EXERCISE 2. OPTIMAL PRODUCTION ORDER

(Chapter 3 – Inventory Management)

Consider a company, which produces Christmas ornaments. About six months before Christmas, the company must commit itself to specific production quantities for all its products. Since there is no clear indication on how the market will respond to the new designs, the company uses historical data from the last five years, current economic conditions and other factors to construct a probabilistic forecast (Figure 1).
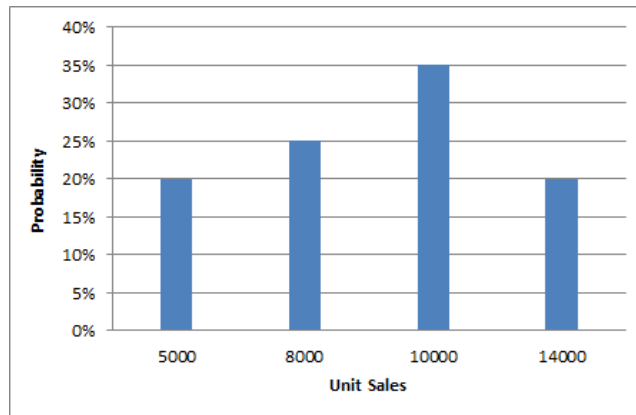
Figure 1. Probabilistic forecast for Christmas ornaments

The company has the following costs in the production of the ornaments:

- To start production, the manufacturer has to invest 10.000€ independent of the amount produced (Fixed cost of production);
- The variable cost of production per unit is equal to 4€;
- During Christmas time the selling price of an ornament is 10€;
- Any ornament not sold during Christmas season is sold to a discount store for 2€ (Salvage value).

Please answer the questions provided below. In your practical report do not forget to critically comment all your answers based on the theoretical classes.

a) Considering the inventory management policies, do a brief literature review (300 words approximately). You can focus on the season demand problem, giving examples of different scientific approaches to the problem, as well as the main problems associated with managing inventory in these circumstances. Is also valuated that you highlighted the main streams of investigation followed by researchers nowadays. Insert your search in the "Methodology section" of your report.

b) Using Excel, determine the optimal production quantity. Represent in a graph the variation of the profit versus the produced quantity (consider all the points of produced quantities between 3.000 and 20.000, with an increment of 1.000 between points).

c) If the variable cost is 7€, what is the optimal production quantity? Can you take any conclusion regarding optimal production quantity, marginal profit and marginal cost?
   i.   Compare with the previous scenario.

d) Company has still some remains from the previous year, 4.000 units. Managers are considering not producing any more units. Do you think this is the best option? If not, how many units would you produce? And if you have 8.000 units in stock, do you have the same opinion? Consider that if you do not produce any more units no additional fixed cost will be incurred. However if you produce a fixed cost is charged independently of the amount produced.
   i.   Do not forget to comment your answer also based all on the graph that relates profit and production for both scenarios.

e) Comment the impact of demand uncertainty and forecasting on inventory management.

f) From the previous analyses we are able to define the associated (s, S) policy. Calculate the recorder point (s) and the Up to level point S.

g) Considering that in this case you have more than one production opportunity and that you continuously look into the inventory of your final product. Calculate the reorder point R, the safety stock and the quantity to produce (Q). Since this is a seasonal product, the ornament is only sold during Christmas Time, namely November, December, and January. For that assume: an expected service level of 95%; an average annual demand equal to the previous exercise with a standard deviation of 930 components; a fixed order cost of 1000€; product cost equals to the company's selling price and holding cost as 20% of that cost; and a lead time of 1 week for production and replenishment. Consider the initial problem description's data.

h) Considering a supply chain perspective, although simplified, where you have a single supplier needed to production needs and a single retailer, and knowing that the lead times from the supplier are 1 week and the one for the retailer is the one previously considered in question g) calculate the reorder points for the supplier; manufacturer and retailer.

i) As the company has expanded to order markets it has now three retailers with and average demand od respectively 705, 500 and 850, and a standard deviation aggregated of 240 units. Calculate in this case the reorder points for the tree levels of the supply chain.