Exercises 2: Optimization in Transport and Logistics

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Opening: 23.05.2013 Exercise: 13.06.2013

The following problem instance is used for the examples 1–7: A Capacitated Vehicle Routing Problem is given. The demand of each customer is 1 and the capacity of the vehicles is 4. Node 0 denotes the depot. The max. route length is 16. Use the Euclidean Distances. The coordinates of the nodes are: 0(0,0), 1(4,1), 2(1,2), 3(0,5), 4(-3,3), 5(-2,1), 6(-5,1), 7(-5,-1), 8(-1,-3), 9(3,-2), 10(6,-1)

1. Demonstrate the **Sweep Algorithm**.
2. Compute the matrix with **savings values**
3. Demonstrate the **sequential** Savings Heuristic.
4. Demonstrate the **parallel** Savings Heuristic.
5. Demonstrate **insertion based** construction heuristics (e.g., nearest neighbor, parallel insertion, ...)
6. Demonstrate the **Fisher and Jaikumar Algorithm**. Determine three seed customers by farthest away method.
7. Demonstrate **local improvement methods** discussed in the class on the basis of so far constructed routes.
8. Demonstrate the **Beasley algorithm** on following graph: depot (0,0), a(-40,10), b(-30,30), c(0,50), d(40,30), e(70,10). The capacities of the customers are: a=5, b=4, c=4, d=2, e=7. The maximum capacity of the vehicle is 10. Take nearest neighbor insertion to get the giant tour.
9. Compute the **forward time slack** and the new arrival, departure and waiting times for the following example:

i	e_i	l_i	A_i	D_i	W_i
0	07:00	19:00	–	07:00	–
1	10:00	13:00	08:00	10:00	2h
2	10:00	13:00	10:30	10:30	–
3	15:00	17:00	11:30	15:00	3.5h
4	07:00	19:00	16:00	–	–

with travel time $t_{01} = t_{23} = t_{34} = 1$h and $t_{12} = 0.5$h