**Efficiency = Actual Output × 100%**

**Effective Capacity**

**Utilization = Actual Output × 100%**

**Design Capacity**

*Both measures are expressed as percentages*

Given the following information, compute the efficiency and utilization of the vehicle repair department:

Design capacity = 50 trucks per day

Effective capacity = 40 trucks per day

Actual output = 36 trucks per day

Diagram

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Table

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Cost-Volume Analysis

The total cost associated with a given volume of output is equal to the sum of the fixed cost and the variable cost per unit times volume:

**TC = FC + VC**

**VC = *Q* × *v***

**where v = variable cost per unit**

Revenue per unit, like variable cost per unit, is assumed to be the same regardless of the quantity of output.

Total revenue will have a linear relationship to output, as illustrated in Figure 5.6B.

The total revenue associated with a given quantity of output, Q, is

**TR = R × Q**

Total profit can be computed using the formula.

**P = TR − TC**

= **R × Q −** **(FC + v × Q)**

Rearranging terms, we have

**P = Q(R − v) − FC**

The difference between revenue per unit and variable cost per unit,

**R − v**, is known as the **contribution margin**.

The required volume, Q, needed to generate a specified profit is

**Q = P + FC**

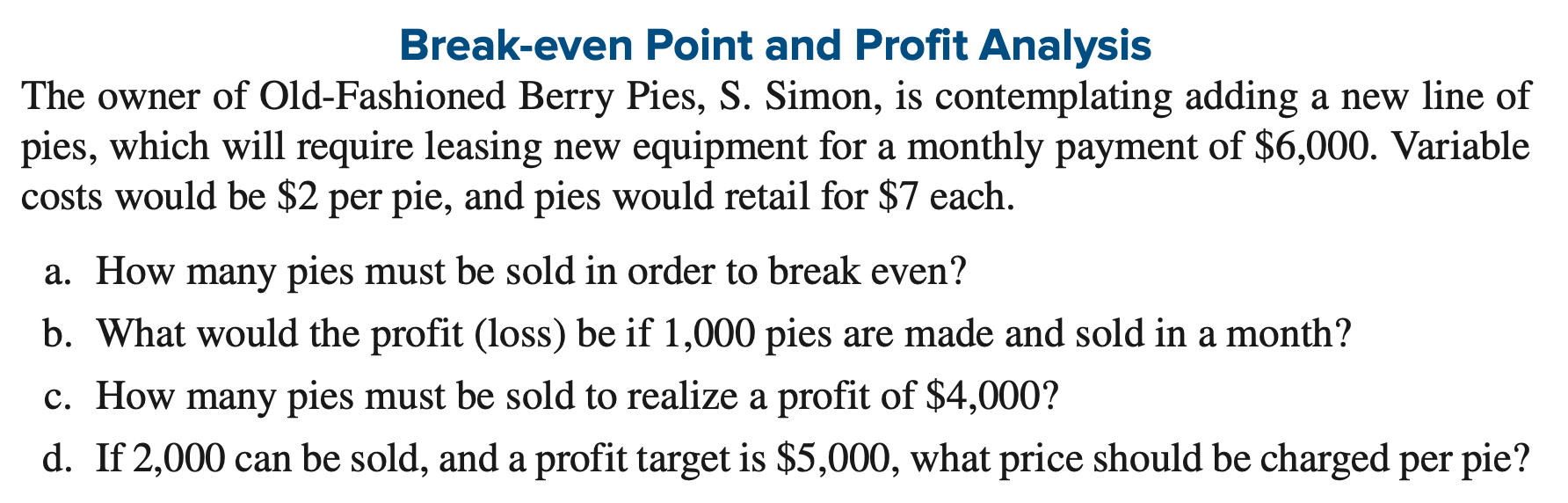
**R−v**

A special case of this is the volume of output needed for total revenue to equal total cost.

This is the break-even point, computed using the formula

**QBEP = FC**

**R−v**



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Table

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**A small firm intends to increase the capacity of a bottleneck operation by adding a new machine.**

**The annual fixed cost would be Tk. 42,000/-, variable cost per unit would be Tk. 15/- and revenue per unit would be Tk. 22/-.**

1. **Write down the cost, revenue, and profit function.**
2. **What annual volume is required to break even?**
3. **What would be the profit if 5,000 units were made?**
4. **How many units must be sold to realize a profit of Tk. 7,000/-?**
5. **1000 units can be sold and profit target is Tk. 4,000/-,** 
   1. **what price should be charged per unit?**

**(i) No of units produced and sold = q**

**Cost Function, C(q) = FC+VC**

**= 42,000+15q**

**Revenue Function, R(q) = 22q**

**Profit function P(q) = R-C= 22q – (42,000 + 15q)**

**= 22q – 42,000 – 15q**

**= 7q – 42,000**

**(ii) For break even, R=C**

**QBEP = FC/R-V**

**= 42,000/22 - 15**

**= 6,000 units**

**(iii) P = Q (R-V) - FC**

**= 5,000 (22-15) – 42,000**

**= 5,000 (7) – 42,000 = 35,000 – 42,000 = -7,000**

**if 5,000 units are sold there will be no profit rather loss of Tk. 7,000/-**

**(iv) Q = P + FC**

**R−v**

**= 7,000+42,000**

**22-15**

**= 49,000**

**7**

**Q = 7,000 units**

**To make a profit of Tk. 7,000/-, 7,000 units must be sold.**

**(v) Given, Q=1000 units and Profit, P= Tk. 4,000/-**

**P = Q (R − v) − FC**

**4000=1000(R -15) – 42000**

**4000= 1000R – 15000 – 42000 = 1000R= 4000+57000**

**R= 61000/1000 R= Tk. 61**

**To sell 1000 units and to make a profit of Tk. 4,000/-, the selling price per unit must be Tk. 61/-.**

Text

Description automatically generated

**(i) For break even, R=C**

**QBEP = FC/R-V**

**= 9,200/0.90-0.70**

**= 46,000 units**

**(ii a) P = Q (R-V) - FC**

**= 61000 (0.90-0.70) – 9,200**

**=$ 3,000/-**

**(ii b) P = Q (R-V) - FC**

**= 87,000 (0.90-0.70) – 9,200**

**=$ 8,200/-**

**(iii) Q = P + FC**

**R−v**

**Q = 16,000+9,200**

**0.9-0.7**

**Q = 25,200/0.2 = 126,000 units**

**In order to make a profit of $16,000/- per month, 126,000 units must be sold.**

Text

Description automatically generated

**(i) For break even, R=C**

**QBEP = FC/R-V**

**= 25000/1 – 0.37**

**= 39,683 pens**

**(ii) Given, Q=30000 units and Profit, P= $15,000/-**

**P = Q (R − v) − FC**

**15,000=30,000(R -0.37) – 25,000**

**15,000= 30000R – 11,100 – 25,000**

**30,000R= 15,000+36,100**

**R= 51,100/30000 R= $1.71**

**To sell 30,000 pens, the company needs to sell at $1.71/- to make a profit of $15,000/-.**

**A company produces 5 different types of product.**

**Product: A Annual demand: 400 units Processing time per unit: 3 hours**

**Product: B Annual demand: 370 units Processing time per unit: 2 hours**

**Product: C Annual demand: 430 units Processing time per unit: 8 hours**

**Product: D Annual demand: 200 units Processing time per unit: 5 hours**

**Product: E Annual demand: 600 units Processing time per unit: 10 hours**

**Machine annual capacity is 3500 hrs.**

**How many Machines/ equipment will be needed to meet the annual demand for these 5 products?**

**Solution:**

**Total processing time for Product A: 400 × 3= 1200 hours**

**Total processing time for Product B: 370 × 2= 740 hours**

**Total processing time for Product C: 430 × 8= 3440 hours**

**Total processing time for Product D: 200 × 5= 1000 hours**

**Total processing time for Product E: 600 × 10= 6000 hours**

**No of machines required=**

**= 3.54 = 4 machines**

**Annual Holding Cost = (Average cycle inventory) (Unit Holding Cost)**

**Annual Ordering Cost = (No of orders/year) (Ordering or setup cost per order)**

**Total Cost= Annual Holding Cost+ Annual Ordering Cost**

**C=Q/2 (H)+D/Q (S)**

* C=total Annual Cost
* Q=Lot size
* H=Unit Holding Cost
* D=Annual demand
* S=Setup cost per order

**Ordering Frequency = AD/Q**

**Order Interval = Time/ Ordering Frequency**

EOQ = sqrt((2DS)/H)

One of the top-selling items in the container group at a museum’s gift shop is a bird feeder. Sales are 18 units per week and the supplier changes Tk60 per unit. The cost of placing an order is tk 45. Annual holding cost is 25% of a feeder’s value and the museum operates 52 weeks per year. Management chose a 390-unit lot size so that new orders could be placed less frequently. Identify EOQ. Determine annual cost of the current lot size of 390 units? Determine annual cost considering the EOQ?

To identify EOQ, we can use the formula:

EOQ = sqrt((2DS)/H)

Where: D = annual demand = 18 units per week x 52 weeks = 936 units per year S = cost per order = Tk45 H = holding cost as a percentage of the item's value = 25% of Tk60 = Tk15

Plugging in the values:

EOQ = sqrt((2 x 936 x 45)/15) = sqrt(56160) = 237 units (rounded to the nearest whole number)

Therefore, the EOQ for the bird feeder is 237 units.

To determine the annual cost of the current lot size of 390 units, we can use the formula:

Total Cost = Ordering Cost + Holding Cost

Ordering Cost = (D/Q) x S Holding Cost = (Q/2) x H

Where: Q = lot size = 390 units

Plugging in the values:

Ordering Cost = (936/390) x 45 = Tk108.46 (rounded to the nearest whole number) Holding Cost = (390/2) x 15% x Tk60 = Tk1,755

Total Cost = Tk108.46 + Tk1,755 = Tk1,863.46 (rounded to the nearest whole number)

Therefore, the annual cost of the current lot size of 390 units is Tk1,863.46.

To determine the annual cost considering the EOQ, we can use the same formulas but with the EOQ value:

Ordering Cost = (936/237) x 45 = Tk177.08 (rounded to the nearest whole number) Holding Cost = (237/2) x 15% x Tk60 = Tk533.25

Total Cost = Tk177.08 + Tk533.25 = Tk710.33 (rounded to the nearest whole number)

Therefore, the annual cost considering the EOQ of 237 units is Tk710.33.

One of the top-selling items in the container group at a museum’s gift shop is a bird feeder. Sales are 29 units per week and the supplier charges Tk60 per unit. The cost of placing an order is tk 65. Annual holding cost is 15% of a feeder’s value and the museum operates 52 weeks per year. Management chose a 490 unit lot size so that new orders could be placed less frequently. Identify EOQ. Determine annual cost of the current lot size of 490 units? Determine annual cost considering the EOQ?

To identify EOQ, we can use the formula:

EOQ = sqrt((2DS)/H)

Where: D = annual demand = 29 units per week x 52 weeks = 1,508 units per year S = cost per order = Tk65 H = holding cost as a percentage of the item's value = 15% of Tk60 = Tk9

Plugging in the values:

EOQ = sqrt((2 x 1,508 x 65)/9) = sqrt(144,740) = 380 units (rounded to the nearest whole number)

Therefore, the EOQ for the bird feeder is 380 units.

To determine the annual cost of the current lot size of 490 units, we can use the formula:

Total Cost = Ordering Cost + Holding Cost

Ordering Cost = (D/Q) x S Holding Cost = (Q/2) x H

Where: Q = lot size = 490 units

Plugging in the values:

Ordering Cost = (1,508/490) x 65 = Tk199.39 (rounded to the nearest whole number) Holding Cost = (490/2) x 15% x Tk60 = Tk1,755

Total Cost = Tk199.39 + Tk1,755 = Tk1,954.39 (rounded to the nearest whole number)

Therefore, the annual cost of the current lot size of 490 units is Tk1,954.39.

To determine the annual cost considering the EOQ, we can use the same formulas but with the EOQ value:

Ordering Cost = (1,508/380) x 65 = Tk258.42 (rounded to the nearest whole number) Holding Cost = (380/2) x 15% x Tk60 = Tk1,710

Total Cost = Tk258.42 + Tk1,710 = Tk1,968.42 (rounded to the nearest whole number)

Therefore, the annual cost considering the EOQ of 380 units is Tk1,968.42.

**One of the top-selling items in the container group at a museum’s gift shop is a bird feeder. Sales are 18 units per week and the supplier charges Tk60 per unit. The cost of placing an order is tk 45. Annual holding cost is 25% of a feeder’s value and the museum operates 52 weeks per year. Management chose a 390 unit lot size so that new orders could be placed less frequently. What is the annual cost of the current lot size of 390 units? Would a lot size of 468 be better?**

The annual cost of the current lot size of 390 units is Tk1,863.46, as calculated in the previous question.

To determine if a lot size of 468 units would be better, we can calculate the total cost using the same formula:

Total Cost = Ordering Cost + Holding Cost

Ordering Cost = (D/Q) x S Holding Cost = (Q/2) x H

Where: D = annual demand = 18 units per week x 52 weeks = 936 units per year S = cost per order = Tk45 H = holding cost as a percentage of the item's value = 25% of Tk60 = Tk15

For a lot size of 468 units: Ordering Cost = (936/468) x 45 = Tk90 Holding Cost = (468/2) x 25% x Tk60 = Tk7,020

Total Cost = Tk90 + Tk7,020 = Tk7,110

Therefore, the annual cost of a lot size of 468 units is Tk7,110.

Comparing this to the current lot size of 390 units, the lot size of 468 units has a higher total cost, so it would not be better. Therefore, the museum should stick with the current lot size of 390 units.

**True/False**

Transportation model is used to find an optimal solution using different alternatives.

True

In NWC method, we always try to allocate to the respective row and column before we move to the next corner

True

The cost will be always lower applying ILC compare to NWC.

False

The supply and requirement will always match in case of resource allocation

True

We try to allocate arbitrarily if there is any tie in ILC

False

The revenue will be always lower than the cost at the upper portion of Break even point.

True

Contribution margin can never be negative under usual circumstance.

True

Number of row and column has to be equal in dealing with transportation model.

False

**If the fixed cost is 10,000, variable cost is 5 taka and selling price is 10 taka, what is the BEP?**

To calculate the break-even point (BEP), we need to know the fixed cost, variable cost, and selling price.

The formula for BEP is:

BEP = Fixed Cost / (Selling Price - Variable Cost)

Substituting the given values, we get:

BEP = 10,000 / (10 - 5) BEP = 2,000

Therefore, the break-even point is 2,000 units. This means that the business needs to sell at least 2,000 units to cover all its costs and start making a profit. If it sells less than 2,000 units, it will make a loss.

**What would be the profit/loss if 2500 units are sold?**

To calculate the profit or loss when a certain number of units are sold, we need to use the following formula:

Profit/Loss = (Selling Price x Number of Units) - (Fixed Cost + Variable Cost x Number of Units)

Substituting the given values, we get:

Profit/Loss = (10 x 2,500) - (10,000 + 5 x 2,500) Profit/Loss = 25,000 - 22,500 Profit/Loss = 2,500

Therefore, if 2,500 units are sold, the business will make a profit of Tk 2,500.