

IE375 Fall 2020 Homework III - Due: November 6, Friday, 17:00

Information on Homework III

- **Homework II is 2%.** Make sure that you review course material before you start. Cite sources used if any.
- **Grading Policy:** The homework grades will not be only based on the correctness of the answers provided, but on the perceived degree of effort on the returned assignment. This means that even without obtaining the correct answers one can obtain full credit. The grade scale will be “2” (full effort, all questions); “1” (some effort or full effort, some questions); “0” (no effort or no submission). The submissions that exceed expectations may get a bonus – grade will be “3” (extra effort). Note that “2” corresponds to a grade out of 100% - 2% of the overall grade in this case. Late submissions will not be accepted.
- The grading scale for each question is 2 points (full effort), 1 point (some effort), and 0 (no effort or no submission). Total points that would lead to your overall HW grade are given below:

Total Points	HW Grade
4+	3
3-4	2
1-2	1
0	0

- **Academic Dishonesty (taken from IE375 Course Information):** Academic misconduct is not tolerated, and violations will be treated in accordance with the University policy. For assignments: Discussion of the course material and working in groups are effective ways of learning. However, this does not mean that you can copy the assignment from one of your friends. You can discuss with your friends, but you should be alone, without any written solution in front of you, when you prepare your assignment. It is extremely important to understand the value of this exercise in the process of learning. Any violation of the above understanding will result measures outlined in the student rules and regulations.
- **Submission Information:** Please send your solution as a pdf file to IE375 Course TA Egemen Elver. Make sure that pdf contains your name, and you mail it from your mail account available in STARS. Also note that if your mail is different than the one provided by Bilkent University, there is a chance that it will be received after the due time.
- **Information on Questions: What is expected? How to study?**

Homework III is on Deterministic Inventory Planning. In both questions you are asked to model and analyze the solution. All the related material can be found in your textbook. Hence, it will be useful for you to over the course material presented in Chapter 4. Specifically, in Question 1) you are asked several questions which includes formulation and solution of a typical case, not necessarily representing an optimization. The second question asks you to use the results of the EOQ problem covered in class and in the textbook. Final parts require you to extend the EOQ.

One final remark: In the exams, please get used to receiving question types that you have not seen before. One useful purpose of homework and exercises is to cover the “routine” so that you can go beyond that during the exams, and elsewhere. Note that these are questions (except the solution of LP) asked in the previous exams of IE375.

PLEASE READ QUESTIONS CAREFULLY. FOR THE QUESTIONS FROM THE TEXT-BOOK THERE MIGHT BE CHANGES IN THE GIVEN VALUES PRESENTED BEFORE THE PROBLEM STATEMENT.

Problem 1

HAL Ltd. Produces a line of high-capacity disk drives for mainframe computers. The housings for the drives are produced in Hamilton, Ontario, and shipped to the main plant in Toronto. Hal uses the drive housings at a fairly steady rate of λ units per year (note that unit might actual unit of one or a box containing more than one housing). Suppose that the housings are shipped in trucks that can hold C housings at a time. It is estimated that the fixed cost of loading the housings on the truck (or trucks if more than one is used at a time) and unloading them on the other end is $\$A$ for shipments of k or fewer housings (we name k as the truckloads; can be greater than C or less than C). Each trip made by a single truck costs the company $\$K$ in driver time, gasoline, oil, insurance, and wear and tear on the truck.

- A) Compute the annual cost of transportation and loading and unloading the housings for the following policies:
 - 1. Shipping one truck per week (this is feasible so you can assume that $52C > \lambda$).
 - 2. Shipping one full truck load as often as needed.
 - 3. Shipping 3 full truck loads as often as needed.
- B) Compute and compare the annual costs for the above policies for the following numerical values: $\lambda = 720$ units, $K = \$160$, $A = \$300$, $C = 40$ units; k can take two values - $k = 120$ or 25 .
- C) For each data set, discuss if you think there are reasons for you to desire not necessarily the option with the lowest annual cost. (Make sure that you read the beginning of Chapter 4)

Question 2

Consider an auto manufacturer that assembles cars in Turkey with a constant rate of 20 cars per day. The car assembly requires engines that are sourced from Japan. Each engine costs the manufacturer 1500 TL and inventory holding costs are 22% of the cost per engine per year. Engines are shipped from Japan over the ocean in one container with a fixed cost of 13000 TL per container. The transportation lead time is 20 days. Assume that the manufacturer works 360 days in a year.

- a) Assume that the container has infinite capacity. How many engines should the car manufacturer order each time? You do not need to have an integer value for the order quantity.
- b) What is the resulting optimal annual holding and setup cost?
- c) What is the time between consecutive orders (cycle length)?
- d) What is the re-order point?
- e) Assume that we are in day 0 and the car manufacturer has 1200 engines in inventory. There are no outstanding orders. When is the first time the manufacturer should place an order to its engine supplier in Japan?
- f) Engines can be shipped from Japan using one standard container (not more than one) and the container has a limited capacity. Assume now that the container can carry at most 75% of the order quantity you found in **Part a**.
 - i. What is the new order quantity the manufacturer would choose?
 - ii. What is the additional annual cost the manufacturer would pay compared to your result in **Part b**?