C&O 370/CM443 Deterministic OR Models – W11

Project II: Nuclear Facility Building Planning Problem

Due Wed. Mar. 2??, 2011

Due at the start (9:30-ϵAM) of class on the due date,
or under the door MC6065 by midnight-ϵ before the due date.

Bruce Power has obtained a new piece of land near its location $250KM$ northwest of Toronto. It has identified n sites where n new buildings are to be placed. Each building has a special function.

Let:

a_{ij}	be the walking distance between sites i, j
$A = (a_{ij})$	the distance matrix (symmetric)
b_{st}	be the number of people that move between buildings s,t
$B = (b_{st})$	the flow matrix (symmetric)
c_{is}	be the cost of locating building i in site s
$C = (c_{is})$	the location cost matrix

1. Formulate a mathematical model to decide which building goes into which site in order to minimize the total travel distance of all the people, while simultaneously minimizing the location costs.

2. Formulate the above model in AMPL. With each value of $n \in \{4, 5, 10, 15\}$ randomly generate (integer) data for the matrices A, B, C and solve this problem, or a relaxation, using AMPL.

3. Suppose that building number 1 houses the *primary containment including the reactor*; while building 2 houses the *emergency diesel power generators and emergency batteries*. Modify the model and ensure that minimizing the distance between these two buildings is a high priority. Repeat Item 2 for this new problem.

4. Suppose that there is a river without a bridge between sites 1 and 2. Using the same data as you obtained above with $n = 5$, formulate and solve the shortest distance problem between these two sites using the distances that are known. Then re-solve the problem. How much should Bruce Power be willing to pay to build a bridge between these two sites?