Exam 1

ISE 754: Logistics Engineering **Spring 2019**

Assigned: 3:45p, Wed, 6 Mar Due: 9p, Thu, 7 Mar

This exam consists of three problems that you should solve by yourself outside of class. The exam is open book, open notes, and open software. This is an individual exam and due consideration will be given to the fact that you are working on your own and thus will be producing original and unique work, not to mention the possibility that you might make several minor errors due to the pressure of working under a deadline. If the Instructor has determined that you have collaborated with anyone else on the exam, the few points that you might lose due to these types of minor errors will be far less than the penalty associated with the violation of academic integrity that you would receive.

Instructions:

For each problem, you should provide a concise summary that includes (a) a single paragraph describing your overall approach and final result, (b) justification of all significant assumptions, and (c) a verbal description of your procedure for solving each major non-standard step in your approach (you can just reference any standard approach covered in class without description). The summary will be the reviewed first when grading each problem. If you are not able to computationally solve the problem, then partial credit will be given if you describe a basically correct approach in your summary.

You should submit an electronic copy of your results via Moodle, including all text and Matlab files that you have created. Also, make sure you have installed the latest updates to Matlog; an email will be sent to notify you if any updates occur during the exam period.

Problem 1: 25 pts

A product will be produced at a single plant and 1600, 1600, 2200, 1200, 2600, and 1500 units per year will be sent to customers located in ZIP codes 72118, 55372, 15010, 88012, 87301, and 73099, respectively. Each unit of the product weighs 175 lb, occupies 38.2 ft^3, and requires 4, 3, 1, and 4 units of raw material from suppliers located in Richmond, CA, Canton, OH, Malden, MA, and Tyler, TX, respectively. Each unit of raw material weighs 8, 14, 4, and 29 lb, and occupies 2.7, 1.3, 2.7, and 3.6 ft^3, respectively. Assuming all transport is P2P FTL, determine the city with a population of at least 50,000 in which the plant should be located.

Problem 2: 50 pts

Proion, Inc., has wholesale distributors located throughout the continental U.S. that sell the products manufactured in its three plants. Each plant manufactures the same mix of products. Proion would like for you to determine if they should consider constructing additional plants. The 5-digit ZIP code and annual demand (in tons) for each wholesaler is provided in worksheet *Customers* of spreadsheet *Exam1DataS19.xlsx* (see Course Schedule for data link). In the *Plants* worksheet, the city, state, annual production and procurement cost, annual cost to distribute products to wholesalers, and maximum capacity is provided for each plant. Although the existing plants are capacity limited and should stay open, any new plant can serve any amount of demand.

Problem 3: 25 pts

The following is Question 2 from HW 6:

> On average, 75 tons of a product are shipped 625 miles from your manufacturing plant to your DC each year. The product is produced and consumed at a constant rate throughout the year. Currently, the product is shipped using independent P2P truckloads. What would be the impact on total annual logistics costs if the average interval between shipments was restricted to not exceeding one week and, if the shipment size is equal to one week's demand, then both TL and LTL are considered? The PPIs for TL and LTL are 123.4 and 141.4, respectively; a truck's cubic and weight capacities are 2,750 ft^3 and 25 tons, respectively; each ton of the product is valued at $12,000; its density of 12 lb per ft^3; the inventory carrying rate is 30%; and in-transit inventory costs can be ignored.

You should create a new question that is adapted from Question 2 by changing the following three elements of the problem:

1. Average inter-shipment inventory fraction
2. Maximum shipment interval
3. Estimation of the obsolescence rate using the percent-reduction interval method

For this problem, you should submit (a) the modified text for your question, (b) a script with the solution for your question, and (c) a description of how each of the three changes impacts the solution, where each change is considered separately in isolation from the other two changes (in order to support your description of the results of the change, you should include in your submission three additional scripts for each individual change).