Exam

Name_____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Answer the question.

1) A manufacturer of hard board and fiber cement sidings and panels purchased new equipment for its new product line. Three alternatives are under consideration. The costs associated with each alternative are given below. Which alternative is most economical to minimize total life cycle costs, if the life of the equipment is estimated to be 7 years and the company operates on average 3800 hours per year? Assume negligible salvage value. 1) _____

Alternative	A	B	C
Investment cost, $	40,000	39,000	41,000
Fixed cost, $/year	4700	4500	4800
Variable cost, $/hour	240	235	243

Answer: A: Total life cycle costs = $6,456,900.00
B: Total life cycle costs = $6,321,500.00
C: Total life cycle costs = $6,538,400.00

To minimize life cycle costs, select Alternative B.

Explanation: Total life cycle costs = Investment cost + Fixed costs over 7 years + Variable costs over 7 years

A: Total life cycle costs = $40,000 + $(4700)(7) + $(240)(3800)(7) = $6,456,900.00
B: Total life cycle costs = $39,000 + $(4500)(7) + $(235)(3800)(7) = $6,321,500.00
C: Total life cycle costs = $41,000 + $(4800)(7) + $(243)(3800)(7) = $6,538,400.00

To minimize life cycle costs, select Alternative B.

2) The annual fixed cost for an inspecting and profiling web controller manufacturing company are $44,000, and the variable costs are $38 per unit. If the selling price per unit is p = 495 - 0.57X, what is the company's range of profitable demand? 2) _____

Answer: The range of profitable demand is 112 to 689 units per year.
Explanation: p = 495 - 0.57D; C_F = $44,000 per year; C_V = $38 per unit

$$D^* = \frac{a - C_V}{2b} = \frac{495 - 38}{2(0.57)} = 401 \text{ units per year}$$

Profit (loss) = Total Revenue - Total Cost
$= 495D - 0.57D^2 - (44{,}000 + 38D)$
$= 495(401) - 0.57(401)^2 - 44{,}000 - 38(401)$
= $47,600.43 per year

Breakeven occurs when profit = 0.

$$\text{Profit} = 0 = -0.57D^2 + 457D - 44{,}000 = D^2 - 801.75D + 77{,}192.98$$

$$D' = \frac{801.75 \pm \sqrt{(801.75)^2 - 4(77{,}192.98)}}{2}$$

D'_1 = 112 units per year
D'_2 = 689 units per year

The range of profitable demand is 112 to 689 units per year.

3) The annual fixed cost for a light fixture manufacturing company are $38,000, and the variable costs are $40 per unit. If the selling price per unit is p = 485 - 1.395X, what is the optimum demand for a light fixture? 3) _____

Answer: 159.50 units per year
Explanation: p = 485 - 1.395D; C_F = $38,000 per year; C_V = $40 per unit

$$D^* = \frac{a - C_V}{2b} = \frac{485 - 40}{2(1.395)} = 159.50 \text{ units per year}$$

4) An accounting and management consulting firm charge-out rate is $112 per hour. The maximum output is 214,000 hours per year. The fixed cost is $610,000 per year and the variable cost is $62 per standard service hour. What is the breakeven point in percentage of total capacity? 4) _____

Answer: 5.70% of capacity
Explanation: C_F = $610,000/yr; C_V = $62/hr
Total revenue = Total cost (breakeven point)
$pD' = C_F + C_V D'$

$$D' = \frac{C_F}{p - C_V} = \frac{\$610{,}000}{(\$112 - \$62)} = 12{,}200$$

$$D' \text{ (\% of capacity)} = \frac{\$12{,}200}{214{,}000} = 0.057 \text{ or } 5.70\% \text{ of capacity}$$

5) A night vision goggle manufacturer is evaluating a make-versus-purchase situation for a component used in its low-priced products. The component can be purchased at a variable wholesale price of P = 1200 + 50X, where X is the number of items. Alternatively, the component can be produced with a direct material cost of $17 per item and direct labor cost of $38 per item. The manufacturing overhead is allocated at 150% of direct labor cost per item. If the company requires, on average, 575 items each year, should the item be purchased or manufactured? 5) _____

Answer: Purchase: $29,950.00

Manufacture: $64,400.00

Select the option that has the least total cost—purchasing the item.

Explanation: Purchase: $C_T = 1200 + 50(575) = \$29,950.00$

Manufacture: $C_T = \$(17 + 38 + 57)(575) = \$64,400.00$

Select option that has the least total cost—purchasing the item.

6) You are deciding between three types of water heaters. The associated costs are shown below. The annual cost of operation for gas and oil heaters is estimated by 365 x 41045/EF x Fuel Cost per Btu, and the annual cost of operation for electric water heaters is estimated by 365 x 12.03/EF x Electricity Cost per kWh. The selected heater will be used for only one year and then sold at the market value. Which alternative should be selected? 6) _____

Alternative	Electric	Gas	Oil
Price of water heater	$28,000	$23,000	$25,000
EF	2.0	0.57	0.75
Fuel cost	$0.1/kWh	$0.00001/Btu	$0.00001/Btu
Annual maintenance costs	$3000	$2200	$2500
Market value	$25,200	$20,700	$22,500

Answer: Total cost of electric heater = $6019.55
Total cost of gas heater = $4762.83
Total cost of oil heater = $5199.75

Select the heater that provides the least annual costs—the gas heater.

Explanation: Electric heater:
The purchase price = $28,000
The annual cost = 365 x 12.03/EF x Electricity Cost per kWh + 3000
= 365 x 12.03/2 x 0.1 + 3000
= $3219.55
Salvage value = $25,200
Total cost = 28,000 + 3219.55 + 25,200
= $6019.55

Gas heater:
The purchase price = $23,000
The annual cost = 365 x 41,045/EF x Fuel Cost per Btu + 2200
= 365 x 41,045/0.57 x 0.00001 + 2200
= $2462.83
Salvage value = $20,700
Total cost = 23,000 + 2462.83 + 20,700
= $4762.83

Oil heater:
The purchase price = $25,000
The annual cost = 365 x 41,045/EF x Fuel Cost per Btu + 2500
= 365 x 41,045/0.75 x 0.00001 + 2500
= $2699.75
Salvage value = $22,500
Total cost = 25,000 + 2699.75 + 22,500
= $5199.75

Select the heater that provides the least total costs—the gas heater.

7) An uninterruptible power system manufacturer is currently deciding between two processes for its new automated assembly system. All defect-free units can be sold at $210 each, and all rejected units can be sold at $11 for scrap. Other related information for each model is given below. 7) _____

Process	A	B
Output rate, units/hour	250	230
Daily available production time, hours	14	16
Material cost, $/unit	25	25
Variable operating cost, $/hour	45	49
Variable overhead cost, $/hour	40	39
Percent reject	40	38

Which process should be adopted to maximize profit per day?

Answer: Process A : Profit per day = $367,710.00

Process B : Profit per day = $401,110.40

Select the process that maximizes profit per day—Process B.

Explanation: Profit per day = Revenue per day - Cost per day

Process A: Profit per day = (250 unit/hr)(14 hr/day)($210/unit)(1- 0.4) + (250 unit/hr)(14 hr/day)($11/unit)(0.4) - (250 unit/hr)(14 hr/day) ($25/unit) - (14 hr/day) ($45/unit + $40/unit)
= 367,710.00

Process B: Profit per day = (230 unit/hr)(16 hr/day)($210/unit)(1- 0.38) + (230 unit/hr)(16 hr/day)($11/unit)(0.38) - (230 unit/hr)(16 hr/day) ($25/unit) - (16 hr/day) ($49/unit + $39/unit)
= 401,110.40

Select the process that maximizes profit per day—Process B.

8) A headhunter company has fixed costs of $57,000 per month and variable costs of $1000 per customer account. The company currently charges $1150 per month for each account and has 38,000 accounts. It wants to raise the monthly fee to $1160.55 to cover enhanced features such as a new web interface and a newly acquired database, which increases the variable cost by 9 percent. What is the new breakeven point in number of accounts? 8) _____

Answer: 807.94 accounts

Explanation: C_F = $57,000/yr; C_V = $(1+ 0.09)1000 = $1090.00/yr ; p = 1160.55

Total revenue = Total cost (breakeven point)

$pD' = C_F + C_V D'$

$$D' = \frac{C_F}{p - C_V} = \frac{\$57,000}{(\$1160.55 - \$1090.00)} = 807.94 \text{ accounts}$$

9) A manufacturing company leases a machine for $31,000 per year. Each unit produced costs $36 in labor and $65 in materials. To break even, 21,000 units must be sold. What is the price of the product? 9) _____

Answer: $102.48

Explanation: C_F = $31,000 per yr; c_V = $36 + $65 per unit

Total revenue = Total cost (breakeven point)

$pD' = C_F + c_V D'$

$p(21,000) = 31,000 + (101)(21,000)$

$p = 1.48 + (101) = \$102.48$

10) A local cable company has a fixed cost of $7400 per month and variable costs of $50 per month per subscriber. If the company charges on average $110 per month to its customers, find the breakeven point in terms of subscribers per month for the company. 10) _____

Answer: 123.33 subscribers per month

Explanation: Let y = number of subscribers

Total revenue = Total cost (breakeven point)

Total revenue = y x $110 per month

Total cost = $7400 + ($50 x y) per month

y = 7400/(110 - 50) = 123.33 subscribers per month

11) The cost for operating a commercial truck is $knv^{1/2}$, where k is a constant of proportionally, v is velocity in miles per hours, and n is the trip length in miles. It is estimated that at 85 mph, the average cost of operation is \$52 per mile. The truck owner wants to minimize the cost of operation, which needs to balance against the cost of delays and unscheduled maintenance, which is assumed to be \$10 per hour. What is the optimum velocity needed to minimize the total costs? 11) _____

Answer: The truck should be operated at an average velocity of 2.33 mph to minimize the total cost of operation and delays.

Explanation: $C_T = C_O + C_C = knv^{1/2} + \frac{\$10n}{v}$

$$\frac{dC_T}{dv} = 0 = 0.5knv^{-0.5} - \frac{10n}{v^2} = 0.5kv^{3/2} - 10$$

$$v = (10/0.5k)^{2/3}$$

To find k, we know that $\frac{C_O}{n} = \$52/\text{mile}$ at v = 85 mph

$$\frac{C_O}{n} = kv^{0.5} = k(85)^{0.5} = 52$$

and

$$k = 52/9.22 = 5.64$$

so

$$v = [10/(0.5 * 5.64)]^{2/3} = 2.33 \text{ miles/hr}$$

The truck should be operated at an average velocity of 2.33 mph to minimize the total cost of operation and delays.

12) A company estimates its annual expenses, Y, in dollars from $Y = 0.235X^2 + 7X + 4$ and annual revenue in dollars from $0.215X^2 + 15X$, where X is annual units sold. Find the value of X that gives maximum profit. 12) _____

Answer: 200 units

Explanation: Profit = Total revenue - Total cost

$$= (0.215X^2 - 1X) - (0.235X^2 + 7X + 4)$$

$$= -0.02X^2 + 8X - 4$$

$$\frac{d\text{Profit}}{dX} = 0 = -0.04X + 8$$

$$X = 8/0.04 = 200 \text{ units}$$

Note: $\frac{d^2\text{Profit}}{dX^2} = -0.04$ Thus, X = 200 units maximizes profit.

13) A manufacturing plant is planning to replace outdated equipment with more energy-efficient and environmental-friendly equipment. Two models are under consideration. Model A is sold for $159,000 and can produce at an optimum speed of 78 unit/hour. Model B is sold for the same price, but can produce at an optimum speed of 76 unit/hour. Model A requires 6 hours of maintenance for every 4300 units produced, while Model B requires 5 hours of maintenance for every 3300 units. The maintenance cost for both models is $100 per hour. The variable operating cost is $340 per hour for Model A and $290 per hour for Model B. Due to obsolete parts, there is a sunk cost of $2700 for model A and $1900 for Model B . If the price of the product is $150 per unit and the company expects to sell 145,000 units each year, which model should be selected? 13) _____

Answer: Model A: $652,284 per 145,000 units
Model B: $575,259 per 145,000 units
Select the design that minimizes the total cost for 145,000 units/year—Model B.

Explanation: The sunk costs can be ignored because they do not affect the analysis of future costs.

Model A: Total cost for 145,000 units = [(6 hours/4300 units)($100/hr) + (1 hour/78 units)
($340/hr)](145,000)
= $652,284

Model B: Total cost for 145,000 units = [(5 hrs/3300 units)($100/hr) + (1 hour/76 units)
($290/hr)](145,000)
= $575,259

Select the design that minimizes the total cost for 145,000 units/year—Model B.

14) A $38,000 coil winding and unwinding machine is estimated to provide additional value to production by $15 per unit. When the machine is operated at 58 units per hour, it needs to be cooled down after 4 hours of operation and receive minor maintenance for 15 minutes. When the machine is operated at 118 units per hour, it needs to be cooled down after 5 hours of operation and receive minor maintenance for 30 minutes. The production line runs 8 hours per day. If each maintenance check costs $625 and the machine has a useful life of 80,000 hours of operations, at what speed should the machine should be operated? 14) _____

Answer: At 58 units per hour, net increase in value per day = $5363.83

At 118 units per hour, net increase in value per day = $11,922.81

Select the machine speed that provides the higher net increase in value per day —machine speed B.

Explanation: At 58 units per hour:
Cycle time = 4 hours + 0.25 hour = 4.25 hours
Cycles per day = 8/4.25 = 1.88 cycles
Value added per day = 1.88 x 4 x 58 x $15 = $6542.40
Cost of maintenance per day = 1.88 x $625 = $1175.00
Cost of operating the machine per day = $38,000/80,000 x 4 x 1.88
= $3.57
Net increase in value per day = $6542.40 - $1175.00 - $3.57
= $5363.83

At 118 units per hour:
Cycle time = 5 hours + 0.5 hour = 5.50 hours
Cycles per day = 8/5.50 = 1.45 cycles
Value added per day = 1.45 x 5 x 118 x $15 = $12,832.50
Cost of maintenance per day = 1.45 x $625 = $906.25
Cost of operating the machine per day = $38,000/80,000 x 5 x 1.45
= $3.44
Net increase in value per day = $12,832.50 - $906.25 - $3.44
= $11,922.81

Select the machine speed that provides the higher net increase in value per day —machine speed B.

15) A garment manufacturing company makes 380,000 articles per year. Each article takes 95 minutes of direct labor at the rate of $9.00 per hour. The overhead costs are $7.50 per direct labor hour. The average price of the finished product is $80 per article. A new machine will reduce the direct labor hour by 15 minutes per article. What is the maximum amount the company should pay for the new machine if it wants to break even by the end of the first year? 15) _____

Answer: $1,567,500.00

Explanation: Let X = breakeven cost of the new machine
Total cost (with old machine) = X + Total cost (with new machine)
Total cost (with old machine) = [(95/60) x ($9.00 + $7.50)](380,000) = $9,927,500.00
Total cost (with new machine) = [(95 - 15)/60 x ($9.00 + $7.50)](380,000) = $8,360,000.00

X = $9,927,500.00 - $8,360,000.00 = $1,567,500.00

1) A: Total life cycle costs = $6,456,900.00
   B: Total life cycle costs = $6,321,500.00
   C: Total life cycle costs = $6,538,400.00

   To minimize life cycle costs, select Alternative B.
2) The range of profitable demand is 112 to 689 units per year.
3) 159.50 units per year
4) 5.70% of capacity
5) Purchase: $29,950.00

   Manufacture: $64,400.00

   Select the option that has the least total cost—purchasing the item.
6) Total cost of electric heater = $6019.55
   Total cost of gas heater = $4762.83
   Total cost of oil heater = $5199.75

   Select the heater that provides the least annual costs—the gas heater.
7) Process A : Profit per day = $367,710.00

   Process B : Profit per day = $401,110.40

   Select the process that maximizes profit per day—Process B.
8) 807.94 accounts
9) $102.48
10) 123.33 subscribers per month
11) The truck should be operated at an average velocity of 2.33 mph to minimize the total cost of operation and delays.
12) 200 units
13) Model A: $652,284 per 145,000 units
    Model B: $575,259 per 145,000 units
    Select the design that minimizes the total cost for 145,000 units/year—Model B.
14) At 58 units per hour, net increase in value per day = $5363.83

    At 118 units per hour, net increase in value per day = $11,922.81

    Select the machine speed that provides the higher net increase in value per day—machine speed B.
15) $1,567,500.00