

Problem Statement: One consideration that must be taken into account in the management of inventory is the determination of order lot size. The fixed order quantity lot size decision rule specifies a number of units that are ordered each time that an order is placed for a particular item. This quantity may be arbitrary, such as a two-week supply or 100 units. However, most firms use a quantity known as the economic order quantity (EOQ). The EOQ is the most economical quantity (lowest cost) available under a given set of conditions.

Costs incurred in the lot size decision include carrying costs, preparation costs, stockout costs, and the cost of the item itself. For this problem, we will assume that stockouts do not occur and that the cost of the item is constant for all lot sizes. Under these assumptions, the total annual cost equals the preparation costs plus the carrying costs. Preparation costs are equal to the cost to prepare an order times the number of preparations per year and carrying costs are equal to the average quantity in inventory times unit cost times the cost rate of carrying one dollar of inventory per year.

Given this rather complicated description, the formula for total cost (preparation costs + carrying costs) can be written more simply as:

$$TC = \frac{SR}{Q} + \frac{QCk}{2}$$

where S is the cost to prepare an order,
R is the annual demand,
Q is the lot size,
C is the cost per unit, and
k is the cost rate of carrying one dollar of inventory per year, for example, $k=.15$ means that \$0.15 in carrying costs are incurred for each dollar of inventory.

You should design a spreadsheet that computes the preparation cost $((S \times R) \div Q)$, the carrying cost $((Q \times C \times k) \div 2)$, and the total cost (the sum of preparation and carrying costs). This spreadsheet should compute these values for the thirteen lot sizes 2,000, 2,500, 3,000 ... , 8,000 units.

Then, using this spreadsheet, you should create an XY Scatter plot that plots preparation cost, carrying cost and total cost on the y-axis and lot size on the x-axis. Modify the chart so that the minimum lot size shown is 2,000 and the maximum lot size shown is 8,000. Also have the legend display at the bottom of the chart. Finally, add an arrow and text box to the chart that shows where total cost is at its minimum (hint: it's the point where preparation and carrying costs are equal and it's called the economic order quantity – see below).

With thirteen discrete lot sizes, it is difficult to determine the actual minimum total cost point. So, in addition to the table and chart, the spreadsheet should also compute the actual optimal cost using the EOQ formula:

$$EOQ = \sqrt{\frac{2RS}{kC}}$$

The minimum total cost is the total cost computed at the EOQ point (remember that EOQ is a quantity). To determine the actual cost at that quantity, you will have to substitute the EOQ value (as Q) into the total cost formula.

Your spreadsheet should be built around the parameters of the problem (S, R, C, and k). You should be able to change any of these values and the spreadsheet should automatically update all the cost figures. For this spreadsheet, set the order preparation cost to \$35, the annual demand to 125,000 units, the cost per unit to \$1.49, and the cost rate of carrying one dollar of inventory per year to 0.28. If you have designed your spreadsheet correctly, the total cost for a 3,500 unit lot size should be \$1,980, the EOQ should be 4,580 units, and the optimal cost at 4,580 units should be \$1,911.

To Turn In: You should print a copy of your spreadsheet results, a separate copy of your chart, and finally a copy of the model formulas (use the Options... command in the Tools menu). For the formula printout, be sure that both row and column headings are shown (this is a point-counting requirement). Include both your name and lab section on your spreadsheet and chart (part of actual spreadsheet – not handwritten).