MATH-H-406 - Dynamic Processes
Exercises session 5: Inventory control

Exercise 1

A supplier of pharmaceutical products has to deliver 600 000 boxes of medicine per year. In case of shortage, the buyer can wait until the product is available again. The supplier estimates that the shortage cost is equal to 0.8 € per day and the storage cost is equal to 0.1 €. The setup cost of a new order is equal to 2 500 € (1 year = 250 days). What is the replenishment rate and how much boxes have to be ordered?

Exercise 2

A small car seller want to know how much cars it has to keep in stock. It knows that the storage cost of a car is equal to 100 € per month (30 days) and the shortage cost is equal to 75 € per day. The manufacturer delivers monthly. The car selling is distributed as follows:

V	0	1	2	3	4	5	6	7	8	9
P(V)	0.02	0.03	0.1	0.15	0.2	0.2	0.15	0.1	0.03	0.02

Exercise 3

A steel reseller wants you to solve its stock management problem. The probability to have a shortage has to be below 11%. The data are:

- Setup cost : 500 €

- Storage cost : 0.50 €

- The demand in 7 days follows a $\mathcal{N}(40, 15)$ (delivery delay)

Exercise 4 (August 2006 exam)

A supplier proposes the following selling conditions for a product:

- The 100 firsts units for 100 €/piece

- The followings for 95 €/piece

The setup cost of an order is equal to 200 €. A customer buys 60 units of this product per month. The interest rate is equal to 0.0005/day. What is the optimal quantity to order? Build a model to solve this problem.

Exercise 5

A seller expects to sell 7 500 units of a product per year. The setup cost is equal to 650 €. Its supplier charges the product 15 €/unit as long as the orders are below 2 500 units. If the order exceeds this limit, the cost is equal to 13 €. Knowing that the seller could invest its money at a rate of 10% per year, how should it manage its stock in order to minimize the costs?

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Exercise 1 (June 2003 exam)

We consider a stock management problem that follows the hypothesis of the basic model of Wilson. The demand is supposed to be constant and is equal to 10 pieces per time unit. The storage cost is equal to 5 € per piece and per time unit and the setup cost is equal to 1 000 €.
What is the optimal strategy? (2 points)
The supplier that manage this stock learns that the demand could be of 15 pieces per time unit and not 10. This scenario can happen, but the first case cannot be ignored either. The supplier plans to have a strategy such that, no matter which case happens, the final cost does not exceed the optimal cost for each scenario by 100 €.
Formulate a constraints on the number of pieces to order that verify this condition. (6 points)
Finally, with the results found, what is the number of pieces to order at each order? (2 points)

Exercise 2 (June 2009 exam)

For the beer festival that lasts 1 day, a village club has to plan the purchase of beer barrel. The beer costs 0.70 € per liter and the selling price is 1.20 € per liter. The unsold beer is assumed by the club.
There is a probability of 70% to have a good weather. In this case, the number of participants will be between 700 and 1 200, with a uniform distibution law. The expected average consumption would be 1.2 l per person.
If the weather is bad, the number of expected participants will be between 600 and 1 000, with a uniform distribution law. The consumption would be 0.8 l per person.
Establish the cumulated probability law (repartition function) of the liters of beer sold during the festival. Taking into account the uncertainty on the quantity of sold beers, how many liters has to be planned in order to maximize the profit?

Exercise 3 (August 2003 exam)

A seller proposes the following selling conditions: the normal price is 3 000 € per unit, but if the number of ordered units exceed 100, the price drops to 2 900 € per unit. The setup cost is equal to 8 000 €. A customer buy 60 units of this product per month. The interest rate is 5.10^{-3}/day. We suppose that a year has 360 days. What is the optimal quantity to order?