ORIE 5129: Data Science for e-Retail and the Sharing Economy
Project

You will complete this project in teams.

Due May 18, 12:00 pm

An online retailer is planning the locations of 3 fulfillment centers (FCs) that will be used over the next 20 years. The first FC will be opened immediately and will be the only operational FC for the next 6 years. After 6 years, a second FC will be opened and the retailer will operate the two FCs concurrently for another 5 years. After a total of 11 years, a third FC will be opened and all three FCs will be operational for another 9 years. The retailer would like to choose the locations of these three FCs.

In the attached spreadsheet, the first tab shows the x and y coordinates of the demand points (DPs) that the online retailer serves. There are 20 DPs. Each DP is served by the closest FC. The yearly cost of serving a DP from a certain FC is simply the Euclidean distance between the DP and the FC. The second tab shows the x and y coordinates of the possible locations for the FCs. There are 10 possible locations for FCs.

(a) Formulate an integer programming model to choose the locations of the first, second and third FCs so that the total cost over the next 20 years is minimized.

(b) Write a Python program that solves the integer programming model in Part a. Accompanying the project description, there is a small Python program that you can use to plot the locations of your FCs and DPs, along with which DP is served by which FC. Use this Python program to give three plots. The first plot should show the location of the first FC and the assignment of DPs to the first FC. This is the situation faced by the company over the first 6 years. The second plot should show the locations of the first two FCs and the assignment of DPs to the first two FCs. This is the situation faced by the company over the next 5 years. Finally, the third plot should show the locations of all three FCs and the assignment of DPs to the three FCs. This is the situation faced by the company in the last 9 years.

(c) Collect your results in a report whose main body is about 2-3 pages. Address your report to a manager who is interested in understanding what your model can do and how sound you believe your results are. Start with an executive summary, discuss your model and findings, and conclude with a summary. Defer the technical details, including the full formulation of your integer program and the Python code, to an appendix.

All your team members should write and sign the following pledge: "*Academic integrity is expected of all students of Cornell University at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare that all of the team members contributed equally to all stages of this project.*"