1-36

The best approach is to construct a matrix showing the payoff for each strategy for each possible distance driven. We note that even the longest distance driven, 800 km, will require only 68 liters of gas, which is within the capacity of the tank.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Distance Driven (KM)** | | |
| **250.00** | **400.00** | **800.00** |
| Gas consumed (L) | 21.25 | 34.00 | 68.00 |
| Return Full (pay $0.97/L) | 20.62 | 32.98 | 65.96 |
| No refuel (pay $1.15/L) | 24.44 | 39.10 | 78.20 |
| Pay $40 | 40.00 | 40.00 | 40.00 |

From this matrix, we see that returning the car with a full tank is always a more profitable strategy than returning it part-full. So we should always use this strategy unless we’re going 800 km, in which case the $40 deal is more attractive.

If we charge $30/4 = $7.50 for the time required to fill up the gas tank, we add a new line to the matrix. Now returning the car part-full is the most attractive option in all cases except the 800 km case, where the $40 deal remains the most attractive.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Distance Driven (KM)** | | |
| **250.00** | **400.00** | **800.00** |
| Gas consumed (L) | 21.25 | 34.00 | 68.00 |
| Return Full | 20.61 | 32.98 | 65.96 |
| Return Full, charge for time | 28.11 | 40.28 | 73.46 |
| No refuel, Pay $1.15/L | 24.44 | 39.10 | 78.20 |
| Pay $40 | 40.00 | 40.00 | 40.00 |

1-39

Area A: We have to include both the cost of buying the inert fill and the cost of hauling it in. However, we are not given the distance over which the inert fill must be hauled, so we will assume that the given figure of $9.40 per cubic meter includes both the purchase of the fill and the cost of hauling it to Area A.

Total Cost = 2 × 106 × $9.40 = $18,800,000

Area B: Difference in Haul

0.60 × 8 km = 8.0 km

0.20 × –3 km = –0.6 km

So on average, choosing Area B will entail an average increase of 7.4 km additional haul per load

Extra time spent per load = additional haul/speed = 7.4 km/25 kph = 0.30 hours

Extra cost per load = 0.3 × $140 = $41.4

14 million cubic meters of rubbish will require 14,000,000/20 loads = 700,000 loads

Total extra cost of moving these loads = $41.4 \* 700,000 = $29,000,000

So Area A is cheaper than Area B by slightly more than $10,000,000

1-44

(a) The suitable criterion is to maximize the difference between output and input. Or simply, maximize net profit. The data from the graphs may be tabulated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Output Units/Hour** | **Total Cost** | **Total Income** | **Net Profit** |
| 50 | $300 | $800 | $500 |
| 100 | $500 | $1,000 | $500 |
| 150 | $700 | $1,350 | $650 ← |
| 200 | $1,400 | $1,600 | $200 |
| 250 | $2,000 | $1,750 | $–250 |

$200

$400

$600

$800

$1,000

$1,200

$1,400

$1,600

$1,800

$2,000

50 100 150 200 250

Output (units/hour)

0

Cost

Cost

Profit

Loss

(b) Minimum input is, of course, zero, and maximum output is 250 units/hour (based on the graph). Since one cannot achieve maximum output with minimum input, the statement makes no sense.

1-46

(a) 75 hours

Average cost = 0

Marginal cost = 0

(b) 125 hours

Average cost = (25)($75) / 125 = $15

Marginal cost = $75

(c) 250 hours

Average cost = (150)($75) / 250 = $45

Marginal cost = $75

1-48

x = number of maps dispensed per year

(a) Fixed Cost (I) = $1,000

(b) Fixed Cost (II) = $5,000

(c) Variable Costs (I) = 0.900

(d) Variable Costs (II) = 0.100

(e) Set Total Cost (I) = Total Cost (II)

$1,000 + 0.90*x* = $5,000 + 0.10*x*

thus *x* = 5,000 maps dispensed per year.

The student can visually verify this from the figure.

(f) System I is recommended if the annual need for maps is <5,000

(g) System II is recommended if the annual need for maps is >5,000

(h) Average Cost @ 3,000 maps:

TC(I) = (0.9) (3.0) + 1.0 = 3.7/3.0 = $1.23 per map

TC(II) = (0.1) (3.0) + 5.0 = 5.3/3.0 = $1.77 per map

Marginal Cost is the variable cost for each alternative, thus:

Marginal Cost (I) = $0.90 per map

Marginal Cost (II) = $0.10 per map

1-53

*x* = units/year

By hand = Painting Machine

$1.40*x* = $15,000/4 + $0.20

*x* = $5,000/1.20 = $4,167 units

1-65

Costs incurred:

$600 purchase of refurbished notebook computer.

$60 replace CD-ROM after two years.

$30 purchase of wireless mouse.

Total cost of ownership: $690

Estimate benefits of ownership (over four years):

$360 saved by playing games on weekends with friends instead of going to the movies.

$200 saved by emailing instead of sending letters and making phone calls.

$100 saved downloading music over the internet.

$80 saved by doing business (like banking) over the internet instead of buying gas for the car.

$30 saved by not buying paper and pens for note taking.

Total estimated benefits: $770

Yes, ownership has been worth it.

1-71

(a) Unit Profit = $197 (0.30)= $59

(b) Overall Batch Cost = $197 (10,000) = $1,970,000

(c) Of the 10,000 batch:

1. (10,000) (0.01) = 100 are scrapped in mfg.

2. (10,000 − 100) (0.03) = 297 of finished product go unsold

3. (9,900 − 297) (0.02) = 192 of sold product are not returned

Total = 589 of original batch are not sold for profit

Overall Batch Profit = (10,000 − 589) $59 = $555,249

(d) New Unit Cost = $63 (0.50) + $24 + $110 = $165.50

New Batch Cost with Contract = 10,000 ($165.5) = $1,655,000

Difference in Batch Cost:

= BC without contract – BC with contract = $1,970,000 − $1,655,000

= $315,000

SungSam can afford to pay up to $315,000 for the contract.

1-73

ITODAY = (72/12) (100) = 600

CLAST YEAR= (525/600) (72) = $63 per square meter

1-80

80% learning curve in use of SPC will reduce costs after 12 months to:

Cost in 12 months = (*x*) 12log (0.80)/log (2.0) = 0.45*x*

Thus costs have been reduced:

[(*x* − 0.45)/*x*] times 100% = 55%

1-84

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Capital Costs** | **O & M** | **Overhaul** |
| 0.00 | –20 | 0 | 0 |
| 1.00 | 0 | –2.5 | 0 |
| 2.00 | 0 | –2.5 | 0 |
| 3.00 | 0 | –2.5 | 0 |
| 4.00 | 0 | –2.5 | –5 |
| 5.00 | 0 | –2.5 | 0 |
| 6.00 | 0 | –2.5 | 0 |
| 7.00 | 2 | –2.5 | 0 |

