SCM.293 Urban Last-Mile Logistics – Homework 2

Bennett Hellman

Problem 1)

Fixed facility cost of hubs = $1000.00

Fixed facility cost of SFs = $1200.00

Cost of first echelon transportation = $2366.35

Cost of second echelon transportation = $11273.93

Number of hubs activated = 1

Number of satellite facilities activated = 3.0

Number of first echelon vehicles employed = 11

Total customer demand (parcels) served through vans = 1135.0

Total customer demand (parcels) served through bikes = 1508.0

Total customer demand (parcels) served through hubs = 0.0

Total customer demand (parcels) served through SFs = 2643.0

Problem 2)

The key indicators for the mixed two-echelon network are shown below. Note that we would expect the objective value to only be better, or the same, since a pure play approach is more restrictive. We see that we need to activate 2 less satellite facilities and rely on hubs much more for distribution. Additionally, we leverage vans more for distribution. We save money with last-mile distribution directly from hubs.

Fixed facility cost of hubs = $1000.00

Fixed facility cost of SFs = $400.00

Cost of first echelon transportation = $892.73

Cost of second echelon transportation = $12731.50

Number of hubs activated = 1

Number of satellite facilities activated = 1.0

Number of first echelon vehicles employed = 4

Total customer demand (parcels) served through vans = 1951.0

Total customer demand (parcels) served through bikes = 692.0

Total customer demand (parcels) served through hubs = 1643.0

Total customer demand (parcels) served through SFs = 1000.0

Problem 3)

Again, removing constraints can only improve our objective value, or make it stay the same and we see the mixed echelon network is cheaper. When we compare the effects of limited-service time, the number of activate hubs and satellite facilities is the same but we rely much more on bikes for delivery in pure play. In mixed echelon, the limited-service time requires us to activate another satellite facility and utilize them more. The objective values are strictly worse with limited-service time, as expected, because the problem more restrictive.

Using only pure play, we achieve:

Fixed facility cost of hubs = $1000.00

Fixed facility cost of SFs = $1200.00

Cost of first echelon transportation = $2366.35

Cost of second echelon transportation = $12542.61

Number of hubs activated = 1

Number of satellite facilities activated = 3.0

Number of first echelon vehicles employed = 11

Total customer demand (parcels) served through vans = 108.0

Total customer demand (parcels) served through bikes = 2535.0

Total customer demand (parcels) served through hubs = 0.0

Total customer demand (parcels) served through SFs = 2643.0

With the mixed-echelon network, we achieve:

Fixed facility cost of hubs = $1000.00

Fixed facility cost of SFs = $800.00

Cost of first echelon transportation = $1770.66

Cost of second echelon transportation = $13107.39

Number of hubs activated = 1

Number of satellite facilities activated = 2.0

Number of first echelon vehicles employed = 8

Total customer demand (parcels) served through vans = 651.0

Total customer demand (parcels) served through bikes = 1992.0

Total customer demand (parcels) served through hubs = 643.0

Total customer demand (parcels) served through SFs = 2000.0