Shanghai Jiao Tong University ECE4530J

Homework 4: Due 2021.7.12

Instructions

1. Please clearly label the problem numbers in your response.
2. Attach any codes at the end of your response.
3. If you hand-write, please keep your response neat and readable.

Problem 1: Suppose that we have 3 data centers $\{1,2,3\}$ and consider $T = 3$. Consider the following parameters:

Data center index i	Substation capacity C_i	Background demand B_i^t	Local marginal price α_i^t	Sensitivity β_i
1	1	0.5	0.1	0.05
2	2	0.5	0.2	0.05
3	2	1+0.05t	0.1+0.01t	0.05

a) Use a random number generator to generate E_i^t such that $0 \le E_i^t \le q_i^t$ for all i and for all t.

b) Arbitrarily select s such that

$$E_i^t \le s_i^t \le \frac{\alpha_i^t}{\beta_i} + E_i^t \qquad 1 \le i \le N,\ 1 \le t \le T.$$

c) Compute the objective function with your selection of s in part b). Assume $\theta = 0.5$. (No optimization needed.)

Problem 2: Consider again the model in problem 1. Suppose that

$$L_t = 1,\ 1 \le t \le T$$
$$d_i^t = 1,\ 1 \le t \le T, 1 \le i \le N$$
$$D = 20$$
$$M_1 = M_2 = 3,\ M_3 = 5$$
$$\mu = 5$$
$$a = 0.1,\ b = 0.02,\ c = 0.1$$
$$s_i^t = 1,\ 1 \le t \le T, 1 \le i \le N$$

a) Construct a feasible solution λ_i^t, x_i^t for all i, t. Compute the corresponding objective value.

b) Find another feasible solution that improves the objective value with respect to that in part a).

Problem 3: Suppose now we want to solve the two-stage problem. We use a **heuristic** algorithm.

a) Consider your results in problem 2 part b). Keep improving your solution to the stage-2 problem until either (i) you have completed 5 iterations or (ii) you can no longer improve your solution. Let's use this solution as the "optimal" solution associated with $s_i^t = 1,\ 1 \le t \le T, 1 \le i \le N$. Note that you can compute an objective value for the stage-1 problem

now.

b) Find another s such that, with the updated value s', if you repeat the procedures in part a), you obtain a better objective value for the stage-1 problem than part a).

c) Conduct another 3 iterations of s. Plot how the stage-1 objective value changes as you iterate.