

## **Differential Analysis: The Key to Decision Making**

### **Adding and Dropping Product Lines and Other Segments**

#### HELPFUL HINT

Use the following three steps to quantify the financial impact of discontinuing a business segment:

Step 1: Calculate the contribution margin that would disappear if the segment is dropped. Put this number in parentheses to denote it as a negative number.

Step 2: Calculate the fixed costs that would be avoided (relevant) if the segment is dropped. Do not put this number in parentheses. This number will be added as an offset to the loss of the contribution margin.

Step 3: Add the amounts from steps 1 and 2. If the result is a negative number, then do not drop the segment. If it is a positive number, then choose to drop the segment.

Or you can restate the two alternatives in a Segment Margin Income Statement

### **The Make or Buy Decision**

#### HELPFUL HINT

Use the following three steps to quantify the financial impact of make or buy decisions:

Step 1: Calculate the total amount that would be paid to the supplier if the buy option is chosen.

Step 2: Calculate the total differential manufacturing costs. These are the variable manufacturing costs and traceable fixed manufacturing costs that will be incurred if the company chooses to make, but avoided if the company chooses to buy.

Step 3: Calculate the difference between the amounts from steps 1 and 2. If the amount from step 1 exceeds the amount from step 2, then choose the make option. If the amount from step 1 is less than the amount from step 2, then choose the buy option.

## **Special Orders**

### HELPFUL HINT

Use the following three steps to quantify the financial impact of accepting a special order:

Step 1: Calculate the total revenue generated by the special order.

Step 2: Calculate the total incremental costs that will be incurred to produce the special order.

Step 3: Take the amount in step 1 and subtract from it the amount in step 2. If the result is a positive number, then accept the special order. If it is a negative number, then reject the special order.

## **UTILIZATION OF A CONSTRAINED RESOURCE**

### HELPFUL HINT

Use the following four steps to help determine the most profitable use of a constrained resource:

Step 1: Calculate each product's contribution margin per unit.

Step 2: Identify the constraining resource and the quantity of that resource that is consumed to make one unit of each product.

Step 3: Calculate each product's contribution margin per unit of the constraining resource.

Step 4: Rank the products from the highest contribution margin per unit of the constraining resource to the lowest.

## **Joint Product Costs and the Contribution Approach**

### HELPFUL HINT

For each end product, use the following three steps to make sell or process further decisions:

Step 1: Calculate the sales value if processed further minus the sales value at the split-off point.

Step 2: Determine the cost of further processing beyond the split-off point.

Step 3: Take the amount in step 1 and subtract from it the amount in step 2. If the result is a positive number, then choose to process further. If it is a negative number, then choose to sell at the split-off point.

While you may need to add additional steps when solving complex problems, these three steps will help organize your analysis.

EXERCISE 12–1 Identifying Relevant Costs [LO12–1]

A number of costs are listed below that may be relevant in decisions faced by the management of Svahn, AB, a Swedish manufacturer of sailing yachts:

Item	Case 1		Case 2	
	Relevant	Not Relevant	Relevant	Not Relevant
a. Sales revenue				
b. Direct materials				
c. Direct labor				
d. Variable manufacturing overhead				
e. Depreciation—Model B100 machine				
f. Book value—Model B100 machine				
g. Disposal value—Model B100 machine				
h. Market value—Model B300 machine (cost)				
i. Fixed manufacturing overhead (general)				
j. Variable selling expense				
k. Fixed selling expense				
l. General administrative overhead				

Place an X in the appropriate column to indicate whether each item is relevant or not relevant in the following situations. Requirement 1 relates to Case 1 above, and requirement 2 relates to Case 2.

- The company chronically has no idle capacity and the old Model B100 machine is the company’s constraint. Management is considering purchasing a Model B300 machine to use in addition to the company’s present Model B100 machine. The old Model B100 machine will continue to be used to capacity as before, with the new Model B300 machine being used to expand production. This will increase the company’s production and sales. The increase in volume will be large enough to require increases in fixed selling expenses and in general administrative overhead, but not in the fixed manufacturing overhead.

The old Model B100 machine is not the company’s constraint, but management is considering replacing it with a new Model B300 machine because of the potential savings in direct materials with the new machine. The Model B100 machine would be sold. This change will have no effect on production or sales, other than some savings in direct materials costs due to less waste.

## Segmented Income Statements and the Contribution Approach

### Adding and Dropping Product Lines and Other Segments

#### HELPFUL HINT

Use the following three steps to quantify the financial impact of discontinuing a business segment:

Step 1: Calculate the contribution margin that would disappear if the segment is dropped. Put this number in parentheses to denote it as a negative number.

Step 2: Calculate the fixed costs that would be avoided (relevant) if the segment is dropped. Do not put this number in parentheses. This number will be added as an offset to the loss of the contribution margin.

Step 3: Add the amounts from steps 1 and 2. If the result is a negative number, then do not drop the segment. If it is a positive number, then choose to drop the segment.

Or you can restate the two alternatives in a Segment Margin Income Statement

While you may need to add additional steps when solving complex problems, these three steps will help organize your analysis.

#### EXERCISE 12–2 Dropping or Retaining a Segment

The Regal Cycle Company manufactures three types of bicycles—a dirt bike, a mountain bike, and a racing bike. Data on sales and expenses for the past quarter follow:

	Total	Dirt Bikes	Mountain Bikes	Racing Bikes
Sales .....	\$300,000	\$90,000	\$150,000	\$60,000
Variable manufacturing and selling expenses .....	<u>120,000</u>	<u>27,000</u>	<u>60,000</u>	<u>33,000</u>
Contribution margin .....	<u>180,000</u>	<u>63,000</u>	<u>90,000</u>	<u>27,000</u>
Fixed expenses:				
Advertising, traceable .....	30,000	10,000	14,000	6,000
Depreciation of special equipment .....	23,000	6,000	9,000	8,000
Salaries of product-line managers .....	35,000	12,000	13,000	10,000
Allocated common fixed expenses* .....	<u>60,000</u>	<u>18,000</u>	<u>30,000</u>	<u>12,000</u>
Total fixed expenses .....	<u>148,000</u>	<u>46,000</u>	<u>66,000</u>	<u>36,000</u>
Net operating income (loss) .....	<u>\$ 32,000</u>	<u>\$17,000</u>	<u>\$ 24,000</u>	<u>\$ (9,000)</u>

\*Allocated on the basis of sales dollars.

The special equipment used to produce racing bikes has no resale value and does not wear out.

1. Should production and sale of the racing bikes be discontinued? Explain. Show computations to support your answer.

HELPFUL HINT

Use the following three steps to quantify the financial impact of make or buy decisions:

Step 1: Calculate the total amount that would be paid to the supplier if the buy option is chosen.

Step 2: Calculate the total differential manufacturing costs. These are the variable manufacturing costs and traceable fixed manufacturing costs that will be incurred if the company chooses to make, but avoided if the company chooses to buy.

Step 3: Calculate the difference between the amounts from steps 1 and 2. If the amount from step 1 exceeds the amount from step 2, then choose the make option. If the amount from step 1 is less than the amount from step 2, then choose the buy option.

While you may need to add additional steps when solving complex problems, these three steps will help organize your analysis.

EXERCISE 12–3 Make or Buy a Component [LO12–3]

Troy Engines, Ltd., manufactures a variety of engines for use in heavy equipment. The company has always produced all of the necessary parts for its engines, including all of the carburetors. An outside supplier has offered to sell one type of carburetor to Troy Engines, Ltd., for a cost of \$35 per unit. To evaluate this offer, Troy Engines, Ltd., has gathered the following information relating to its own cost of producing the carburetor internally:

	Per Unit	15,000 Units per Year
Direct materials .....	\$14	\$210,000
Direct labor .....	10	150,000
Variable manufacturing overhead .....	3	45,000
Fixed manufacturing overhead, traceable .....	6*	90,000
Fixed manufacturing overhead, allocated .....	9	135,000
Total cost .....	<u>\$42</u>	<u>\$630,000</u>

\*One-third supervisory salaries; two-thirds depreciation of special equipment (no resale value).

1. Assuming that the company has no alternative use for the facilities that are now being used to produce the carburetors, should the outside supplier's offer be accepted? Show all computations.
2. Suppose that if the carburetors were purchased, Troy Engines, Ltd., could use the freed capacity to launch a new product. The segment margin of the new product would be \$150,000 per year. Should Troy Engines, Ltd., accept the offer to buy the carburetors for \$35 per unit? Show all computations.

## Special Orders

Managers must often evaluate whether a *special order* should be accepted, and if the order is accepted, the price that should be charged.

A **special order** is a one-time order that is not considered part of the company's normal ongoing business.

### HELPFUL HINT

Use the following three steps to quantify the financial impact of accepting a special order:

Step 1: Calculate the total revenue generated by the special order.

Step 2: Calculate the total incremental costs that will be incurred to produce the special order.

Step 3: Take the amount in step 1 and subtract from it the amount in step 2. If the result is a positive number, then accept the special order. If it is a negative number, then reject the special order.

While you may need to add additional steps when solving complex problems, these three steps will help organize your analysis.

### EXERCISE 12–4 Evaluating a Special Order [LO12–4]

Imperial Jewelers is considering a special order for 20 handcrafted gold bracelets to be given as gifts to members of a wedding party. The normal selling price of a gold bracelet is \$189.95 and its unit product cost is \$149.00 as shown below:

Direct materials .....	\$ 84.00
Direct labor .....	45.00
Manufacturing overhead .....	<u>20.00</u>
Unit product cost .....	<u><u>\$149.00</u></u>

Most of the manufacturing overhead is fixed and unaffected by variations in how much jewelry is produced in any given period. However, \$4.00 of the overhead is variable with respect to the number of bracelets produced. The customer who is interested in the special bracelet order would like special filigree applied to the bracelets. This filigree would require additional materials costing \$2.00 per bracelet and would also require acquisition of a special tool costing \$250 that would have no other use once the special order is completed. This order would have no effect on the company's regular sales and the order could be fulfilled using the company's existing capacity without affecting any other order.

Required:

What effect would accepting this order have on the company's net operating income if a special price of \$169.95 per bracelet is offered for this order? Should the special order be accepted at this price?

## HELPFUL HINT

Use the following four steps to help determine the most profitable use of a constrained resource:

Step 1: Calculate each product's contribution margin per unit.

Step 2: Identify the constraining resource and the quantity of that resource that is consumed to make one unit of each product.

Step 3: Calculate each product's contribution margin per unit of the constraining resource.

Step 4: Rank the products from the highest contribution margin per unit of the constraining resource to the lowest.

If you start by completing these four steps, it will help you compute the most profitable use of a constrained resource.

### EXERCISE 12–5 Utilizing a Constrained Resource [LO12–5]

Outdoor Luggage Inc. makes high-end hard-sided luggage for sports equipment. Data concerning three of the company's most popular models appear below.

	Ski Guard	Golf Guard	Fishing Guard
Selling price per unit . . . . .	\$200	\$300	\$255
Variable cost per unit . . . . .	\$60	\$140	\$55
Plastic injection molding machine processing time required to produce one unit . . . . .	2 minutes	5 minutes	4 minutes
Pounds of plastic pellets per unit . . . . .	7 pounds	4 pounds	8 pounds

The total time available on the plastic injection molding machine is the constraint in the production process. Which product would be the most profitable use of this constraint? Which product would be the least profitable use of this constraint?

1. A severe shortage of plastic pellets has required the company to cut back its production so much that the plastic injection molding machine is no longer the bottleneck. Instead, the constraint is the total available pounds of plastic pellets. Which product would be the most profitable use of this constraint? Which product would be the least profitable use of this constraint?
2. Which product has the largest unit contribution margin? Why wouldn't this product be the most profitable use of the constrained resource in either case?

EXERCISE 12–7 Sell or Process Further [LO12–7]

Dorsey Company manufactures three products from a common input in a joint processing operation. Joint processing costs up to the split-off point total \$350,000 per quarter. The company allocates these costs to the joint products on the basis of their relative sales value at the split-off point. Unit selling prices and total output at the split-off point are as follows:

Product	Selling Price	Quarterly Output
A .....	\$16 per pound	15,000 pounds
B .....	\$8 per pound	20,000 pounds
C .....	\$25 per gallon	4,000 gallons

Each product can be processed further after the split-off point. Additional processing requires no special facilities. The additional processing costs (per quarter) and unit selling prices after further processing are given below: Which product or products should be sold at the split-off point and which product or products should be processed further?

Product	Additional Processing Costs	Selling Price
A .....	\$63,000	\$20 per pound
B .....	\$80,000	\$13 per pound
C .....	\$36,000	\$32 per gallon



## In Class Assignments

### The Foundational 15

Cane Company manufactures two products called Alpha and Beta that sell for \$120 and \$80, respectively. Each product uses only one type of raw material that costs \$6 per pound. The company has the capacity to annually produce 100,000 units of each product. Its unit costs for each product at this level of activity are given below:

	Alpha	Beta
Direct materials .....	\$ 30	\$12
Direct labor .....	20	15
Variable manufacturing overhead .....	7	5
Traceable fixed manufacturing overhead .....	16	18
Variable selling expenses .....	12	8
Common fixed expenses .....	15	10
Total cost per unit .....	<u>\$100</u>	<u>\$68</u>

The company considers its traceable fixed manufacturing overhead to be avoidable, whereas its common fixed expenses are deemed unavoidable and have been allocated to products based on sales dollars.

Required:

(Answer each question independently unless instructed otherwise.)

1. What is the total amount of traceable fixed manufacturing overhead for the Alpha product line and for the Beta product line?
2. What is the company's total amount of common fixed expenses?
3. Assume that Cane expects to produce and sell 80,000 Alphas during the current year. One of Cane's sales representatives has found a new customer that is willing to buy 10,000 additional Alphas for a price of \$80 per unit. If Cane accepts the customer's offer, how much will its profits increase or decrease?
4. Assume that Cane expects to produce and sell 90,000 Betas during the current year. One of Cane's sales representatives has found a new customer that is willing to buy 5,000 additional Betas for a price of \$39 per unit. If Cane accepts the customer's offer, how much will its profits increase or decrease?
5. **(Will not have time to do this assignment in class).** ~~Assume that Cane expects to produce and sell 95,000 Alphas during the current year. One of Cane's sales representatives has found a new customer that is willing to buy 10,000 additional Alphas for a price of \$80 per unit. If Cane accepts the customer's offer, it will decrease Alpha sales to regular customers by 5,000 units. Should Cane accept this special order?~~
6. Assume that Cane normally produces and sells 90,000 Betas per year. If Cane discontinues the Beta product line, how much will profits increase or decrease?
7. Assume that Cane normally produces and sells 40,000 Betas per year. If Cane discontinues the Beta product line, how much will profits increase or decrease?
8. Assume that Cane normally produces and sells 60,000 Betas and 80,000 Alphas per year. If Cane discontinues the Beta product line, its sales representatives could increase sales of Alpha by 15,000 units. If Cane discontinues the Beta product line, how much would profits increase or decrease?

9. Assume that Cane expects to produce and sell 80,000 Alphas during the current year. A supplier has offered to manufacture and deliver 80,000 Alphas to Cane for a price of \$80 per unit. If Cane buys 80,000 units from the supplier instead of making those units, how much will profits increase or decrease?
10. Assume that Cane expects to produce and sell 50,000 Alphas during the current year. A supplier has offered to manufacture and deliver 50,000 Alphas to Cane for a price of \$80 per unit. If Cane buys 50,000 units from the supplier instead of making those units, how much will profits increase or decrease?
11. How many pounds of raw material are needed to make one unit of Alpha and one unit of Beta?
12. What contribution margin per pound of raw material is earned by Alpha and Beta?
13. Assume that Cane's customers would buy a maximum of 80,000 units of Alpha and 60,000 units of Beta. Also assume that the company's raw material available for production is limited to 160,000 pounds. How many units of each product should Cane produce to maximize its profits?
14. If Cane follows your recommendation in requirement 13, what total contribution margin will it earn?

### EXERCISE 12–8 Utilization of a Constrained Resource

Barlow Company manufactures three products: A, B, and C. The selling price, variable costs, and contribution margin for one unit of each product follow:

	Product		
	A	B	C
Selling price . . . . .	<u>\$180</u>	<u>\$270</u>	<u>\$240</u>
Variable expenses:			
Direct materials . . . . .	24	72	32
Other variable expenses . . . . .	<u>102</u>	<u>90</u>	<u>148</u>
Total variable expenses . . . . .	<u>126</u>	<u>162</u>	<u>180</u>
Contribution margin . . . . .	<u>\$ 54</u>	<u>\$108</u>	<u>\$ 60</u>
Contribution margin ratio . . . . .	30%	40%	25%

The same raw material is used in all three products. Barlow Company has only 5,000 pounds of raw material on hand and will not be able to obtain any more of it for several weeks due to a strike in its supplier's plant. Management is trying to decide which product(s) to concentrate on next week in filling its backlog of orders. The material costs \$8 per pound.

1. Compute the amount of contribution margin that will be obtained per pound of material used in each product.
2. Which orders would you recommend that the company work on next week—the orders for product A, product B, or product C? Show computations.
3. A foreign supplier could furnish Barlow with additional stocks of the raw material at a substantial premium over the usual price. If there is unfilled demand for all three products, what is the highest price that Barlow Company should be willing to pay for an additional pound of materials? Explain.

### EXERCISE 12–13 Sell or Process Further [LO12–7]

Wexpro, Inc., produces several products from processing 1 ton of clypton, a rare mineral. Material and processing costs total \$60,000 per ton, one-fourth of which is allocated to product X15. Seven thousand units of product X15 are produced from each ton of clypton. The units can either be sold at the split-off point for \$9 each, or processed further at a total cost of \$9,500 and then sold for \$12 each.

Should product X15 be processed further or sold at the split-off point?