MST MS5 and ETIIA 3E10, Lent 2009

Operations Management

Example Sheet I

1. A company produces a chemical compound that is used as a fertiliser. Annual demand for the compound is 600,000 kilograms per year. The fixed cost of setting up for a production of the chemical is £1,500, and the variable cost of production is £3.50 (= its book value) per kilogram produced. The company uses an interest rate of 22% to account for the cost of capital, and the annual cost of storage of the chemical amounts to 12% of the value. Find the optimal size of the production run for this compound.

2. You are the manager of the supplies department of East Anglia Manufacturing (EAM), which orders a good number of component parts from external vendors. The annual usage of part MT101 is 4000 units, compared with 16,000 units for part MT102. EAM orders parts MT101 and MT102 from different vendors, and each is used in many different assembly operations in the company. The cost to EAM of placing an order is the same for both parts, and their prices are very nearly equal. Each is ordered in quantities of 400. They are *not* substitutes for each other.

   a) Explain why this ordering policy is *not* consistent with the principles of EOQ.
   b) Does this imply that one or both order quantities should be changed? Explain.

3. Discuss at least three reasons that have convinced operations managers that the application of the Economic Order/Batch Quantity models are inappropriate for determining ordering and manufacturing batch sizes.

4. Consider the following three-step production process, beginning with raw material inventory and ending with finished units inventory:

   RAW MATERIAL → TASK A → TASK B → TASK C → FINISHED UNITS

   Tasks A, B, and C take 3 minutes, 5 minutes, and 2 minutes, respectively, to process one unit of the product at that task (i.e., the activity time). This production process is staffed by three operators, with one operator assigned to each of the three tasks. Assume there is no variability in the process, the operators are capable of working at 100% efficiency, and no in-process inventory is permitted between tasks.

   (a) What is the capacity of this production process?
   (b) What is the utilisation of the operator at task A?
   (c) Suppose each operator receives regular wages of £12 per hour for an 8 hour day, and £18 per hour for any time over 8 hours. Twelve hours per day is the maximum work time permitted for each operator. A finished unit sells for £10 (with unlimited demand at that price), and the unit cost is £6 plus the cost of labour.
      (i) Should you use overtime?
      (ii) Would you recommend hiring a skilled operator whose wage rate is £22 per hour (regular time), if s/he could perform Task B at an accelerated activity time of 4 minutes per unit?

5. Consider a component with holding cost per period of 5p. The batch set-up cost for manufacturing the component is £5. The net requirements for the component for periods 1 though 10 are, in order: 20, 27, 30, 18, 35, 35, 10, 11, 24, 15.

   a) Calculate the batches of this component that would be produced using the Least Unit Cost (LUC) heuristic. What is the total cost?
   b) Show that the LUC schedule is not optimal by finding the total cost for the following schedule: (95, 0, 0, 0, 91, 0, 0, 0, 39, 0).
   c) Could the LUC method still be used if the holding cost per period or the variable (unit) cost changed from one period to the next?

6. Discuss the need for, and problems associated with inventory in manufacturing systems. Give at least three examples each.

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