

IENG332 Production Planning-I

Homework 2

Due date: 24.05.2018

Note 1: Some of the parameters in your homework questions are related to your student numbers. Let A be the last digit of your student number, B be the second digit from the end of your student number and C be the third one. Let's assume that your student number is E.g., if your student number is 134957 then you should take $A = 7$, $B=5$ and $C=9$ in the following homework questions.

Note 2: In your solutions if you have fractional numbers make rounding using 3 digits after the decimal separator. For example if you compute any forecast value as 262.345676445 round it to 262.346. When you compute order sizes in questions 1 to 4 round your order size to the closest integer.

Note 3: Use A4 papers. Write all of your answers by hand. Do not submit computer print-outs. Your writings should be clear and understandable. You should be meticulous while preparing your homeworks. Homeworks like a scribble will lose marks.

Question 1: A company supplies a certain type of product. The demand for product is **5000** unit per year. The unit purchasing cost is \$ **(25+A)** per unit. The fixed ordering cost is \$ **(80+B)**. Unit inventory holding cost is \$ **3** for each year. Backlogging is not allowed.

- What should be the order size (Q^*) in order to minimize the annual total cost?
- What is the total annual cost for Q^* ?
- What is the length of time between two successive orders?
- How many orders will be given in a year?
- What is the average level of inventory?

Question 2: A company supplies a certain type of product. The demand for the product is **5000** unit per year. The unit purchasing cost is \$ **(30+A)** per unit. The fixed ordering cost is \$ **(70+B)**. Unit inventory holding cost is \$ **3** for each year. Backlogging is allowed. If the demand exceeds the inventory, the company estimates that there will be two types of penalty costs associated with the backorder. The loss of goodwill is **\$0.1 per unit short**, and a "bookkeeping" cost of **\$8** per unit short per year.

- What should be the order size (Q^*) in order to minimize the annual total cost?
- What is the total annual cost for Q^* ?
- What is the length of time between two successive orders?
- How many orders will be given in a year?
- What is the average level of inventory?

Question 3: A company produces a certain type of product. The demand for product is **5000** unit per year. The production cost is \$ **(30+A)** per unit and the production rate is **20,000** units per year. The set up cost is \$ **(300+B)**. Inventory holding cost is **15%** for each year. Backlogging is not allowed.

- What should be the size of production batch (Q^*) in order to minimize their annual total cost?
- What is the total annual cost for Q^* ?
- What is the length of time to produce a batch with the size Q^* ?
- What is the length of time between the start points of two successive production periods?
- What is the average level of inventory?

Question 4: A company purchases an item from its supplier. The supplier applies 3 different prices according to the size of the order. The corresponding price is applied for all units in the order. The demand of the company to the item is 60000 units per year. The fixed ordering cost is \$ ($80+A$) per order. Interest rate is 30%.

Order size	$1 \leq Q \leq 500$	$501 \leq Q \leq 1000$	$1001 \leq Q$
Price of the supplier (\$)	50	45	40

What should be the order size (Q^*) in order to minimize the company's annual total cost?

Question 5: The Weighty Trash Bag Company has the following price schedule for its large trash can lines for orders of less than 500 bags, the company charges $30+B$ cents per bag; for orders of 500 or more but fewer than 1000 bags; it charges $29+B$ cents per bag; and for orders of 1000 or more it charges $28+B$ cents per bag. In this case the breakpoints occur at 500 and 1000. The discount schedule is all units because the discount is applied to all of the units in an order.

Consider example, but assume incremental discounts. That is, the trash bags cost $30+B$ cents each of quantities of 500 or fewer; for quantities between 500 and 500 and 1000, to the first 500 cost $30+B$ cents each and remaining amount cost $29+B$ cents each; for quantities of 1000 or over the first 500 cost $30+B$ cents each, the next 500 cost $29+B$ cents each, and the remaining amount cost $28+B$ cents each. We need to determine a mathematical expression

Assume that the company considering what sending order to place with Weighty uses trash bags at a fairly constant rate of 600 per year. The accounting department estimates that the fixed cost of placing an order is $\$8+A$, and holding costs are based on 20 percent annual interest rate.

Which method is better? Why?

Question 6: FnG is a production company. They use 15 different items in their production. The list of these items and some related data are given in the following table. Apply the ABC analysis and find the classes of the items.

item	Unit cost (\$)	Annual usage (unit)
1	$40+A$	200
2	$150+B$	350
3	5	300
4	120	930
5	40	400
6	4	600
7	8	700
8	$10+C$	350
9	1	2500
10	12	180