**Topic: Simulation for an inventory problem**

Textbook: Chapter 6.5

Part a)

Example and question:

Suppose in the inventory model, customers demanding the particular product appear in accordance with a Poisson process with rate 8 per day, and the amount demanded by each customer is a random variable having the following distribution:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| N | 1 | 2 | 3 | 4 |
| p | 0.7 | 0.2 | 0.08 | 0.02 |

The cost price of the product is $5 per unit and the storing cost is $0.5 per unit for each day. Delivery cost is $10. It takes 2 hours until the order is delivered. The sell price is $12 per unit. If the inventory level *x* is less than the customers demanding, there also would be a loss (the loss is what should have been earned is not earned). Suppose the loss function is *L*(*D,x*)*=*(*D-x*)×2*, x<D* and the shopkeeper adopts the (*s*,*S*)=(10,120).

Suppose there is no inventory for this product at the initial time,

1. Show a trace for the inventory model. In a trace, the type of event, the number of demanding and the current inventory, revenue, profit are all printed out after each event occurs. Plot the inventory level over ten days, and check your result.
2. Use simulation to estimate whether the shopkeeper makes profits during one month? What is the average net profit for one day?

Part b)

Consider a more complicate inventory system which has a retail store and a depot. The store keeps a small amount of inventory on site, and frequently orders replacement stock from the depot. The depot supplies batches of stock to the store, keeps a large amount of inventory, and infrequently orders large quantities of replacement stock. Delivery from the depot to the store should be quite quick, but the lead time for deliveries to the depot could be quite large. Such systems are used when storage at the store is expensive, but storage at the depot is cheap.

The parameters needed to describe this inventory system are

* *D* Demand (at store) ;
* *L1 , L2* delivery time for store and depot;
* *K1, K2* ordering/delivery cost for store and depot;
* *r*  sell price per unit
* h1, h2 holding cost per item per unit time at store and depot
* *L*(*D*,*x*) loss due to shortage (at store)
* (*s1*,*S1*) ordering policy for store
* (*s2*,*S2*) ordering policy for depot

Choose a product you are interested in, and simulate the product's inventory according to this more complicate system. Make the appropriate assumption. Define the ‘events’ and ‘variables’ in your simulation model. Show a trace for the inventory model and estimate whether the shopkeeper will make profits in a given period of time if your ordering policies are adopted.