
DIFFERENTIAL COST ANALYSIS

MULTIPLE CHOICE

Question Nos. 9, 11-13, 15-20, and 29 are AICPA adapted.

Question Nos. 21, 22, 28, and 32-34 are ICMA adapted.

Question Nos. 10, 14, 30, and 31 are CIA adapted.

- B** 1. Additional output that results in a positive difference between differential revenues and differential costs is beneficial to a company *if and only if*:
- A. other sales are affected
 - B. other sales are unaffected and other unit costs are unaffected
 - C. other unit costs are increased and idle capacity is decreased
 - D. other sales are unaffected but other unit costs are increased
 - E. there is no idle capacity
- C** 2. The effect of discontinuing a department with a contribution to overhead of \$30,000 and allocated overhead of \$48,000, of which \$26,000 cannot be eliminated, would be to:
- A. increase profit by \$8,000
 - B. decrease profit by \$26,000
 - C. decrease profit by \$ 8,000
 - D. decrease profit by \$22,000
 - E. increase profit by \$ 4,000

SUPPORTING CALCULATION:

$$(\$48,000 - \$26,000) - \$30,000 = (\$8,000)$$

- D** 3. Gizmo Manufacturing is considering dropping a product line. It currently produces a multipurpose woodworking clamp in a simple manufacturing process that uses special equipment. Variable costs amount to \$6.00 per unit. Fixed factory overhead costs, exclusive of depreciation, have been allocated to this product at a rate of \$3.50 a unit and will continue whether or not production ceases. Depreciation on the special equipment amounts to \$20,000 a year. If production of the clamp is stopped, the special equipment can be sold for \$18,000; if production continues, however, the equipment will be useless for further production at the end of one year and will have no salvage value. The clamp has a unit sales price of \$10. Ignoring income tax effects, the minimum number of units that would have to be sold in the current year to make it worthwhile to keep the equipment (on a cash-flow basis) is:
- A. 20,000
 - B. 5,000
 - C. 3,000
 - D. 4,500
 - E. 36,000

SUPPORTING CALCULATION:

$$x (\$10 - \$6) = \$18,000$$

$$\$4x = \$18,000$$

$$x = 4,500$$

- B** 4. The costing method used to determine the lowest price that could be quoted for a special order that would use idle capacity within a production area is:
- A. process
 - B. direct
 - C. standard
 - D. absorption
 - E. job order
- E** 5. In deciding whether to manufacture a part or buy it from an outside vendor, a cost that is irrelevant to the short-run decision is:
- A. indirect materials
 - B. direct labor
 - C. variable factory overhead
 - D. fixed factory overhead that will be avoided if the part is bought from an outside vendor
 - E. fixed factory overhead that will continue even if the part is bought from an outside vendor
- C** 6. Faced with a long-run make-or-buy decision, the manager should do all of the following *except*:
- A. compare the making of the parts with alternative uses that could be made of the firm's own facilities if the parts are purchased
 - B. compare the cost of making the parts with the cost of buying them
 - C. use a cost study with only the differential costs and with no allocation of existing fixed overhead or profit
 - D. consider differences in the required capital investment and the timing of cash flows
 - E. consider the quantity and quality of the parts as well as the technical know-how required
- E** 7. An opportunity cost is:
- A. a cost that may be saved by not adopting an alternative
 - B. a cost that may be shifted to the future with little or no effect on current operations
 - C. a cost that cannot be avoided because it has already been incurred
 - D. the difference in total costs that results from selecting one alternative instead of another
 - E. the profit foregone by selecting one alternative instead of another
- E** 8. The term "differential cost" refers to:
- A. the profit foregone by selecting one alternative instead of another
 - B. a cost that does not entail any dollar outlay but that is relevant to the decision-making process
 - C. a cost that continues to be incurred even though there is no activity
 - D. a cost common to all alternatives in question and not clearly or practically allocable to any of the alternatives
 - E. the difference in total costs that results from selecting one alternative instead of another

- A 9. In a make-or-buy decision:**
- A. fixed costs that can be avoided in the future are relevant**
 - B. only variable costs are relevant**
 - C. only prime costs are relevant**
 - D. fixed costs that will continue regardless of the decision are relevant**
 - E. only conversion costs are relevant**
- D 10. For the past 12 years, the Jolt Company has produced the small electric motors that fit into its main product line of dental drilling equipment. As materials costs have steadily increased, the controller of the Jolt Company is reviewing the decision to continue to make the small motors and has identified the following facts:**
- 1. The equipment used to manufacture the electric motors has a book value of \$150,000.**
 - 2. The space now occupied by the Electric Motor Manufacturing Department could be used to eliminate the need for storage space now being rented.**
 - 3. Comparable units can be purchased from an outside supplier for \$59.75.**
 - 4. Four of the people who work in the Electric Motor Manufacturing Department would be terminated and given eight weeks of severance pay.**
 - 5. A \$10,000 unsecured note is still outstanding on the equipment used in the manufacturing process.**

Which of the items above are relevant to the decision that the controller has to make?

- A. 1, 2, 4, and 5**
- B. 1, 3, 4, and 5**
- C. 1, 3, and 4**
- D. 2, 3, and 4**
- E. 2, 3, 4, and 5**

- D 11. Ely Electronics has the following standard costs and other data:

	<u>Part A4</u>	<u>Part B5</u>
Direct materials	\$.40	\$ 8.00
Direct labor	1.00	4.70
Factory overhead.....	4.00	2.00
Unit standard cost	<u>\$ 5.40</u>	<u>\$ 14.70</u>
Units needed per year	6,000	8,000
Machine hours per unit	4	2
Unit cost if purchased	\$ 5.00	\$ 15.00

In past years, Ely has manufactured all of its required components; however, this year only 30,000 hours of otherwise idle machine time can be devoted to the production of components.

Accordingly, some of the parts must be purchased from outside suppliers. In producing parts, factory overhead is applied at \$1.00 per standard machine hour. Fixed capacity costs that will not be affected by any make-or-buy decision represent 60% of the applied overhead.

The 30,000 hours of available machine time are to be scheduled so that Ely realizes maximum potential cost savings. The relevant unit production costs that should be considered in the decision to schedule machine time are:

- A. \$5.40 for A4 and \$14.70 for B5
- B. \$5.00 for A4 and \$15.00 for B5
- C. \$1.40 for A4 and \$12.70 for B5
- D. \$3.00 for A4 and \$13.50 for B5
- E. none of the above

SUPPORTING CALCULATION:

$$A4 = \$0.40 + \$1.00 + .40(\$4.00) = \$3.00$$

$$B5 = \$8.00 + \$4.70 + .40(\$2.00) = \$13.50$$

- E 12. Production of a special order will increase the contribution margin when the additional revenue from the special order is greater than:
- A. the nonvariable costs incurred in producing the order
 - B. the direct materials and labor costs in producing the order
 - C. the fixed costs incurred in producing the order
 - D. the indirect costs of producing the order
 - E. the marginal cost in producing the order
- C 13. In considering a special order that will enable a company to make use of present idle capacity, which of the following costs would be irrelevant?
- A. fixed factory overhead that can be avoided
 - B. materials
 - C. depreciation of the factory building
 - D. direct labor
 - E. variable overhead

- E 14. In deciding whether to manufacture a part or buy it from an outside vendor, a cost that is relevant to the short-run decision is:
- A. direct labor
 - B. variable overhead
 - C. fixed overhead that will be avoided if the part is bought from an outside vendor
 - D. direct materials
 - E. all of the above
- D 15. A company owns equipment that is used to manufacture important parts for its production process. The company plans to sell the equipment for \$10,000 and to select one of the following two alternatives: (1) acquire new equipment for \$80,000, or (2) purchase the important parts from an outside company at \$4 per part. To select the best alternative, the company should compare the cost of manufacturing the parts:
- A. plus \$80,000 to the cost of buying the parts less \$10,000
 - B. to the cost of buying the parts less \$10,000
 - C. less \$10,000 to the cost of buying the parts
 - D. plus \$80,000 to the cost of buying the parts
 - E. none of the above
- C 16. The following standard costs pertain to a component part manufactured by Rob Co.:

Direct materials	\$ 4
Direct labor	10
Factory overhead.....	<u>40</u>
Standard cost per unit	<u>\$</u>

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Factory overhead is applied at \$1 per standard machine hour. Fixed capacity cost is 60% of applied factory overhead and is not affected by any make-or-buy decision. It would cost \$49 per unit to buy the part from an outside supplier. In the decision to make or buy, what is the total relevant unit manufacturing cost?

- A. \$54
- B. \$38
- C. \$30
- D. \$5
- E. none of the above

SUPPORTING CALCULATION:

$$\$4 + \$10 + .40(\$40) = \$30$$

- E 17. The Reno Company manufactures Part No. 498 for use in its production cycle. The cost per unit for 20,000 units of Part No. 498 are as follows:

Direct materials	\$ 6
Direct labor	30
Variable overhead	12
Fixed overhead applied.....	<u>16</u>
.....	<u>\$</u>

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The Tray Company has offered to sell 20,000 units of Part No. 498 to Reno for \$60 per unit.

Reno will make the decision to buy the part from Tray if there is a savings of \$25,000 for Reno.

If Reno accepts Tray's offer, \$9 per unit of the fixed overhead applied would be totally eliminated.

Furthermore, Reno has determined that the released facilities could be used to save relevant costs in the manufacture of Part No. 575. In order to have a savings of \$25,000, the amount of relevant costs that would be saved by using the released facilities in the manufacture of Part No. 575 would have to be:

- A. \$80,000
- B. \$60,000
- C. \$125,000
- D. \$140,000
- E. \$85,000

SUPPORTING CALCULATION:

$$\$60 - (\$6 + \$30 + \$12 + \$9) = \$3$$

$$\$3(20,000) + 25,000 = \$85,000$$

- C 18. At December 31, Zar Co. had a machine with an original cost of \$84,000, accumulated depreciation of \$60,000, and an estimated salvage value of zero. On December 31, Zar was considering the purchase of a new machine having a five-year life, costing \$120,000, and having an estimated salvage value of \$20,000 at the end of the five years. In its decision concerning the possible purchase of the new machine, how much should Zar consider to be a sunk cost at December 31?
- A. \$120,000
 - B. \$100,000
 - C. \$24,000
 - D. \$4,000
 - E. none of the above

SUPPORTING CALCULATION:

$$\$84,000 - \$60,000 = \$24,000$$

- B 19. Stewart Industries has been producing two bearings, components B12 and B18, for use in production. Data regarding these two components are:

	<u>B12</u>	<u>B18</u>
Machine hours required per unit	<u>2.5</u>	<u>3.0</u>
Standard cost per unit		
Direct material	\$ 2.25	\$ 3.75
Direct labor.....	4.00	4.50
Manufacturing overhead		
Variable ¹	2.00	2.25
Fixed ²	<u>3.75</u>	<u>4.50</u>
.....	<u>\$ 12.00</u>	<u>\$ 15.00</u>

¹Variable manufacturing overhead is applied on the basis of direct labor hours.

²Fixed manufacturing overhead is applied on the basis of machine hours.

Stewart's annual requirement for these components is 8,000 units of B12 and 11,000 units of B18. Recently, Stewart's management decided to devote additional machine time to other product lines resulting in only 41,000 machine hours per year that can be dedicated to the production of the bearings. An outside company has offered to sell Stewart the annual supply of the bearings at prices of \$11.25 for B12 and \$13.50 for B18. Stewart wants to schedule the otherwise idle 41,000 machine hours to produce bearings so that the company can minimize its costs (maximize its net benefits).

The net benefit (loss) per machine hour that would result if Stewart Industries accepts the supplier's offer of \$13.50 per unit for component B18 is:

- A. \$.50
- B. \$(1.00)
- C. \$1.50
- D. \$(1.75)
- E. some amount other than those given above

SUPPORTING CALCULATION:

$$(\$3.75 + \$4.50 + \$2.25) - \$13.50 = (\$3.00) \div 3 = (\$1.00)$$

The following questions are based on the material in the Appendix to the chapter.

- D 20. If plant capacity for cutting time and shaping time is 80 hours and 100 hours, respectively, and it takes four hours to cut and two hours to shape a standard model and two hours to cut and five hours to shape a deluxe model, the maximum number of standard and deluxe models that can be produced are:
- A. 50 standard and 40 deluxe
 - B. 20 standard and 40 deluxe
 - C. 40 standard and 20 deluxe
 - D. 20 standard and 20 deluxe
 - E. 20 standard and 50 deluxe

SUPPORTING CALCULATION:

$$\text{Cutting} = 4x + 2y \leq 80$$

$$\text{Shaping} = 2x + 5y \leq 100$$

$$\text{Standard} = 80 \div 4 = 20$$

$$\text{Deluxe} = 100 \div 5 = 20$$

- A 21. Plant capacity for cutting time and shaping time is 80 hours and 100 hours, respectively, and it takes four hours to cut and two hours to shape a standard model and two hours to cut and five hours to shape a deluxe model. If the standard models were represented on the horizontal axis and the deluxe models were represented on the vertical axis of a graph, the shaping constant would be expressed as:
- A. $2x + 5y \leq 100$
 - B. $2x + 5y \geq 100$
 - C. $4x + 2y \geq 100$
 - D. $4x + 2y \leq 100$
 - E. $2x + 2y \leq 100$
- D 22. If there is one unique optimal solution to a linear programming problem, that solution would be found at:
- A. the highest point on the y -axis
 - B. the objective function
 - C. the origin
 - D. a corner point
 - E. the highest point on the x -axis
- D 23. An iterative, stepwise procedure that is used to solve linear programming problems is the:
- A. graphical technique
 - B. identity matrix
 - C. cost minimization problem
 - D. simplex method
 - E. matrix algebra approach
- A 24. Linear programming is an operations research technique that allocates resources. Mathematical expressions are used to describe the problem. The measure of effectiveness that is to be maximized or minimized is called the:
- A. objective function
 - B. derivative of the function
 - C. nonlinear function
 - D. constraints
 - E. decision variables
- A 25. The term "constraints" in a linear programming model generally describes:
- A. scarce resources
 - B. dependent variables
 - C. inefficiencies
 - D. the objective function
 - E. costs

- B 26. A 200-bed hospital serves 500 meals per day. An analytic tool that would help management plan meals to meet nutrition goals at minimum cost is:
- A. Monte Carlo simulation
 - B. linear programming
 - C. material requirements planning
 - D. Markov analysis
 - E. exponential smoothing

- E 27. Linear programming is a mathematical technique designed to help an organization allocate its resources. A linear programming problem takes the form presented below:

$$f = A^1X^1 + A^2X^2 + \dots + A^nX^n \text{ subject to } B^1X^1 + B^2X^2 + \dots + B^nX^n \leq C^1$$

What is the name for the following function?

$$f = A^1X^1 + A^2X^2 + \dots + A^nX^n$$

- A. revenue function
 - B. cost function
 - C. constraint function
 - D. linear function
 - E. objective function
- B 28. Pleasant Valley Company makes two ceramic products, vases (V) and bowls (B). Each vase requires two pounds of material and three hours of labor. Each bowl requires two pounds of material and one hour of labor. During the next production week, there will be 100 pounds of material and 60 hours of labor available to make vases and bowls. Each pound of material costs \$4 and each hour of labor costs \$10. All factory overhead is fixed; it is estimated to be \$200 for this production process for a week. Pleasant Valley sells vases for \$50 each and bowls for \$35 each. The objective function for Pleasant Valley would be:
- A. maximize $Z = \$50V + \$35B$
 - B. maximize $Z = \$12V + \$17B$
 - C. minimize $Z = \$38V + \$18B$
 - D. maximize $Z = \$12V + \$17B = \$200$
 - E. some function other than those given above

SUPPORTING CALCULATION:

$$V = \$50 - (2 \times \$4) - (3 \times \$10) = \$12$$

$$B = \$35 - (2 \times \$4) - (1 \times \$10) = \$17$$

PROBLEMS

PROBLEM

1.

Effect of Special Order on Profits. Markham Modems, Inc. recently received a special order to manufacture 10,000 units for a Brazilian company. This order specified that the selling price per unit should not exceed \$50. Because the order was received without the effort of the Sales Department, no commission would be paid. However, an export-handling charge of \$2 per unit would be incurred. Management anticipates that acceptance of the order will have no effect on other sales.

The company is operating at 80% of capacity, or 80,000 units, and expects to continue at this level for the coming year, without the Brazilian order. Unit selling price and costs, based on estimated actual capacity for the coming year, are:

Selling price	<u>\$65.00</u>
Expenses	
Direct materials	\$15.00
Direct labor	20.00
Variable factory overhead.....	7.50
Fixed factory overhead	3.00
Sales commissions.....	5.00
Other marketing expenses (75% variable)	2.00
General expenses (25% fixed).....	<u>4.00</u>
Total	<u>\$56.50</u>

Required: Prepare an analysis showing the effect on profits if the company accepts the special order.

SOLUTION

Markham Modems, Inc. Effect of Special Order on Profits

	<u>Per Unit</u>
Differential costs	
Direct materials	\$ 15.00
Direct labor	20.00
Variable factory overhead.....	7.50
Other marketing expenses.....	1.50
Export-handling charge	2.00
General expenses (75% variable)	<u>3.00</u>
Total	\$ 49.00
Differential selling price.....	<u>50.00</u>
Profit per unit	<u>\$</u>
<u>1.00</u>	

Profit per unit x Units sold = \$1 x 10,000 = \$10,000 increase in profit

PROBLEM

2.

Effect of New Order on Profits. Island Cyclery, Inc. manufactures trail bikes. Management is considering the expansion of its sales to the tourist market. All sales for this market would be made to a rental agency in St. John, and the rental agent would receive a discount. An investigation of the trail-bike market reveals the following data:

Trail bikes sold year-to-date	1,000
Production capacity of trail bikes	2,000
Costs for this year (at standard):	
Materials.....	\$200,000
Direct labor	275,000
Factory overhead	
Variable	100,000
Fixed	175,000
Sales commissions.....	45,000
Packing and shipping.....	25,000
Advertising.....	85,000
Administrative expenses.....	190,000

A trail bike regularly wholesales for \$800, but the St. John transaction calls for a selling price of \$700. There would be no sales commission. Because the St. John rental agency will pay cash, the allowance for doubtful accounts (which usually amounts to 2% of sales and is included in administrative expenses) will not be required.

However, packing and shipping costs would increase by \$25 per unit to compensate for transpacific freight. All other selling and administrative expenses are fixed. The company estimates that 500 trail bikes will satisfy the St. John tourist market.

Required: Prepare an analysis showing the effect on profits if the new order is accepted by the company. (Show both per-unit selling price and costs and total sales and costs for the new order.)

SOLUTION

	<u>Per Unit</u>	<u>Total</u>
Sales.....	\$ 700	\$ 350,000
Differential costs		
Materials (\$200,000 ÷ 1,000 units).....	\$ 200	\$ 100,000
Direct labor (\$275,000 ÷ 1,000 units)	275	137,500
Variable factory overhead (\$100,000 ÷ 1,000 units).....	100	50,000
Packing and shipping [(\$25,000 ÷ 1,000) + \$25]	50	25,000
Total	<u>\$ 625</u>	<u>\$</u>
<u>312,500</u>		
Increase in profit	<u>\$ 75</u>	<u>\$</u>
<u>37,500</u>		

PROBLEM

3.

Decision to Add New Product Line. The management of Banter Inc. is considering the entry of its new Jokes product line in the market. Because its existing product line, Riddles, has similar characteristics to the new product line, management expects the Jokes sales to require a minimum of additional expense. It is also anticipated that Riddles sales will increase if both product lines are offered in a package deal. The Jokes product line would be manufactured in a company-owned facility that is now being rented to another firm for \$600,000 per year. Depreciation on this facility and all other building expenses are presently \$100,000 per year. In addition, the company will need to rent equipment to manufacture the new product line at an additional cost of \$150,000 per year. The contribution margin for the Jokes product line would be \$50 per unit, and annual sales are estimated at 10,000 units. Last year, sales for the Riddles product line amounted to 40,000 units. Other relevant per unit sales and cost data were:

Selling price	\$100
Variable cost of goods sold	25
Fixed cost of goods sold	20
Variable marketing and administrative expenses	10
Fixed marketing and administrative expenses	15

If the new Jokes product line is undertaken, the company expects a 10% increase in Riddles sales. Otherwise, Riddles sales will remain unchanged. Additional facilities will not be needed to manufacture the additional Riddles units.

Required: Prepare an analysis showing the effect on profit if this new product line is accepted by the company.

SOLUTION**Contribution from:**

Jokes contribution margin (10,000 units @ \$50)		\$ 500,000
Riddles sales (40,000 units x 10%):		
Sales (4,000 units @ \$100)	\$ 400,000	
Variable cost of goods sold (4,000 units @ \$25)	(100,000)	
Variable marketing and administrative expenses		
(4,000 units @ \$10)	(40,000)	260,000
Total		\$ 760,000
Less:		
Rental foregone on company-owned facility	\$ 600,000	
Depreciation of new equipment	150,000	750,000
Increase in profits		<u>\$ 10,000</u>

PROBLEM

4.

Decision to Eliminate a Division. Major League Company has two operating divisions —American and National. The January income statements for each division and the company as a whole are:

	<u>American Division</u>	<u>National Division</u>	<u>Total</u>
Sales.....	\$ 112,500	\$ 60,000	\$ 172,500
Cost of goods sold:			
Prime cost	\$ 20,000	\$ 15,000	\$ 35,000
Variable factory overhead.....	15,000	12,000	27,000
Fixed factory overhead	22,500	18,000	40,500
Total	<u>\$ 57,500</u>	<u>\$ 45,000</u>	<u>\$ 102,500</u>
Gross profit	<u>\$ 55,000</u>	<u>\$ 15,000</u>	<u>\$ 70,000</u>
Other expenses:			
Sales commissions.....	\$ 10,000	\$ 5,000	\$ 15,000
Packing and shipping.....	9,000	7,000	16,000
Advertising.....	12,000	8,000	20,000
Administrative	16,000	8,000	24,000
Total	<u>\$ 47,000</u>	<u>\$ 28,000</u>	<u>\$ 75,000</u>
Operating income (loss)	<u>\$ 8,000</u>	<u>\$ (13,000)</u>	<u>\$ (5,000)</u>

Company creditors recently informed management that the company must attain more profitable operations before further credit will be extended. One possible move that would aid this situation would be to sell the National Division. One prospective buyer would buy this division for \$200,000; the money from the sale could be invested at 8% interest.

One effect of the sale of the National Division would be that all of its variable manufacturing costs could be eliminated; however, none of the fixed factory overhead expenses would be avoided. The sales commissions and packing and shipping expenses are completely variable. The advertising expenses for the company as a whole would be \$15,000 after the elimination of the National Division. Finally, half of the administrative expenses charged to the National Division would be eliminated if the division were sold.

Required:

- (1) Prepare a revised income statement for the company as a whole for the month of January if the National Division is eliminated to improve the credit rating.
- (2) Should the National Division be eliminated to improve profits?

SOLUTION

(1)

Major League Company
Income Statement
For Month Ended January 31, 19--

Sales.....		\$ 112,500
Cost of goods sold:		
Prime cost	\$20,000	
Variable factory overhead.....	15,000	
Fixed factory overhead	<u>40,500</u>	
Total		<u>75,500</u>
Gross profit		\$ 37,000
Other expenses:		
Sales commissions.....	\$10,000	
Packing and shipping.....	9,000	
Advertising.....	15,000	
Administrative	<u>20,000</u>	
Total		<u>\$ 54,000</u>
Operating loss		\$ (17,000)
Nonoperating income:		
Interest income	<u>1,333</u>	<u>1,333</u>
*		
Loss before taxes.....		<u>\$ (15,667)</u>
<u> </u>)		
*(200,000 x .08) ÷ 12		

(2)

No, the National Division should not be eliminated. The company will incur \$10,667 less loss if the division is continued because the fixed overhead cannot be eliminated.

PROBLEM

5.

Make-or-Buy Decision. TGIF Inc. manufactures party games. Most games are played on boards that are purchased from an outside supplier at the cost of \$1 each. The company uses 50,000 boards a year. Management requests that an analysis be made to determine the profitability of producing the boards internally.

The materials required to manufacture each board cost \$.15 per board. To print the game pattern and to glue the pattern to the board includes a direct labor cost of \$.20 per board. The company would also have to lease a board press costing \$20,000 for a four-year lease. Presently, there is adequate space in the Producing Department for the manufacture of 20,000 boards per year.

If the company were to produce all of its boards internally, it would be necessary to cease its manufacture of checkers and to purchase these pieces from the outside, resulting in an additional \$25,000 cost. Also, a checker caster costing \$8,000 with a \$4,000 book value would have to be scrapped without a salvage value.

Required: Prepare a recommendation to management to aid in the make-or-buy decision for the game boards; use an analysis of the differential costs required for the manufacture of 20,000 and then 50,000 boards vs. the cost of purchasing each quantity from an outside supplier.

SOLUTION

	<u>20,000 Boards</u>	<u>50,000 Boards</u>
Cost to purchase from outside	<u>\$ 20,000</u>	<u>\$ 50,000</u>
Manufacturing costs:		
Direct materials (\$.15 per board)	\$ 3,000	\$ 7,500
Direct labor (\$.20 per board)	4,000	10,000
Lease—new board press (\$20,000/4 yrs.)	5,000	5,000
Cost to purchase checkers from outside	--	25,000
Total	<u>\$ 12,000</u>	<u>\$ 47,500</u>
Differential profit (loss) from manufacturing	<u>\$ 8,000</u>	<u>\$ 2,500</u>

The recommendation to management would be to make 20,000 game boards and purchase 30,000 from the outside because it results in more differential profit than producing 50,000 boards. The cost of the checker caster is irrelevant to the make-or-buy decision because it is a sunk cost.

PROBLEM

6.

Sell or Process Further. From a particular joint process, Gusher Company produces three products—Kerosene, Gasoline, and Fuel Oil. Each product may be sold at the point of split-off or processed further. Additional processing requires no special facilities, and the production costs of further processing are entirely variable and traceable to the products involved. In 19--, these products were processed beyond split-off. Joint production costs for the year were \$60,000. Sales values and costs needed to evaluate Gusher's 19-- production policy follow:

<u>Product</u>	<u>Gallons Produced</u>	<u>Sales Values at Split-Off</u>	<u>Additional Costs and Sales Values if Processed Further</u>	
			<u>Sales Values</u>	<u>Added Costs</u>
Kerosene	6,000	\$25,000	\$42,000	\$12,000
Gasoline	4,000	41,000	45,000	6,000
Fuel Oil	2,000	24,000	32,000	8,000

Joint costs are allocated to the products based on the percentage of the individual product's sales value to the total sales value of all products.

Required:

- (1) For gallons of Kerosene, compute the unit production cost most relevant to a "sell" or "process further" decision.
- (2) Determine which products the company should subject to additional processing in order to maximize profits.

SOLUTION

- (1) Added costs/Gallons produced = $\$12,000/6,000 = \2.00 . Two dollars is the most relevant Kerosene unit production cost for a "sell" or "process further" decision.
- (2) Gusher Company should subject only Kerosene to additional processing in order to maximize profits because the added sales value exceeds the added costs. For Gasoline, the added costs exceed the added sales value; for Fuel Oil, the added sales value equals the added cost, so other factors would be dominant.

	<u>Kerosene</u>	<u>Gasoline</u>	<u>Fuel Oil</u>
Sales value if processed further	\$ 42,000	\$ 45,000	\$ 32,000
Sales value at split-off	25,000	41,000	24,000
Added sales value	\$ 17,000	\$ 4,000	\$ 8,000
Added costs	\$ 12,000	\$ 6,000	\$ 8,000

The following problems are based on material appearing in the Appendix to the chapter.

PROBLEM

7.

Problem Formulation. Barby-Q Inc. manufactures gas grills and charcoal grills. Each gas grill sells for \$160, and each charcoal grill sells for \$60. The variable costs of a gas grill are \$100 and the fixed costs allocated to the normal production level equal \$25. Variable costs of a charcoal grill are \$30, and the fixed costs allocated to charcoal grills are \$15 per unit. There is a limitation of 10,000 pounds of steel used to manufacture both products. The charcoal grills require 1 pound of steel per unit; each gas grill requires 2 pounds. The demand for gas grills is limited to 5,000 units. Both products must be completed in the Finishing Department, where the equipment is limited to 500 hours of use per period. Ten charcoal grills can be finished in one hour, but only three gas grills can be finished per hour.

Required: Formulate the objective function and the constraints. Use x to represent gas grills and y to represent charcoal grills. (Do not solve this problem.)

SOLUTION

$$\begin{array}{ll}\text{Maximize:} & \$60x + \$30y \\ \text{Constraints:} & 2x + y \leq 10,000 \text{ (steel constraint)} \\ & x \leq 5,000 \text{ (demand constraint)} \\ & .33x + .1y \leq 500 \text{ (finishing constraint)}\end{array}$$

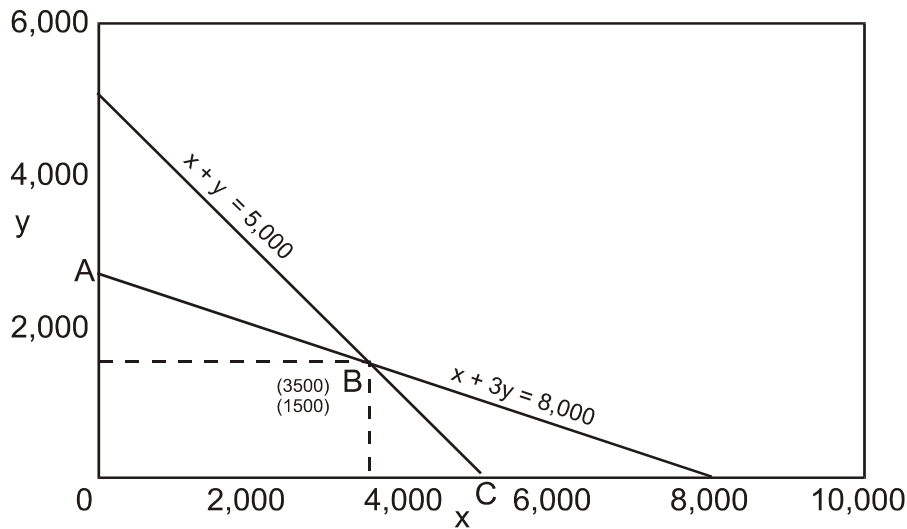
PROBLEM

8.

Profit Maximization: Graphic Method. Consider the following linear programming problem:

$$\begin{array}{ll}\text{Maximize:} & \$2x + \$3y \\ \text{Constraints:} & x + y < 5,000 \\ & x + 3y < 8,000\end{array}$$

Required: Solve this problem using the graphic method.

SOLUTION

<u>Letter on Graph</u>	<u>Corner Point</u>	<u>Profit</u>	<u>Total Profit</u>
A	0x ; 2,667	(0 x \$2) + (2,667 x \$3)	\$ 8,000
B	3,500x ; 1,500 y	(3,500 x \$2) + (1,500 x \$3)	11,500 ¹
C	5,000x ; 0 y	(5,000 x \$2) + (0 x \$3)	10,000

¹**Optimal solution**

Solution of the simultaneous equations: $x + y = 5,000$
 $x + 3y = 8,000$

Rearranging second equation and solving for x: $x = 8,000 - 3y$

Substituting into the first equation: $(8,000 - 3y) + y = 5,000$
 $-2y = -3,000$
 $y = 1,500$

Substituting into the second equation: $x + 3(1,500) = 8,000$
 $x = 3,500$