

## HW 2: Single-Facility Location

ISE 754: Logistics Engineering

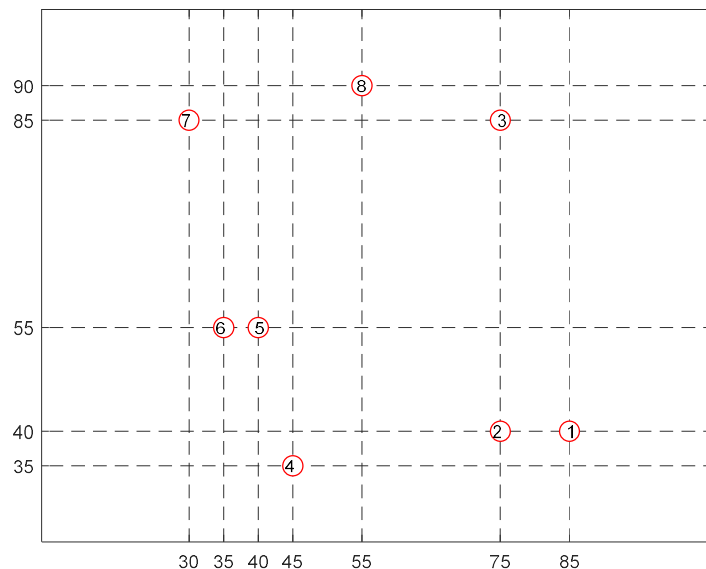
Fall 2020

Assigned: Thu, 20 Aug (Groups of 2)

Due: 11:59p, Thu, 27 Aug

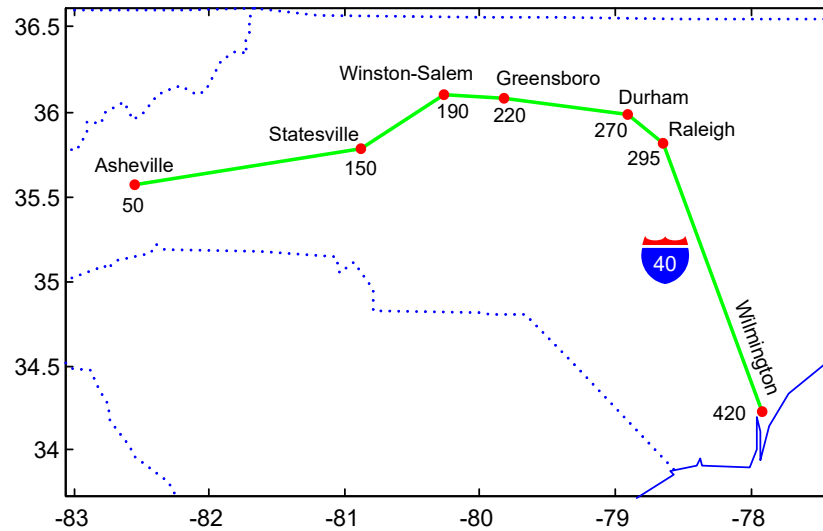
Please, first, solve questions 1 and 2 by hand (you can submit a scanned copy of your solution, or you can just turn in a paper copy in class) and then, for all three questions, please create a script in Matlab that performs the calculations needed to answer each question, one cell for each part of each question. You should create (or download, see Schedule) the function `iff.m` for use by your script. Please submit your script and diary output file via Moodle.

1. A new tool crib is to be located on the floor of a facility. Workers from eight different workstations will make 11, 46, 36, 20, 32, 23, 20, and 18 trips per shift to the tool crib. The 2-D locations of the workstations are shown in the figure below. Assuming rectilinear distance is a reasonable approximation of the actual travel distance, determine the optimal location for the tool crib that will minimize the total distance that the workers travel. (Note: you can use `fminsearch` in your script to find the optimal location.)

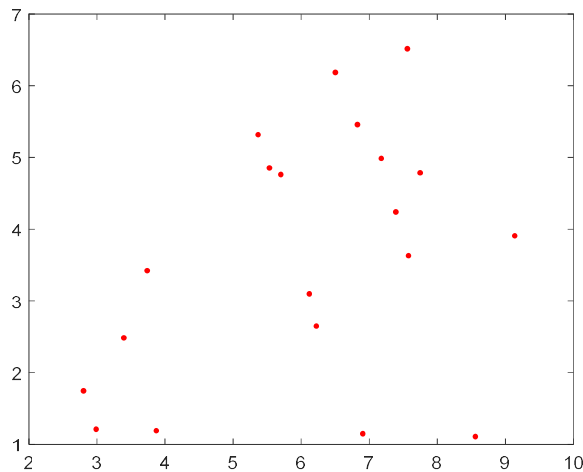


2. A product will be produced at a single plant. Each ton of the product requires 2 tons of raw material A from a supplier located in Durham on the figure above (right), 0.55 tons of raw material B from a supplier located Statesville, 1.2 tons of raw material C from a supplier located in Wilmington, and 0.35 tons of raw material D from a supplier located in Asheville. The annual demand for the product for the four customers located in Asheville, Winston-Salem, Greensboro, and Raleigh are 10, 38, 20, and 46 tons, respectively. The cost per ton-mile to ship the raw materials A, B, C, and D to the plant is \$0.08, \$0.05, \$0.15, and \$0.03, respectively, and the cost per ton-mile to ship the finished goods from the plant to the customers is \$0.80. All scrap is disposed of locally. (a) Assuming that I-40 will be used for all travel, where should the plant be located in order to minimize transportation

costs? (b) With respect to its monetary weight, is the product weight gaining or weight losing?



3. Using `rand` with seed 2073 (`rng(273)`), locate twenty points within the rectangle defined by (2,1) and (10,7).
  - (a) Determine the location that minimizes the sum of the squared-Euclidean distances.
  - (b) Determine the location that minimizes the sum of the Euclidean distances.
  - (c) Determine the location that minimizes the maximum Euclidean distance.
  - (d) Determine the location that minimizes the sum of the Euclidean distances, with the restriction that the location cannot be within the rectangle defined by (5,3) and (7,5). The straight line from the location to any point can cross the rectangle (e.g., if the location restriction is due to zoning, then travel across the zone can still occur).
  - (e) Determine the location that maximizes the minimum Euclidean distance, with the restriction that the location must be within the rectangle defined by (2,1) and (10,7).



4. Please solve, by hand, the 1-D cooperative location problem in slides no. 28, 29 from “Type of Location Problems” in Moodle for  $k = 3$ . Verify that your solution is correct by generating a plot of the “Normalized TC vs mile” as in slide no. 29. Interpret what happens when “ $k$ ” goes higher and higher.