead (P)	49	63	0	30	118	59
Strichen (S)	21	57	30	0	102	35
Towie (TO)	84	63	118	102	0	69
Turriff (TU)	18	44	59	35	69	0

Table 2: Travel times between cities: Part II

3. Recommendations

Using the solutions created in the previous exercises as a starting point, make a recommendation for which supermarkets should be served by the same truck, and what route each truck should travel. Consider improving your solutions by improving the individual tours, moving supermarkets from one truck to another, or swapping two supermarkets between two different trucks. Draw your recommended tours on Figure 4, and report the total times for each tour and the overall total over all tours. Also report how many pallets each truck will deliver.

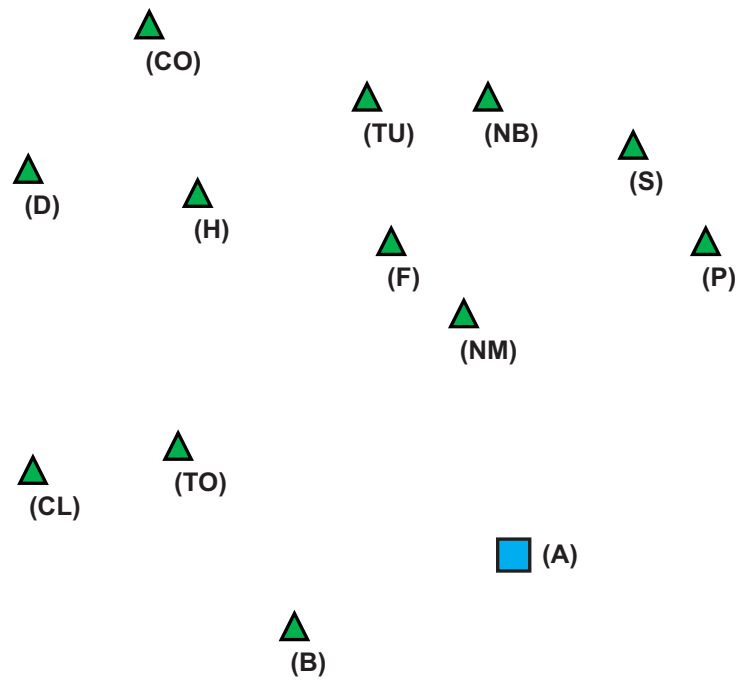


Figure 2: Solution generated by the sweep heuristic.

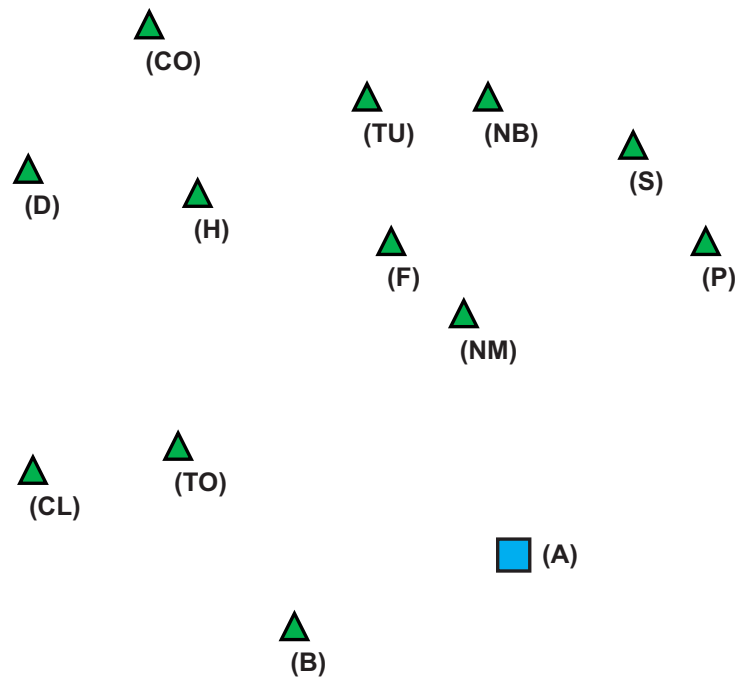


Figure 4: Recommended solution.