IE375 Fall 2020 Exercise Set # III

1) **Question from Chapter 4 of your text-book, 7th Edition, p. 245 – Problem 45 (6th Edition, p. 243 – Problem 45)**

Note that this problem is a "sort of real-sized" problem in the sense that you deal with a lot of items simultaneously. We recommend that you use a computerized tool (a spreadsheet or any programming language) to solve the problem.

45. Green's Buttons of Rolla, Missouri, supplies all the New Jersey Fabrics stores with eight different styles of buttons for men's dress shirts. The plastic injection molding machine can produce only one button style at a time and substantial time is required to reconfigure the machine for different button styles. As Green's has contracted to supply fixed quantities of buttons for the next three years, its demand can be treated as fixed and known. The relevant data for this problem appear in the following table.

Button Type	Annual Sales	Production Rate (units/day)	Setup Time (hours)	Variable Cost
A	25,900	4,500	6	$0.003
B	42,000	5,500	4	0.002
C	14,400	3,300	8	0.008
D	46,000	3,200	4	0.002
E	12,500	1,800	3	0.010
F	75,000	3,900	6	0.005
G	30,000	2,900	1	0.004
H	18,900	1,200	3	0.007

Assume 250 working days per year. Green's accounting department has established an 18 percent annual interest rate for the cost of capital and a 3 percent annual interest rate to account for storage space. Setup costs are $20 per hour required to reconfigure the equipment for a new style. Suppose that the firm decides to use a rotation cycle policy for production of the buttons.

a. What is the optimal rotation cycle time?

b. How large should the lots be?

c. What is the average annual cost of holding and setups at the optimal solution?

d. What contractual obligations might Green's have with New Jersey Fabrics that would prevent them from implementing the policy you determined in parts (*a*) and (*b*)? More specifically, if Green's agreed to make three shipments per year for each button style, what production policy would you recommend?

2) Lenovo uses two different types of processors for its laptops: single-core and dual-core. Lenovo sources these processors from three different suppliers. Demands for processors, purchase costs, and fixed ordering costs are as follows:

Processor type	Demand (units/day)	Purchase cost ($/unit)	Fixed ordering cost ($)
Single-core	500	80	10000
Dual-core	1000	100	12000

The inventory holding cost per unit per year is assumed to be 20% of the unit purchase cost for all processor types. Assume 365 days in a year.

(a) Answer the following

i. What is the optimal order quantity for each processor type?

ii. What is the optimal total annual cost (inventory holding costs plus purchase costs plus fixed ordering costs) for each processor type?

(b) Supplier of the dual-core processor makes the following offer: Lenovo can order both processor types for a fixed ordering cost of 12000, of course if both processors are ordered at the same time. However, purchase cost per unit for the single-core processor will increase to 81$/unit.

i. What is the optimal order quantity for each processor type?

ii. What is the optimal total annual cost in this case?

iii. Do you think that Lenovo should accept this offer?

3) Consider the extension of EOQ which allowed for backorders. As an additional parameter to the lot-size, *Q*, we solve for *b*, where *b* is defined as the maximum number of backorders allowed. We also define *p* as the cost of backorders/unit/unit time. With the purchase cost per year being equal to a constant, we exclude that from the objective function.

a) Formulate the problem by writing the average total costs (see lecture notes)

b) One can take the partial derivative of the average total cost function with respect to Q and b; equate these derivatives to 0 (first-order conditions for optimality; obtain two equations to solve for unknowns and obtain the following result, (as given in the lecture notes)

$b^*=\{h/(p+h)\}Q^*$ and $Q^*=\{(2K\lambda/h)*[(p+h)/p]\}^{1/2}$

Using these results, plug those into the average total cost function you have formulated in Part a) and show that it is always less than the average total cost function obtained by EOQ with no backorders

Recall: Average Total Cost (EOQ with no backorders) = $\{2K\lambda h\}^{1/2}$

4) Question from Chapter 4 of your text-book, 7th Edition, p. 208 – Problem 4 (6th Edition, p. 208 – Problem 4)

5) Question from Chapter 4 of your text-book, 7th Edition, p. 208 – Problem 7 (6th Edition, p. 208 – Problem 7)

6) Question from Chapter 4 of your text-book, 7th Edition, p. 216 – Problem 10 (6th Edition, p. 216 – Problem 10)

7) Question from Chapter 4 of your text-book, 7th Edition, p. 219 – Problem 19 (6th Edition, p. 219 – Problem 19)

8) Question from Chapter 4 of your text-book, 7th Edition, p. 245 – Problem 44 (6th Edition, p. 243 – Problem 44)