Chapter 13
Relevant Costs for Decision Making

Solutions to Questions

13-1 A relevant cost is a cost that differs in total between the alternatives in a decision.

13-2 An incremental cost (or benefit) is the change in cost (or benefit) that will result from some proposed action. An opportunity cost is the benefit that is lost or sacrificed in rejecting some course of action. A sunk cost is a cost that has already been incurred and that cannot be changed by any future decision.

13-3 No. Variable costs are relevant costs only if they differ in total between the alternatives under consideration.

13-4 No. Not all fixed costs are sunk—only those for which the cost has already been irrevocably incurred. A variable cost can be a sunk cost, if it has already been incurred.

13-5 No. A variable cost is a cost that varies in total amount in direct proportion to changes in the level of activity. A differential cost measures the difference in cost between two alternatives. If the level of activity is the same for the two alternatives, a variable cost will be unaffected and it will be irrelevant.

13-6 No. Only those future costs that differ between the alternatives under consideration are relevant.

13-7 Only those costs that can be avoided as a result of dropping the product line are relevant in the decision. Costs that will not differ regardless of whether the line is retained or discontinued are irrelevant.

13-8 Not necessarily. An apparent loss may be the result of allocated common costs or of sunk costs that cannot be avoided if the product line is dropped. A product line should be discontinued only if the contribution margin that will be lost as a result of dropping the line is less than the fixed costs that can be avoided. Even in that situation there may be arguments in favor of retaining the product line if its presence promotes the sale of other products.

13-9 Allocations of common fixed costs can make a product line (or other segment) appear to be unprofitable, whereas in fact it may be profitable.

13-10 If a company decides to make a part internally rather than to buy it from an outside supplier, then a portion of the company's facilities have to be used to make the part. The company's opportunity cost is measured by the benefits that could be derived from the best alternative use of the facilities.

13-11 Any resource that is required to make products and get them into the hands of customers could be a constraint. Some examples are machine time, direct labor time, floor space, raw materials, investment capital, supervisory time, and storage space. While not covered in the text, constraints can also be intangible and often take the form of a formal or informal policy that prevents the organization from furthering its goals.

13-12 Assuming that fixed costs are not affected, profits are maximized when the total contribution margin is maximized. A company can maximize its contribution margin by focusing on the products with the greatest amount of contribution margin per unit of the constrained resource.

13-13 Joint products are two or more products that are produced from a common input. Joint costs are the costs that are incurred up to the

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split-off point. The split-off point is the point in the manufacturing process where joint products can be recognized as individual products.

13-14 Joint costs should not be allocated among joint products. If joint costs are allocated among the joint products, then managers may think they are avoidable costs of the end products. However, the joint costs will continue to be incurred as long as the process is run regardless of what is done with one of the end products. Thus, when making decisions about the end products, the joint costs are not avoidable and are irrelevant.

13-15 As long as the incremental revenue from further processing exceeds the incremental costs of further processing, the product should be processed further.

13-16 Most costs of a flight are either sunk costs, or costs that do not depend on the number of passengers on the flight. Depreciation of the aircraft, salaries of personnel on the ground and in the air, and fuel costs, for example, are the same whether the flight is full or almost empty. Therefore, adding more passengers at reduced fares at certain times of the week when seats would otherwise be empty does little to increase the total costs of making the flight, but can do much to increase the total contribution and total profit.

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Exercise 13-1 (15 minutes)

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

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Exercise 13-2 (30 minutes)

1. No, production and sale of the racing bikes should not be discontinued. If the racing bikes were discontinued, then the net operating income for the company as a whole would decrease by $11,000 each quarter:

Lost contribution margin		$(27,000)
Fixed costs that can be avoided:		
Advertising, traceable	$ 6,000	
Salary of the product line manager	10,000	16,000
Decrease in net operating income for the company as a whole		$(11,000)

The depreciation of the special equipment is a sunk cost and is not relevant to the decision. The common costs are allocated and will continue regardless of whether or not the racing bikes are discontinued; thus, they are not relevant to the decision.

Alternative Solution:

	Current Total	*Total If Racing Bikes Are Dropped*	*Difference: Net Operating Income Increase or (Decrease)*
Sales	$300,000	$240,000	$(60,000)
Less variable expenses	120,000	87,000	33,000
Contribution margin	180,000	153,000	(27,000)
Less fixed expenses:			
Advertising, traceable	30,000	24,000	6,000
Depreciation on special equipment*	23,000	23,000	0
Salaries of product managers	35,000	25,000	10,000
Common allocated costs	60,000	60,000	0
Total fixed expenses	148,000	132,000	16,000
Net operating income	$ 32,000	$ 21,000	$(11,000)

*Includes pro-rated loss on the special equipment if it is disposed of.

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Exercise 13-2 (continued)

2. The segmented report can be improved by eliminating the allocation of the common fixed expenses. Following the format introduced in Chapter 12 for a segmented income statement, a better report would be:

	Total	*Dirt Bikes*	*Mountain Bikes*	*Racing Bikes*
Sales	$300,000	$90,000	$150,000	$60,000
Less variable manufacturing and selling expenses	120,000	27,000	60,000	33,000
Contribution margin	180,000	63,000	90,000	27,000
Less traceable fixed expenses:				
Advertising	30,000	10,000	14,000	6,000
Depreciation of special equipment	23,000	6,000	9,000	8,000
Salaries of the product line managers	35,000	12,000	13,000	10,000
Total traceable fixed expenses	88,000	28,000	36,000	24,000
Product line segment margin	92,000	$35,000	$ 54,000	$ 3,000
Less common fixed expenses	60,000			
Net operating income	$ 32,000			

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Exercise 13-3 (30 minutes)

1.

	Per Unit Differential Costs		15,000 units	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$35		$525,000
Direct materials	$14		$210,000	
Direct labor	10		150,000	
Variable manufacturing overhead	3		45,000	
Fixed manufacturing overhead, traceable[1]	2		30,000	
Fixed manufacturing overhead, common				
Total costs	$29	$35	$435,000	$525,000
Difference in favor of continuing to make the carburetors	$6		$90,000	

[1] Only the supervisory salaries can be avoided if the carburetors are purchased. The remaining book value of the special equipment is a sunk cost; hence, the $4 per unit depreciation expense is not relevant to this decision. Based on these data, the company should reject the offer and should continue to produce the carburetors internally.

2.

	Make	*Buy*
Cost of purchasing (part 1)		$525,000
Cost of making (part 1)	$435,000	
Opportunity cost—segment margin foregone on a potential new product line	150,000	
Total cost	$585,000	$525,000
Difference in favor of purchasing from the outside supplier	$60,000	

Thus, the company should accept the offer and purchase the carburetors from the outside supplier.

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Exercise 13-4 (15 minutes)

Only the incremental costs and benefits are relevant. In particular, only the variable manufacturing overhead and the cost of the special tool are relevant overhead costs in this situation. The other manufacturing overhead costs are fixed and are not affected by the decision.

	Per Unit	*Total for 20 Bracelets*
Incremental revenue	$169.95	$3,399.00
Incremental costs:		
Variable costs:		
Direct materials	$ 84.00	1,680.00
Direct labor	45.00	900.00
Variable manufacturing overhead	4.00	80.00
Special filigree	2.00	40.00
Total variable cost	$135.00	2,700.00
Fixed costs:		
Purchase of special tool		250.00
Total incremental cost		2,950.00
Incremental net operating income		$ 449.00

Even though the price for the special order is below the company's regular price for such an item, the special order would add to the company's net operating income and should be accepted. This conclusion would not necessarily follow if the special order affected the regular selling price of bracelets or if it required the use of a constrained resource.

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Exercise 13-5 (30 minutes)

1.

	A	*B*	*C*
(1) Contribution margin per unit	$54	$108	$60
(2) Direct material cost per unit	$24	$72	$32
(3) Direct material cost per pound	$8	$8	$8
(4) Pounds of material required per unit (2) ÷ (3)	3	9	4
(5) Contribution margin per pound (1) ÷ (4)	$18	$12	$15

2. The company should concentrate its available material on product A:

	A	*B*	*C*
Contribution margin per pound (above)	$ 18	$ 12	$ 15
Pounds of material available	× 5,000	× 5,000	× 5,000
Total contribution margin	$90,000	$60,000	$75,000

Although product A has the lowest contribution margin per unit and the second lowest contribution margin ratio, it is preferred over the other two products since it has the greatest amount of contribution margin per pound of material, and material is the company's constrained resource.

3. The price Barlow Company would be willing to pay per pound for additional raw materials depends on how the materials would be used. If there are unfilled orders for all of the products, Barlow would presumably use the additional raw materials to make more of product A. Each pound of raw materials used in product A generates $18 of contribution margin over and above the usual cost of raw materials. Therefore, Barlow should be willing to pay up to $26 per pound ($8 usual price plus $18 contribution margin per pound) for the additional raw material, but would of course prefer to pay far less. The upper limit of $26 per pound to manufacture more product A signals to managers how valuable additional raw materials are to the company.

If all of the orders for product A have been filled, Barlow Company would then use additional raw materials to manufacture product C. The company should be willing to pay up to $23 per pound ($8 usual price plus $15 contribution margin per pound) for the additional raw materials to manufacture more product C, and up to $20 per pound ($8 usual price plus $12 contribution margin per pound) to manufacture more product B if all of the orders for product C have been filled as well.

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Exercise 13-6 (10 minutes)

	A	*B*	*C*
Selling price after further processing	$20	$13	$32
Selling price at the split-off point	16	8	25
Incremental revenue per pound or gallon	$ 4	$ 5	$ 7
Total quarterly output in pounds or gallons	×15,000	×20,000	×4,000
Total incremental revenue	$60,000	$100,000	$28,000
Total incremental processing costs	63,000	80,000	36,000
Total incremental profit or loss	$(3,000)	$ 20,000	$(8,000)

Therefore, only product B should be processed further.

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Exercise 13-7 (20 minutes)

1.

Fixed cost per mile ($5,000* ÷ 50,000 miles)	$0.10
Variable cost per mile	0.07
Average cost per mile	$0.17

* Insurance	$1,600
Licenses	250
Taxes	150
Garage rent	1,200
Depreciation	1,800
Total	$5,000

This answer assumes the resale value of the truck does not decline because of the wear and tear that comes with use.

2. The insurance, the licenses, and the variable costs (gasoline, oil, tires, and repairs) would all be relevant to the decision, since these costs are avoidable by not using the truck. (However, the owner of the garage might insist that the truck be insured and licensed if it is left in the garage. In that case, the insurance and licensing costs would not be relevant since they would be incurred regardless of the decision.) The taxes would not be relevant, since they must be paid regardless of use; the garage rent would not be relevant, since it must be paid to park the truck; and the depreciation would not be relevant, since it is a sunk cost. However, any decrease in the resale value of the truck due to its use would be relevant.

3. Only the variable costs of $0.07 would be relevant, since they are the only costs that can be avoided by having the delivery done commercially.

4. In this case, only the fixed costs associated with the second truck would be relevant. The variable costs would not be relevant, since they would not differ between having one or two trucks. (Students are inclined to think that variable costs are always relevant in decision-making, and to think that fixed costs are always irrelevant. This requirement helps to dispel that notion.)

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Exercise 13-8 (30 minutes)

No, the bilge pump product line should not be discontinued. The computations are:

Contribution margin lost if the line is dropped		€(460,000)
Fixed costs that can be avoided:		
Advertising	€270,000	
Salary of the product line manager	32,000	
Insurance on inventories	8,000	310,000
Net disadvantage of dropping the line		€(150,000)

The same solution can be obtained by preparing comparative income statements:

	Keep Product Line	*Drop Product Line*	*Difference: Net Operating Income Increase or (Decrease)*
Sales	€850,000	€ 0	€(850,000)
Less variable expenses:			
Variable manufacturing expenses	330,000	0	330,000
Sales commissions	42,000	0	42,000
Shipping	18,000	0	18,000
Total variable expenses	390,000	0	390,000
Contribution margin	460,000	0	(460,000)
Less fixed expenses:			
Advertising	270,000	0	270,000
Depreciation of equipment	80,000	80,000	0
General factory overhead	105,000	105,000	0
Salary of product line manager	32,000	0	32,000
Insurance on inventories	8,000	0	8,000
Purchasing department expenses	45,000	45,000	0
Total fixed expenses	540,000	230,000	310,000
Net operating loss	€ (80,000)	€(230,000)	€(150,000)

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Exercise 13-9 (20 minutes)

The costs that are relevant in a make-or-buy decision are those costs that can be avoided as a result of purchasing from the outside. The analysis for this exercise is:

	Per Unit Differential Costs		*30,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$21.00		$630,000
Cost of making:				
Direct materials	$ 3.60		$108,000	
Direct labor	10.00		300,000	
Variable overhead	2.40		72,000	
Fixed overhead	3.00 *		90,000	
Total cost	$19.00	$21.00	$570,000	$630,000

* The remaining $6 of fixed overhead cost would not be relevant, since it will continue regardless of whether the company makes or buys the parts.

The $80,000 rental value of the space being used to produce part S-6 represents an opportunity cost of continuing to produce the part internally. Thus, the completed analysis would be:

	Make	*Buy*
Total cost, as above	$570,000	$630,000
Rental value of the space (opportunity cost)	80,000	
Total cost, including opportunity cost	$650,000	$630,000
Net advantage in favor of buying	$20,000	

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Exercise 13-10 (15 minutes)

1. Annual profits will be increased by $39,000:

	Per Unit	*15,000 Units*
Incremental sales	$14.00	$210,000
Incremental costs:		
Direct materials	5.10	76,500
Direct labor	3.80	57,000
Variable manufacturing overhead	1.00	15,000
Variable selling and administrative	1.50	22,500
Total incremental costs	11.40	171,000
Incremental profits	$ 2.60	$ 39,000

The fixed costs are not relevant to the decision, since they will be incurred regardless of whether the special order is accepted or rejected.

2. The relevant cost is $1.50 (the variable selling and administrative expenses). All other variable costs are sunk, since the units have already been produced. The fixed costs would not be relevant, since they will not change in total as a consequence of the price charged for the left-over units.

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Exercise 13-11 (15 minutes)

The company should accept orders first for C, second for A, and third for B. The computations are:

		A	*B*	*C*
(1)	Direct materials required per unit........	$24	$15	$9
(2)	Cost per pound.................................	$3	$3	$3
(3)	Pounds required per unit (1) ÷ (2)......	8	5	3
(4)	Contribution margin per unit..............	$32	$14	$21
(5)	Contribution margin per pound of materials used (4) ÷ (3)	$4.00	$2.80	$7.00

Since C uses the least amount of material per unit of the three products, and since it is the most profitable of the three in terms of its use of materials, some students will immediately assume that this is an infallible relationship. That is, they will assume that the way to spot the most profitable product is to find the one using the least amount of the constrained resource. The way to dispel this notion is to point out that product A uses more material (the constrained resource) than does product B, but yet it is preferred over product B. *The key factor is not how much of a constrained resource a product uses, but rather how much contribution margin the product generates per unit of the constrained resource.*

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Exercise 13-12 (10 minutes)

Sales value if processed further (7,000 units × $12 per unit)	$84,000
Sales value at the split-off point (7,000 units × $9 per unit)	63,000
Incremental revenue	21,000
Less cost of processing further	9,500
Net advantage of processing further	$11,500

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Exercise 13-13 (30 minutes)

1. The relevant costs of a hunting trip would be:

Travel expense (100 miles @ $0.21 per mile) ...	$21
Shotgun shells	20
One bottle of whiskey	15
Total	$56

   This answer assumes that Bill would not be drinking the bottle of whiskey anyway. It also assumes that the resale values of the camper, pickup truck, and boat are not affected by taking one more hunting trip.

   The money lost in the poker game is not relevant because Bill would have played poker even if he did not go hunting. He plays poker every weekend.

   The other costs are sunk at the point at which the decision is made to go on another hunting trip.

2. If Bill gets lucky and bags another two ducks, all of his costs are likely to be about the same as they were on his last trip. Therefore, it really doesn't cost him anything to shoot the last two ducks—except possibly the costs for extra shotgun shells. The costs are really incurred in order to be able to hunt ducks and would be the same whether one, two, three, or a dozen ducks were actually shot. All of the costs, with the possible exception of the costs of the shotgun shells, are basically fixed with respect to how many ducks are actually bagged during any one hunting trip.

3. In a decision of whether to give up hunting entirely, more of the costs listed by John are relevant. If Bill did not hunt, he would not need to pay for: gas, oil, and tires; shotgun shells; the hunting license; and the whiskey. In addition, he would be able to sell his camper, equipment, boat, and possibly pickup truck, the proceeds of which would be considered relevant in this decision. The original costs of these items are not relevant, but their resale values are relevant.

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Exercise 13-13 (continued)

These three requirements illustrate the slippery nature of costs. A cost that is relevant in one situation can be irrelevant in the next. None of the costs—except possibly the cost of the shotgun shells—are relevant when we compute the cost of bagging a particular duck; some of them are relevant when we compute the cost of a hunting trip; and more of them are relevant when we consider the possibility of giving up hunting.

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Exercise 13-14 (10 minutes)

Contribution margin lost if the Linen Department is dropped:	
Lost from the Linen Department	$600,000
Lost from the Hardware Department (10% × $2,100,000)	210,000
Total lost contribution margin	810,000
Less fixed costs that can be avoided ($800,000 – $340,000)	460,000
Decrease in profits for the company as a whole	$350,000

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Exercise 13-15 (15 minutes)

The target production level is 40,000 starters per period, as shown by the relations between per-unit and total fixed costs.

	"Cost" Per Unit	*Differential Costs*		
		Make	*Buy*	*Explanation*
Direct materials	$3.10	$3.10		Can be avoided by buying
Direct labor	2.70	2.70		Can be avoided by buying
Variable manufacturing overhead....	0.60	0.60		Can be avoided by buying
Supervision............	1.50	1.50		Can be avoided by buying
Depreciation	1.00	—		Sunk Cost
Rent	0.30	—		Allocated Cost
Outside purchase price....................			$8.40	
Total cost	$9.20	$7.90	$8.40	

The company should make the starters, rather than continuing to buy from the outside supplier. Making the starters will result in a $0.50 per starter cost savings, or a total savings of $20,000 per period:

$$\$0.50 \text{ per starter} \times 40{,}000 \text{ starters} = \$20{,}000$$

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Problem 13-16 (30 minutes)

1. Contribution margin lost if the flight is discontinued		$(12,950)
Flight costs that can be avoided if the flight is discontinued:		
Flight promotion	$ 750	
Fuel for aircraft	5,800	
Liability insurance (1/3 × $4,200)	1,400	
Salaries, flight assistants	1,500	
Overnight costs for flight crew and assistants	300	9,750
Net decrease in profits if the flight is discontinued		$ (3,200)

The following costs are not relevant to the decision:

Cost	*Reason*
Salaries, flight crew	Fixed annual salaries, which will not change.
Depreciation of aircraft	Sunk cost.
Liability insurance (two-thirds)	Two-thirds of the liability insurance is unaffected by this decision.
Baggage loading and flight preparation	This is an allocated cost that will continue even if the flight is discontinued.

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Problem 13-16 (continued)

Alternative Solution:

	Keep the Flight	*Drop the Flight*	*Difference: Net Operating Income Increase or (Decrease)*
Ticket revenue	$14,000	$ 0	$(14,000)
Less variable expenses	1,050	0	1,050
Contribution margin	12,950	0	(12,950)
Less flight expenses:			
Salaries, flight crew	1,800	1,800	0
Flight promotion	750	0	750
Depreciation of aircraft	1,550	1,550	0
Fuel for aircraft	5,800	0	5,800
Liability insurance	4,200	2,800	1,400
Salaries, flight assistants	1,500	0	1,500
Baggage loading and flight preparation	1,700	1,700	0
Overnight costs for flight crew and assistants at destination	300	0	300
Total flight expenses	17,600	7,850	9,750
Net operating loss	$ (4,650)	$ (7,850)	$ (3,200)

2. The goal of increasing the seat occupancy could be obtained by eliminating flights with a lower-than-average seat occupancy. By eliminating these flights and keeping the flights with a higher average seat occupancy, the overall average seat occupancy for the company as a whole would be improved. This could reduce profits, however, in at least two ways. First, the flights that are eliminated could have contribution margins that exceed their avoidable costs (such as in the case of flight 482 in part 1). If so, then eliminating these flights would reduce the company's total contribution margin more than it would reduce total costs, and profits would decline. Second, these flights might be acting as "feeder" flights, bringing passengers to cities where connections to more profitable flights are made.

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Problem 13-17 (15 minutes)

1.

	Per 16-Ounce T-Bone
Revenue from further processing:	
Sales price of one filet mignon (6 ounces × $4.00 per pound ÷ 16 ounces per pound)........	$1.50
Sales price of one New York cut (8 ounces × $2.80 per pound ÷ 16 ounces per pound)........	1.40
Total revenue from further processing	2.90
Less sales revenue from one T-bone steak	2.25
Incremental revenue from further processing	0.65
Less cost of further processing.............................	0.25
Profit per pound from further processing	$0.40

2. The T-bone steaks should be processed further into the filet mignon and the New York cut. This will yield $0.40 per pound in added profit for the company. The $0.45 "profit" per pound shown in the text is not relevant to the decision, since it contains allocated joint costs. The company will incur the joint costs regardless of whether the T-bone steaks are sold outright or processed further; thus, this cost should be ignored in the decision.

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Problem 13-18 (60 minutes)

1. The simplest approach to the solution is:

Gross margin lost if the store is closed			$(316,800)
Costs that can be avoided:			
Sales salaries	$70,000		
Direct advertising	51,000		
Store rent	85,000		
Delivery salaries	4,000		
Store management salaries ($21,000 – $12,000)	9,000		
Salary of new manager	11,000		
General office compensation	6,000		
Insurance on inventories ($7,500 × 2/3)	5,000		
Utilities	31,000		
Employment taxes	15,000	*	287,000
Decrease in company profits if the North Store is closed			$ (29,800)

*Salaries avoided by closing the store:

Sales salaries	$70,000
Delivery salaries	4,000
Store management salaries	9,000
Salary of new manager	11,000
General office compensation	6,000
Total avoided	100,000
Employment tax rate	× 15%
Employment taxes avoided	$15,000

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Problem 13-18 (continued)

Alternative Solution:

	North Store Kept Open	*North Store Closed*	*Difference: Net Operating Income Increase or (Decrease)*
Sales	$720,000	$ 0	$(720,000)
Less cost of goods sold	403,200	0	403,200
Gross margin	316,800	0	(316,800)
Operating expenses:			
Selling expenses:			
Sales salaries	70,000	0	70,000
Direct advertising	51,000	0	51,000
General advertising	10,800	10,800	0
Store rent	85,000	0	85,000
Depreciation of store fixtures	4,600	4,600	0
Delivery salaries	7,000	3,000	4,000
Depreciation of delivery equipment	3,000	3,000	0
Total selling expenses	231,400	21,400	210,000
Administrative expenses:			
Store management salaries	21,000	12,000	9,000
Salary of new manager	11,000	0	11,000
General office compensation	12,000	6,000	6,000
Insurance on fixtures and inventory	7,500	2,500	5,000
Utilities	31,000	0	31,000
Employment taxes	18,150	3,150	15,000 *
General office—other	18,000	18,000	0
Total administrative expenses	118,650	41,650	77,000
Total operating expenses	350,050	63,050	287,000
Net operating income (loss)	$(33,250)	$(63,050)	$ (29,800)

*See the computation on the prior page.

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Problem 13-18 (continued)

2. Based on the data in (1), the North Store should not be closed. If the store is closed, then the company's overall net operating income will decrease by $29,800 per quarter. If the store space cannot be subleased or the lease broken without penalty, a decision to close the store would cause an even greater decline in the company's overall net income. If the $85,000 rent cannot be avoided and the North Store is closed, the company's overall net operating income would be reduced by $114,800 per quarter ($29,800 + $85,000).

3. Under these circumstances, the North Store should be closed. The computations are as follows:

Gross margin lost if the North Store is closed (part 1)	$(316,800)
Gross margin gained from the East Store: $720,000 × 1/4 = $180,000; $180,000 × 45%* = $81,000	81,000
Net operating loss in gross margin.................................	(235,800)
Less costs that can be avoided if the North Store is closed (part 1)	287,000
Net advantage of closing the North Store	$ 51,200

*The East Store's gross margin percentage is:
$486,000 ÷ $1,080,000 = 45%

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Problem 13-19 (60 minutes)

1. The fl2.80 per drum general overhead cost is not relevant to the decision, since this cost will be the same regardless of whether the company decides to make or buy the drums. Also, the present depreciation figure of fl1.60 per drum is not a relevant cost, since it represents a sunk cost (in addition to the fact that the old equipment is worn out and must be replaced). The cost of supervision is relevant to the decision, since this cost can be avoided by buying the drums.

	Differential Costs Per Drum		*Total Differential Costs—60,000 Drums*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price....		fl18.00		fl1,080,000
Direct materials..............	fl10.35		fl621,000	
Direct labor (fl6.00 × 70%)............	4.20		252,000	
Variable overhead (fl1.50 × 70%)............	1.05		63,000	
Supervision....................	0.75		45,000	
Equipment rental*..........	2.25 *		135,000	
Total cost	fl18.60	fl18.00	fl1,116,000	fl1,080,000
Difference in favor of buying..	fl0.60		fl36,000	

*fl135,000 per year ÷ 60,000 drums = fl2.25 per drum.

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Problem 13-19 (continued)

2. a. Notice that unit costs for both supervision and equipment rental decrease with the greater volume since these fixed costs are spread over more units.

	Differential Cost Per Drum		*Total Differential Cost—75,000 Drums*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price......		fl18.00		fl1,350,000
Direct materials................	fl10.35		fl776,250	
Direct labor	4.20		315,000	
Variable overhead	1.05		78,750	
Supervision (fl45,000 ÷ 75,000 drums)	0.60		45,000	
Equipment rental (fl135,000 ÷ 75,000 drums)	1.80		135,000	
Total cost	fl18.00	fl18.00	fl1,350,000	fl1,350,000
Difference........................	fl0		fl0	

The company would be indifferent between the two alternatives if 75,000 drums were needed each year.

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Problem 13-19 (continued)

b. Again, notice that the unit costs for both supervision and equipment rental decrease with the greater volume of units.

	Differential Costs Per Drum		*Total Differential Cost— 90,000 Drums*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price......		fl18.00		fl1,620,000
Direct materials................	fl10.35		fl931,500	
Direct labor	4.20		378,000	
Variable overhead	1.05		94,500	
Supervision (fl45,000 ÷ 90,000 drums)	0.50		45,000	
Equipment rental (fl135,000 ÷ 90,000 drums)	1.50		135,000	
Total cost	fl17.60	fl18.00	fl1,584,000	fl1,620,000
Difference in favor of making	fl0.40		fl36,000	

The company should purchase the new equipment and make the drums if 90,000 units per year are needed.

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Problem 13-19 (continued)

3. Other factors that the company should consider include:
   a. Will volume in future years be increasing, or will it remain constant at 60,000 units per year? (If volume increases, then renting the new equipment becomes more desirable, as shown in the computations above.)
   b. Can quality control be maintained if the drums are purchased from the outside supplier?
   c. Will costs for materials and labor increase in future years, thereby increasing the cost of making the drums?
   d. Will the outside supplier be dependable in meeting shipping schedules?
   e. Can the company begin making the drums again if the supplier proves to be undependable, or are there alternative suppliers?
   f. What is the labor outlook in the supplier's industry (e.g., are frequent labor strikes likely)?
   g. If the outside supplier's offer is accepted and the need for drums increases in future years, will the supplier have the added capacity to provide more than 60,000 drums per year?

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Problem 13-20 (45 minutes)

1.

Selling price per unit	$32
Less variable expenses per unit	18 *
Contribution margin per unit	$14

*$10.00 + $4.50 + $2.30 + $1.20 = $18.00

Increased sales in units (60,000 units × 25%)	15,000
Contribution margin per unit	× $14
Incremental contribution margin	$210,000
Less added fixed selling expenses	80,000
Incremental net operating income	$130,000

Yes, the increase in fixed selling expenses would be justified.

2.

Variable manufacturing cost per unit	$16.80 *
Import duties per unit	1.70
Permits and licenses ($9,000 ÷ 20,000 units)	0.45
Shipping cost per unit	3.20
Break-even price per unit	$22.15

*$10 + $4.50 + $2.30 = $16.80.

3. The relevant cost is $1.20 per unit, which is the variable selling expense per Dak. Since the irregular units have already been produced, all production costs (including the variable production costs) are sunk. The fixed selling expenses are not relevant since they will be incurred whether or not the irregular units are sold. Depending on how the irregular units are sold, the variable expense of $1.20 per unit may not even be relevant. For example, the units may be disposed of through a liquidator without incurring the normal variable selling expense.

4. If the plant operates at 30% of normal levels, then only 3,000 units will be produced and sold during the two-month period:

60,000 units per year × 2/12 = 10,000 units.
10,000 units × 30% = 3,000 units produced and sold.

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Problem 13-20 (continued)

Given this information, the simplest approach to the solution is:

Contribution margin lost if the plant is closed (3,000 units × $14 per unit*)		$(42,000)
Fixed costs that can be avoided if the plant is closed:		
Fixed manufacturing overhead cost ($300,000 × 2/12 = $50,000; $50,000 × 40%)	$20,000	
Fixed selling cost ($210,000 × 2/12 = $35,000; $35,000 × 20%)	7,000	27,000
Net disadvantage of closing the plant		$(15,000)

*$32.00 – ($10.00 + $4.50 + $2.30 + $1.20) = $14.00

Some students will take a longer approach such as that shown below:

	Continue to Oper-ate	*Close the Plant*
Sales (3,000 units × $32 per unit)	$ 96,000	$ 0
Less variable expenses (3,000 units × $18 per unit)	54,000	0
Contribution margin	42,000	0
Less fixed expenses:		
Fixed manufacturing overhead cost:		
$300,000 × 2/12	50,000	
$300,000 × 2/12 × 60%		30,000
Fixed selling expense:		
$210,000 × 2/12	35,000	
$210,000 × 2/12 × 80%		28,000
Total fixed expenses	85,000	58,000
Net operating income (loss)	$(43,000)	$(58,000)

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Problem 13-20 (continued)

5. The relevant costs are those that can be avoided by purchasing from the outside manufacturer. These costs are:

Variable manufacturing costs	$16.80
Fixed manufacturing overhead cost ($300,000 × 75% = $225,000; $225,000 ÷ 60,000 units)	3.75
Variable selling expense ($1.20 × 1/3)	0.40
Total costs avoided	$20.95

   To be acceptable, the outside manufacturer's quotation must be *less* than $20.95 per unit.

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Problem 13-21 (45 minutes)

1. Product RG-6 yields a contribution margin of $8 per unit ($22 – $14 = $8). If the plant closes, this contribution margin will be lost on the 16,000 units (8,000 units per month × 2 months) that could have been sold during the two-month period. However, the company will be able to avoid certain fixed costs as a result of closing down. The analysis is:

Contribution margin lost by closing the plant for two months ($8 per unit × 16,000 units)		$(128,000)
Costs avoided by closing the plant for two months:		
Fixed manufacturing overhead cost $45,000 per month × 2 months = $90,000)	$90,000	
Fixed selling costs ($30,000 per month × 10% × 2 months)	6,000	96,000
Net disadvantage of closing, before start-up costs		(32,000)
Add start-up costs		8,000
Disadvantage of closing the plant		$ (40,000)

No, the company should not close the plant; it should continue to operate at the reduced level of 8,000 units produced and sold each month. Closing will result in a $40,000 greater loss over the two-month period than if the company continues to operate. An additional factor is the potential loss of goodwill among the customers who need the 8,000 units of RG-6 each month. By closing down, the needs of these customers will not be met (no inventories are on hand), and their business may be permanently lost to another supplier.

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Problem 13-21 (continued)

Alternative Solution:

	Plant Kept Open	*Plant Closed*	*Difference: Net Operating Income Increase or (Decrease)*
Sales (8,000 units × $22 per unit × 2)	$ 352,000	$ 0	$(352,000)
Less variable expenses (8,000 units × $14 per unit × 2)	224,000	0	224,000
Contribution margin	128,000	0	(128,000)
Less fixed costs:			
Fixed manufacturing overhead costs ($150,000 × 2)	300,000	210,000	90,000
Fixed selling costs ($30,000 × 2)	60,000	54,000 *	6,000
Total fixed costs	360,000	264,000	96,000
Net operating loss before start-up costs	(232,000)	(264,000)	(32,000)
Start-up costs	0	(8,000)	(8,000)
Net operating loss	$(232,000)	$(272,000)	$ (40,000)

* $30,000 × 90% = $27,000 × 2 = $54,000

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Problem 13-21 (continued)

2. Birch Company will be indifferent at a level of 11,000 total units sold over the two-month period. The computations are:

Cost avoided by closing the plant for two months (see above)	$96,000
Less start-up costs	8,000
Net avoidable costs	$88,000

$$\frac{\text{Net avoidable costs}}{\text{Per unit contribution margin}} = \frac{\$88{,}000}{\$8 \text{ per unit}} = 11{,}000 \text{ units}$$

Verification:

	Operate at 11,000 Units for Two Months	*Close for Two Months*
Sales (11,000 units × $22 per unit)	$ 242,000	$ 0
Less variable expenses (11,000 units × $14 per unit)	154,000	0
Contribution margin	88,000	0
Less fixed expenses:		
Manufacturing overhead ($150,000 and $105,000, × 2)	300,000	210,000
Selling ($30,000 and $27,000, × 2)	60,000	54,000
Total fixed expenses	360,000	264,000
Start-up costs	0	8,000
Total costs	360,000	272,000
Net operating loss	$(272,000)	$(272,000)

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Problem 13-22 (60 minutes)

1. The $90,000 in fixed overhead costs charged to the new product is a common cost that will be the same whether the tubes are produced internally or purchased from the outside. Hence, they are not relevant. The variable manufacturing overhead per box of Chap-Off would be $0.50, as shown below:

Total manufacturing overhead cost per box of Chap-Off ...	$1.40
Less fixed portion ($90,000 ÷ 100,000 boxes)................	0.90
Variable overhead cost per box......................................	$0.50

The total variable costs of producing one box of Chap-Off would be:

Direct materials..	$3.60
Direct labor...	2.00
Variable manufacturing overhead	0.50
Total variable cost per box	$6.10

If the tubes for the Chap-Off are purchased from the outside supplier, then the variable cost per box of Chap-Off would be:

Direct materials ($3.60 × 75%)....................................	$2.70
Direct labor ($2.00 × 90%)...	1.80
Variable manufacturing overhead ($0.50 × 90%)............	0.45
Cost of tube from outside	1.35
Total variable cost per box	$6.30

Therefore, the company should reject the outside supplier's offer. A savings of $0.20 per box of Chap-Off will be realized by producing the tubes internally.

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Problem 13-22 (continued)

Another approach to the solution would be:

Cost avoided by purchasing the tubes:	
Direct materials ($3.60 × 25%)	$0.90
Direct labor ($2.00 × 10%)	0.20
Variable manufacturing overhead ($0.50 × 10%)	0.05
Total costs avoided	$1.15 *
Cost of purchasing the tubes from the outside	$1.35
Cost savings per box by making internally	$0.20

* This $1.15 is the cost of making one box of tubes internally, since it represents the overall cost savings that will be realized per box of Chap-Off by purchasing the tubes from the outside.

2. The maximum purchase price would be $1.15 per box. The company would not be willing to pay more than this amount, since the $1.15 represents the cost of producing one box of tubes internally, as shown in Part 1. To make purchasing the tubes attractive, however, the purchase price should be *less than* $1.15 per box.

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Problem 13-22 (continued)

3. At a volume of 120,000 boxes, the company should buy the tubes. The computations are:

Cost of making 120,000 boxes:	
120,000 boxes × $1.15 per box	$138,000
Rental cost of equipment	40,000
Total cost	$178,000
Cost of buying 120,000 boxes:	
120,000 boxes × $1.35 per box	$162,000

Or, on a total cost basis, the computations are:

Cost of making 120,000 boxes:	
120,000 boxes × $6.10 per box	$732,000
Rental cost of equipment	40,000
Total cost	$772,000
Cost of buying 120,000 boxes:	
120,000 boxes × $6.30 per box	$756,000

Thus, buying the boxes will save the company $16,000 per year.

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Problem 13-22 (continued)

4. Under these circumstances, the company should make the 100,000 boxes of tubes and purchase the remaining 20,000 boxes from the outside supplier. The costs would:

Cost of making: 100,000 boxes × $1.15 per box.......	$115,000
Cost of buying: 20,000 boxes × $1.35 per box	27,000
Total cost..	$142,000

   Or, on a total cost basis, the computation would be:

Cost of making: 100,000 boxes × $6.10 per box.......	$610,000
Cost of buying: 20,000 boxes × $6.30 per box	126,000
Total cost..	$736,000

   Since the amount of cost under this alternative is $20,000 less than the best alternative in Part 3, the company should make as many tubes as possible with the current equipment and buy the remaining tubes from the outside supplier.

5. Management should take into account at least the following additional factors:
   a) The ability of the supplier to meet required delivery schedules.
   b) The quality of the tubes purchased from the supplier.
   c) Alternative uses of the capacity that would be used to make the tubes.
   d) The ability of the supplier to supply tubes if volume increases in future years.
   e) The problem of alternative sources of supply if the supplier proves undependable.

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Problem 13-23 (30 minutes)

1. Since the fixed costs will not change as a result of the order, they are not relevant to the decision. The cost of the new machine is relevant, and this cost will have to be recovered by the current order since there is no assurance of future business from the retail chain.

	Unit	*Total— 5,000 units*
Revenue from the order ($50 × 84%)	$42	$210,000
Less costs associated with the order:		
Direct materials	15	75,000
Direct labor	8	40,000
Variable manufacturing overhead	3	15,000
Variable selling expense ($4 × 25%)	1	5,000
Special machine ($10,000 ÷ 5,000 units)	2	10,000
Total costs	29	145,000
Net increase in profits	$13	$ 65,000

2. Revenue from the order:

Revenue from the order:	
Reimbursement for costs of production (variable production costs of $26, plus fixed manufacturing overhead cost of $9 = $35 per unit; $35 per unit × 5,000 units)	$175,000
Fixed fee ($1.80 per unit × 5,000 units)	9,000
Total revenue	184,000
Less incremental costs—variable production costs ($26 per unit × 5,000 units)	130,000
Net increase in profits	$ 54,000

3. Sales revenue:

Sales revenue:	
From the U.S. Army (above)	$184,000
From regular channels ($50 per unit × 5,000 units)	250,000
Net decrease in revenue	(66,000)
Less variable selling expenses avoided if the Army's order is accepted ($4 per unit × 5,000 units)	20,000
Net decrease in profits if the Army's order is accepted	$(46,000)

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Problem 13-24 (45 minutes)

1.

	Debbie	*Trish*	*Sarah*	*Mike*	*Sewing Kit*
Direct labor cost per unit	$ 3.20	$2.00	$ 5.60	$ 4.00	$ 1.60
Direct labor hours per unit* (a)	0.40	0.25	0.70	0.50	0.20
Selling price	$13.50	$5.50	$21.00	$10.00	$ 8.00
Less variable costs:					
Direct materials	4.30	1.10	6.44	2.00	3.20
Direct labor	3.20	2.00	5.60	4.00	1.60
Variable overhead	0.80	0.50	1.40	1.00	0.40
Total variable costs	8.30	3.60	13.44	7.00	5.20
Contribution margin (b)	$ 5.20	$1.90	$ 7.56	$ 3.00	$ 2.80
Contribution margin per DLH (b) ÷ (a)	$13.00	$7.60	$10.80	$ 6.00	$14.00

* Direct labor cost per unit ÷ 8 direct labor hour.

2.

Product	*DLH Per Unit*	*Estimated Sales (units)*	*Total Hours*
Debbie	0.40 hours	50,000	20,000
Trish	0.25 hours	42,000	10,500
Sarah	0.70 hours	35,000	24,500
Mike	0.50 hours	40,000	20,000
Sewing Kit	0.20 hours	325,000	65,000
Total hours required			140,000

3. Since the Mike doll has the lowest contribution margin per labor hour, its production should be reduced by 20,000 dolls (10,000 excess hours divided by 0.5 hours production time per doll = 20,000 dolls). Thus, production and sales of the Mike doll will be reduced to one-half of that planned, or 20,000 dolls for the year.

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Problem 13-24 (continued)

4. Since the additional capacity would be used to produce the Mike doll, the company should be willing to pay up to $14 per hour ($8 usual rate plus $6 contribution margin per hour) for added labor time. Thus, the company could employ workers for overtime at the usual time-and-a-half rate of $12 per hour ($8 × 1.5 = $12), and still improve overall profit.

5. Additional output could be obtained in a number of ways including working overtime, adding another shift, expanding the workforce, contracting out some work to outside suppliers, and eliminating wasted labor time in the production process. The first four methods are costly, but the last method can add capacity at very low cost.

   Note: Some would argue that direct labor is a fixed cost in this situation and should be excluded when computing the contribution margin per unit. However, when deciding which products to emphasize, no harm is done by misclassifying a fixed cost as a variable cost—providing that the fixed cost is the constraint. If direct labor were removed from the variable cost category, the net effect would be to bump up the contribution margin per direct labor-hour by $8 for each of the products. The products will be *ranked* exactly the same—in terms of the contribution margin per unit of the constrained resource—whether direct labor is considered variable or fixed. However, this only works when the fixed cost is the cost of the constraint itself.

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Problem 13-25 (45 minutes)

1. A product should be processed further so long as the incremental revenue from the further processing exceeds the incremental costs. The incremental revenue from further processing of the Grit 337 is:

Selling price of the silver polish, per jar	$4.00
Selling price of 1/4 pound of Grit 337 ($2.00 ÷ 4)	0.50
Incremental revenue per jar	$3.50

The incremental variable costs are:

Other ingredients	$0.65
Direct labor	1.48
Variable manufacturing overhead (25% × $1.48)	0.37
Variable selling costs (7.5% × $4)	0.30
Incremental variable cost per jar	$2.80

Therefore, the incremental contribution margin is $0.70 per jar ($3.50 – $2.80). The $1.60 cost per pound ($0.40 per 1/4 pound) required to produce the Grit 337 would not be relevant in this computation, since it is incurred regardless of whether the Grit 337 is further processed into silver polish or sold outright.

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Problem 13-25 (continued)

2. Only the cost of advertising and the cost of the production supervisor are avoidable if production of the silver polish is discontinued. Therefore, the number of jars of silver polish that must be sold each month to justify continued processing of the Grit 337 into silver polish is:

Production supervisor	$3,000
Advertising—direct	4,000
Avoidable fixed costs	$7,000

$$\frac{\text{Avoidable fixed costs}}{\text{Incremental CM per jar}} = \frac{\$7,000}{\$0.70 \text{ per jar}} = 10,000 \text{ jars per month}$$

Therefore, if 10,000 jars of silver polish can be sold each month, the company would be indifferent between selling it or selling all of the Grit 337 as a cleaning powder. If the sales of the silver polish are greater than 10,000 jars per month, then continued processing of the Grit 337 into silver polish would be advisable since the company's total profits will be increased. If the company can't sell at least 10,000 jars of silver polish each month, then production of the silver polish should be discontinued. To verify this, we show on the next page the total contribution to profits of sales of 9,000, 10,000 and 11,000 jars of silver polish, contrasted to sales of equivalent amounts of Grit 337 sold outright (i.e., 10,000 jars of silver polish would require the use of 2,500 pounds of Grit 337 that otherwise could be sold outright as cleaning powder, etc.):

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Problem 13-25 (continued)

	9,000 Jars of Polish; or 2,250 pounds of Grit 337	*10,000 Jars of Polish; or 2,500 pounds of Grit 337*	*11,000 Jars of Polish; or 2,750 pounds of Grit 337*
Sales of Silver Polish:			
Sales @ $4.00 per jar	$36,000	$40,000	$44,000
Less variable expenses:			
Production cost of Grit 337 @ $1.60 per pound	3,600 *	4,000 *	4,400 *
Further processing and selling costs of the polish @ $2.80 per jar	25,200	28,000	30,800
Total variable expenses	28,800	32,000	35,200
Contribution margin	7,200	8,000	8,800
Less avoidable fixed costs:			
Production supervisor	3,000	3,000	3,000
Advertising	4,000	4,000	4,000
Total avoidable fixed costs	7,000	7,000	7,000
Total contribution to common fixed costs and to profits	$ 200	$ 1,000	$ 1,800
Sales of Grit 337:			
Sales @ $2.00 per pound	$ 4,500	$ 5,000	$ 5,500
Less variable expenses:			
Production cost of Grit 337 @ $1.60 per pound	3,600 *	4,000 *	4,400 *
Contribution to common fixed costs and to profits	$ 900	$ 1,000	$ 1,100

* This cost will be incurred regardless of whether the Grit 337 is further processed into silver polish or sold outright as cleaning powder; therefore, it is not relevant to the decision, as stated earlier. It is included in the computation above for the specific purpose of showing that it will be incurred under either alternative. The same thing could have been done with the depreciation on the mixing equipment.

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Problem 13-26 (45 minutes)

1. Only the avoidable costs are relevant in a decision to drop the Model C3 lawnchair product. The avoidable costs are:

Direct materials	R122,000
Direct labor	72,000
Fringe benefits (20% of direct labor)	14,400
Variable manufacturing overhead	3,600
Product manager's salary	10,000
Sales commissions (5% of sales)	15,000
Fringe benefits (20% of salaries and commissions)	5,000
Shipping	10,000
Total avoidable cost	R252,000

The following costs are not relevant in this decision:

Cost	*Reason not relevant*
Building rent and maintenance	All products use the same facilities; no space would be freed if a product were dropped.
Depreciation	All products use the same equipment so no equipment can be sold. Furthermore, the equipment does not wear out through use.
General administrative expenses	Dropping the Model C3 lawnchair would have no effect on total general administrative expenses.

Having determined the costs that can be avoided if the Model C3 lawnchair is dropped, we can now make the following computation:

Sales revenue lost if the Model C3 lawnchair is dropped	R300,000
Less costs that can be avoided (see above)	252,000
Decrease in overall company net operating income if the Model C3 lawnchair is dropped	R 48,000

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Problem 13-26 (continued)

Thus, the Model C3 lawnchair should not be dropped unless the company can find more profitable uses for the resources consumed by the Model C3 lawnchair.

2. To determine the minimum acceptable level of sales, we must first classify the avoidable costs into variable and fixed costs as follows:

	Variable	*Fixed*
Direct materials	R122,000	
Direct labor	72,000	
Fringe benefits (20% of direct labor)	14,400	
Variable manufacturing overhead	3,600	
Product managers' salaries		R10,000
Sales commissions (5% of sales)	15,000	
Fringe benefits (20% of salaries and commissions)	3,000	2,000
Shipping	10,000	
Total costs	R240,000	R12,000

The Model C3 lawnchair should be retained as long as its contribution margin covers its avoidable fixed costs. Break-even analysis can be used to find the sales volume where the contribution margin just equals the avoidable fixed costs.

The contribution margin ratio is computed as follows:

$$\text{CM ratio} = \frac{\text{Contribution margin}}{\text{Sales}}$$

$$= \frac{\text{R300,000-R240,000}}{\text{R300,000}} = 20\%$$

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Problem 13-26 (continued)

The break-even sales volume can be found using the break-even formula:

$$\text{Break-even point} = \frac{\text{Fixed costs}}{\text{CM ratio}}$$

$$= \frac{\text{R}12{,}000}{0.20} = \text{R}60{,}000$$

Therefore, as long as the sales revenue from the Model C3 lawnchair exceeds R60,000, it is covering its own avoidable fixed costs and is contributing toward covering the common fixed costs and toward the profits of the entire company.

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Case 13-27 (60 minutes)

1. The original cost of the facilities at Clayton is a sunk cost and should be ignored in any decision. The decision being considered here is whether to continue operations at Clayton. The only relevant costs are the future facility costs that would be affected by this decision. If the facility were shut down, the Clayton facility has no resale value. In addition, if the Clayton facility were sold, the company would have to rent additional space at the remaining processing centers. On the other hand, if the facility were to remain in operation, the building should last indefinitely, so the company does not have to be concerned about eventually replacing it. Essentially, there is no real cost at this point of using the Clayton facility despite what the financial performance report indicates. Indeed, it might be a better idea to consider shutting down the other facilities since the rent on those facilities might be avoided.

   The costs that are relevant in the decision to shut down the Clayton facility are:

Increase in rent at Billings and Great Falls	$600,000
Decrease in local administrative expenses	(90,000)
Net increase in costs	$510,000

   In addition, there would be costs of moving the equipment from Clayton and there might be some loss of sales due to disruption of services. In sum, closing down the Clayton facility would almost certainly lead to a decline in BSC's profits.

   Even though closing down the Clayton facility would result in a decline in overall company profits, it would result in an improved performance report for the Rocky Mountain Region (ignoring the costs of moving equipment and potential loss of revenues from disruption of service to customers).

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Case 13-27 (continued)

Financial Performance
After Shutting Down the Clayton Facility
Rocky Mountain Region

	Total
Sales	$50,000,000
Operating expenses:	
Direct labor	32,000,000
Variable overhead	850,000
Equipment depreciation	3,900,000
Facility expense*	2,300,000
Local administrative expense**	360,000
Regional administrative expense	1,500,000
Corporate administrative expense	4,750,000
Total operating expense	45,660,000
Net operating income	$ 4,340,000

* $2,800,000 – $1,100,000 + $600,000 = $2,300,000
** $450,000 – $90,000 = $360,000

2. If the Clayton facility is shut down, BSC's profits will decline, employees will lose their jobs, and customers will at least temporarily suffer some decline in service. Therefore, Romeros is willing to sacrifice the interests of the company, its employees, and its customers just to make her performance report look better.

   While Romeros is not a management accountant, the Standards of Ethical Conduct for Management Accountants still provide useful guidelines.

   a) By recommending closing the Clayton facility, Romeros would violate the Competence Standard that stipulates recommendations should be based on appropriate analysis of relevant and reliable information.

   b) The Integrity Standard requires that management accountants "avoid actual or apparent conflicts of interest and advise all appropriate parties of any potential conflict." Romeros has a conflict of interest in this case, since her recommendation will serve to make her own performance look better while actually leading to a decline in the company's profits.

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c) The Integrity Standard is also violated in that her recommendation to close down the Clayton facility would "subvert the attainment of the organization's legitimate and ethical objectives."

d) Romeros would also be violating the Objectivity Standard that requires a management accountant to "disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations presented." Presumably, if the corporate board were fully informed of the consequences of this action, they would disapprove.

In sum, it is difficult to describe the recommendation to close the Clayton facility as ethical behavior. In Romeros' defense, however, it is not fair to hold her responsible for the mistake made by her predecessor.

It should be noted that the performance report required by corporate headquarters is likely to lead to other problems such as the one illustrated here. The arbitrary allocations of corporate and regional administrative expenses to processing centers may make other processing centers appear to be unprofitable even though they are not. In this case, the problems created by these arbitrary allocations were compounded by using an irrelevant facilities expense figure on the performance report.

3. Prices should be set ignoring the depreciation on the Clayton facility. As argued in part (1) above, the real cost of using the Clayton facility is zero. Any attempt to recover the sunk cost of the original cost of the building by charging higher prices than the market will bear will lead to less business and lower profits.

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Case 13-28 (60 minutes)

1. Continuing to obtain covers from its own Denver Cover Plant would allow QualSupport to maintain its current level of control over the quality of the covers and the timing of their delivery. Keeping the Denver Cover Plant open also allows QualSupport more flexibility than purchasing the coverings from outside suppliers. QualSupport could more easily alter the coverings' design and change the quantities produced, especially if long-term contracts are required with outside suppliers. QualSupport should also consider the economic impact that closing Denver Cover will have on the community and how this might affect QualSupport's other operations in the region.

2. a. The following costs can be avoided by closing the plant, and therefore are relevant to the decision:

Materials		$14,000,000
Labor:		
Direct	$13,100,000	
Supervision	900,000	
Indirect plant	4,000,000	18,000,000
Differential pension cost ($5,000,000 – $3,000,000)		2,000,000
Total annual relevant costs		$34,000,000

b. The following costs can't be avoided by closing the plant, and therefore are not relevant to the decision:

Depreciation—equipment	$ 3,200,000
Depreciation—building	7,000,000
Continuing pension cost ($5,000,000 – $2,000,000)	3,000,000
Plant manager and staff	800,000
Corporate allocation	4,000,000
Total annual continuing costs	$18,000,000

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Depreciation is not relevant because it represents expiration of a sunk cost. Three-fifths of the annual pension expense ($3,000,000) is not relevant because it would continue whether or not the plant is closed. The amount for plant manager and staff is not relevant because Vosilo and his staff would continue with QualSupport and administer the three remaining plants. The corporate allocation is not relevant because this represents costs incurred outside Denver Cover and assigned to the plant.

c. The following nonrecurring costs would arise in the year that the plant is closed, but would not be incurred in any other year:

Termination charges on canceled material orders ($14,000,000 × 20%)	$2,800,000
Employment assistance	1,500,000
Total recurring costs	$4,300,000

These two costs are relevant to the decision because they will be incurred only if the plant is closed.

3. No, the plant should not be closed. The computations are:

	First Year	*Other Years*
Cost of purchasing the covers outside	$(35,000,000)	$(35,000,000)
Costs avoided by closing the plant (Part 2a)	34,000,000	34,000,000
Cost of closing the plant (first year only)	(4,300,000)	
Salvage value of equipment and building	3,200,000	
Net advantage (disadvantage) of closing the plant	$ (2,100,000)	$ (1,000,000)

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Case 13-28 (continued)

4. Factors that should be considered by QualSupport before making a decision include:
   a. Alternative uses of the building and equipment.
   b. Any tax implications.
   c. The outside supplier's prices in future years.
   d. The cost to manufacture coverings at the Denver Cover Plant in future years.
   e. The value of the time Vosilo and his staff would have spent managing the Denver Cover Plant. This time may be spent on other important matters.
   f. The morale of QualSupport employees at remaining plants.

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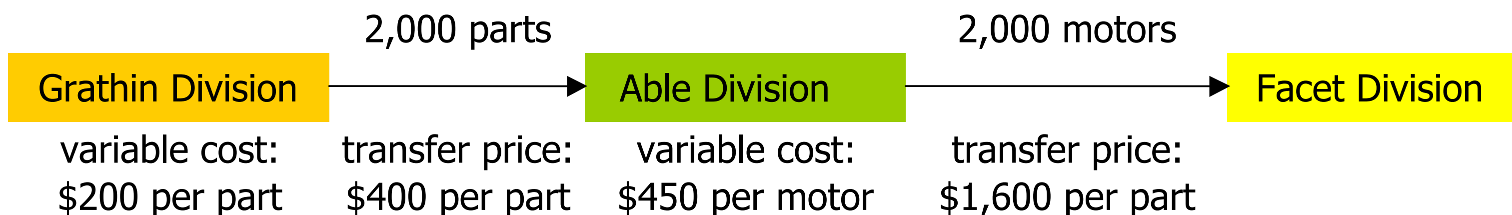
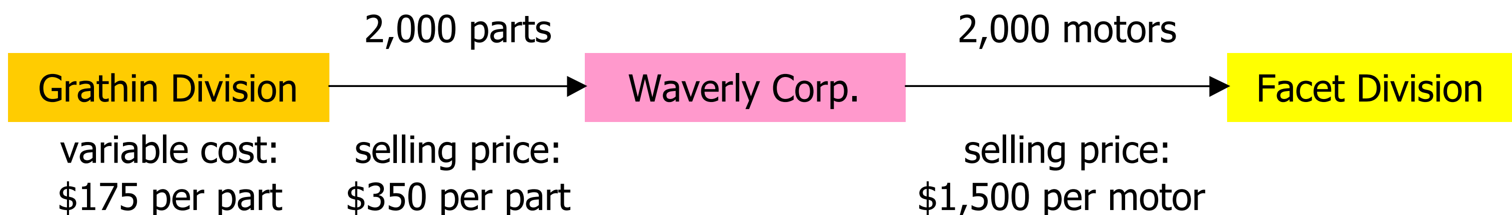
Case 13-29 (75 minutes)

This is a difficult case that will challenge the best students. Part of the challenge is simply to understand the alternatives. As an aid, a diagram of the two alternatives, which we will call Alternatives A and B, is show below, together with the relevant data.

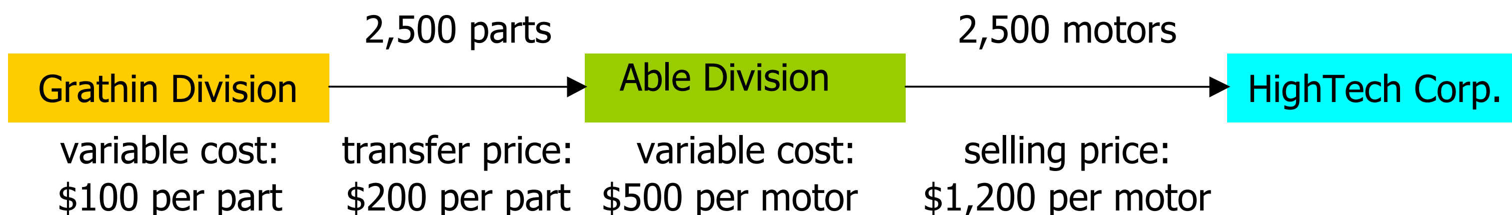
Alternative A



Alternative B



AND



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Case 13-29 (continued)

In both parts of the case the general fixed overhead costs are irrelevant since they are allocated costs that will remain the same regardless of which alternative is accepted. Also note that the same amount of total machine time would be consumed in both the Grathin Division's plant and the Able Division's plant regardless of which order is accepted. Thus, the amount of machine time that would be required is not a factor in the decision.

Grathin's plant:
Facet Division order:
2,000 motors × 2.5 hours per motor = 5,000 hours.
HighTech Corporation order:
2,500 motors × 2.0 hours per motor = 5,000 hours.

Able's plant:
Facet Division order:
2,000 motors × 5.0 hours per motor = 10,000 hours.
HighTech Corporation order:
2,500 motors × 4.0 hours per motor = 10,000 hours.

1. The Able Division would accept the order from the Facet Division. Computations to support this conclusion follow:

Expected contribution margin from the Facet Division order:

Sales revenue to Able Division (2,000 motors × $1,600 per motor)		$3,200,000
Less variable costs:		
Transfer price to Grathin Division (2,000 parts × $400 per part)	$800,000	
Other variable costs (2,000 motors × $450 per motor)	900,000	1,700,000
Contribution margin...............................		$1,500,000

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Case 13-29 (continued)

Expected contribution margin from HighTech Corporation order:

Sales revenue to Able Division (2,500 motors × $1,200 per motor)		$3,000,000
Less variable costs:		
Transfer price to Grathin Division (2,500 parts × $200 per part)	$ 500,000	
Other variable costs (2,500 motors × $500 per motor)	1,250,000	1,750,000
Contribution margin..............................		$1,250,000

Thus, the Able Division will net $250,000 ($1,500,000 – $1,250,000) more in contribution margin by taking the order from the Facet Division.

2. From the perspective of the company as a whole, the situation is at once simpler and more complex. It is simpler because transfer prices are irrelevant. Whatever one division pays, the other receives. From the standpoint of the entire company, money is taken out of one pocket and put into the other. The situation is more complex in that the company must take into account that if Able Division accepts the order from HighTech Corporation, Facet Division will need to acquire its motors from Waverly Corporation rather than from Able Division. This is Alternative B in the diagram on the first page of the solution. But let's start with Alternative A, the simpler alternative. From the standpoint of the entire company, the cost of the motors transferred to Facet Division is $650 per motor, the variable costs of Grathin Division plus the variable costs of Able Division. The total cost of the motors would be $1,300,000 (2,000 motors @ $650 per motor). This is restated in slightly different form below:

Alternative A

Facet Division acquires motors from Able Division, which acquires parts from Grathin Division

Grathin Division's variable expenses (2,000 parts × $200 per part).............................	$ 400,000
Able Division's variable expenses (2,000 motors × $450 per motor).......................	900,000
Total cost of Alternative A	$1,300,000

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Case 13-29 (continued)

Alternative B

This alternative is more complex than Alternative A. There are really two parts to this alternative. In the first part, Facet Division purchases the required motors from Waverly Corporation, which purchases parts from Grathin Division. In the second part, Able Division sells motors to HighTech Corporation using parts supplied by Grathin Division. (Refer back to the diagram.) We will compute the financial consequences of these two parts separately and then combine them.

Part 1: Facet Division's purchase of motors	
Facet Division's payment to Waverly Corporation (2,000 motors × $1,500 per motor)	$3,000,000
Waverly Corporation's payments to Grathin Division (2,000 parts × $350 per part)	(700,000)
Grathin Division's variable expenses (2,000 parts × $175 per part)	350,000
Total cost (a)	$2,650,000
Part 2: HighTech Corporation's purchase of motors	
HighTech Corporation's payments to Able Division (2,500 motors × $1,200 per motor)	$3,000,000
Able Division's variable expenses (2,500 motors × $500 per motor)	(1,250,000)
Grathin Division's variable expenses (2,500 motors × $100 per motor)	(250,000)
Total contribution margin (b)	$1,500,000
Net cost to the company of Alternative B (a) – (b)	$1,150,000

Since the $1,150,000 cost of Alternative B is less than the $1,300,000 cost of Alternative A, it is the preferred alternative.

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Case 13-30 (30 minutes)

1. As much yarn as possible should be processed into sweaters. Products should be processed further so long as the added revenues from further processing are greater than the added costs. In the case at hand, the added revenues and costs are:

		Per Sweater
Added revenue ($30.00 – $20.00)		$10.00
Added costs:		
Buttons, thread, lining........................	$2.00	
Direct labor	5.80	7.80
Added contribution margin....................		$ 2.20

Thus, the company will gain $2.20 in contribution margin for each spindle of yarn that is further processed into a sweater. The fixed manufacturing overhead costs are not relevant to the decision, since they will be the same regardless of whether the yarn is sold or processed further. Also, in making this computation we must omit the $16.00 cost of manufacturing the yarn, since this cost will be incurred whether the yarn is sold as is or is used in sweaters.

2. The lowest price the company should accept is $27.80 per sweater. The simplest approach to this answer is:

Present selling price per sweater	$30.00
Less added contribution margin being realized on each sweater sold	2.20
Minimum selling price per sweater........	$27.80

A more involved approach to the $27.80 figure is to reason as follows:

If the wool yarn is sold outright, then the company will realize a contribution margin of $9.40 per spindle:

		Per Spindle
Selling price...........................		$20.00
Less variable expenses:		
Raw wool.............................	$7.00	
Direct labor	3.60	10.60
Contribution margin................		$ 9.40

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Case 13-30 (continued)

This $9.40 represents an opportunity cost to the company; thus, the price of the sweaters must be high enough to include this minimum contribution margin figure. In addition, the company must be able to cover all of its variable costs from the time the raw wool is purchased until the sweater is completed. Therefore, the minimum price would be:

Variable costs of producing a spindle of yarn:		
Raw wool	$7.00	
Direct labor	3.60	$10.60
Added variable costs of producing a sweater:		
Buttons, etc.	2.00	
Direct labor	5.80	7.80
Total variable costs		18.40
Opportunity cost—contribution margin if the yarn is sold outright		9.40
Minimum selling price per sweater		$27.80

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Case 13-31 (90 minutes)

1. The lowest price Wesco could bid for the one-time special order of 20,000 pounds (20 lots) without losing money would be $24,200—the relevant cost of the order, as shown below.

Direct materials:	
AG-5: 300 pounds per lot × 20 lots = 6,000 pounds. Substitute BH-3 on a one-for-one basis to its total of 3,500 pounds. If BH-3 is not used in this order, it will be salvaged for $600. Therefore, the relevant cost is	$ 600
The remaining 2,500 pounds would be AG-5 at a cost of $1.20 per pound	3,000
KL-2: 200 pounds per lot × 20 lots = 4,000 pounds at $1.05 per pound	4,200
CW-7: 150 pounds per lot × 20 lots = 3,000 pounds at $1.35 per pound	4,050
DF-6: 175 pounds per lot × 20 lots = 3,500 pounds. Use 3,000 pounds in inventory at $0.60 per pound ($0.70 market price – $0.10 handling charge), and purchase the remaining 500 pounds at $0.70 per pound	2,150
Total direct materials cost	14,000
Direct labor: 25 DLHs per lot × 20 lots = 500 DLHs. Because only 400 hours can be scheduled during regular time this month, overtime would have to be used for the remaining 100 hours.	
400 DLHs × $14.00 per DLH	5,600
100 DLHs × $21.00 per DLH	2,100
Total direct labor cost	7,700
Overhead: This special order will not increase fixed overhead costs. Therefore, only the variable overhead is relevant.	
500 DLHs × $3.00 per DLH	1,500
Total relevant cost of the special order	$23,200

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Case 13-31 (continued)

2. In this part, we calculate the price for recurring orders of 20,000 pounds (20 lots) using the company's rule of marking up its full manufacturing cost. This is not the best pricing policy to follow, but is a common practice in business.

   Direct materials: Because the initial order will exhaust existing inventories of BH-3 and DF-6 and new supplies would have to be purchased, all raw materials should be charged at their expected future cost, which is the current market price.

AG-5: 6,000 pounds × $1.20 per pound	$ 7,200
KL-2: 4,000 pounds × $1.05 per pound	4,200
CW-7: 3,000 pounds × $1.35 per pound	4,050
DF-6: 3,500 pounds × $0.70 per pound	2,450
Total direct materials cost	17,900

   Direct labor: 90% (i.e., 450 DLHs) of the production of a batch can be done on regular time; but the remaining production (i.e., 50 DLHs) must be done on overtime.

Regular time 450 DLHs × $14.00 per DLH	6,300
Overtime premium 50 DLHs × $21.00 per DLH	1,050
Total direct labor cost	7,350

   Overhead: The full manufacturing cost includes both fixed and variable manufacturing overhead.

Manufacturing overhead applied:	
500 DLHs × $13.50 per DLH	6,750
Full manufacturing cost	32,000
Markup (40% × $32,000)	12,800
Selling price (full manufacturing cost plus markup)	$44,800

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Case 13-32 (120 minutes)

1. The product margins computed by the accounting department for the drums and bike frames should not be used in the decision of which product to make. The product margins are lower than they should be due to the presence of allocated fixed common costs that are irrelevant in this decision. Moreover, even after the irrelevant costs have been removed, what matters is the profitability of the two products in relation to the amount of the constrained resource—welding time—that they use. A product with a very low margin may be desirable if it uses very little of the constrained resource. In short, the financial data provided by the accounting department are useless and potentially misleading for making this decision.

2. Students may have answered this question assuming that direct labor is a variable cost, even though the case strongly hints that direct labor is a fixed cost. The solution is shown here assuming that direct labor is fixed. The solution assuming that direct labor is variable will be shown in part (4).

Solution assuming direct labor is fixed

		Manufactured	
	Purchased WVD Drums	WVD Drums	Bike Frames
Selling price	$149.00	$149.00	$239.00
Less variable costs:			
Materials	138.00	52.10	99.40
Variable manufacturing overhead	0.00	1.35	1.90
Variable selling and administrative	0.75	0.75	1.30
Total variable cost	138.75	54.20	102.60
Contribution margin	$ 10.25	$ 94.80	$136.40

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Case 13-32 (continued)

3. Since the demand for the welding machine exceeds the 2,000 hours that are available, products that use the machine should be prioritized based on their contribution margin *per welding hour*. The computations are carried out below under the assumption that direct labor is a fixed cost and then under the assumption that it is a variable cost.

Solution assuming direct labor is fixed

	Manufactured	
	WVD Drums	*Bike Frames*
Contribution margin per unit (above) (a)...........	$94.80	$136.40
Welding hours per unit (b)................................	0.4 hour	0.5 hour
Contribution margin per welding hour (a) ÷ (b)..	$237.00 per hour	$272.80 per hour

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Case 13-32 (continued)

Since the contribution margin per unit of the constrained resource (i.e., welding time) is larger for the bike frames than for the WVD drums, the frames make the most profitable use of the welding machine. Consequently, the company should manufacture as many bike frames as possible up to demand and then use any leftover capacity to produce WVD drums. Buying the drums from the outside supplier can fill any remaining unsatisfied demand for WVD drums. The necessary calculations are carried out below.

Analysis assuming direct labor is a fixed cost

	(a) Quantity	*(b)* Unit Contribution Margin	*(c)* Welding Time per Unit	*(a) × (c)* Total Welding Time	Balance of Welding Time	*(a) × (b)* Total Contribution
Total hours available					2,000	
Bike frames produced.................	1,600	$136.40	0.5	800	1,200	$218,240
WVD Drums—make....................	3,000	$94.80	0.4	1,200	0	284,400
WVD Drums—buy	3,000	$10.25				30,750
Total contribution margin............						533,390
Less: Contribution margin from present operations: 5,000 drums × $94.80 CM per drum ...						474,000
Increased contribution margin and net operating income						$ 59,390

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Case 13-32 (continued)

4. The computation of the contribution margins and the analysis of the best product mix are repeated here under the assumption that direct labor costs are variable.

Solution assuming direct labor is a variable cost

	Purchased WVD Drums	Manufactured WVD Drums	Manufactured Bike Frames
Selling price	$149.00	$149.00	$239.00
Less variable costs:			
Materials	138.00	52.10	99.40
Direct labor	0.00	3.60	28.80
Variable manufacturing overhead	0.00	1.35	1.90
Variable selling and administrative	0.75	0.75	1.30
Total variable cost	138.75	57.80	131.40
Contribution margin	$ 10.25	$ 91.20	$107.60

Solution assuming direct labor is a variable cost

	Manufactured WVD Drums	Manufactured Bike Frames
Contribution margin per unit (above) (a)	$91.20	$107.60
Welding hours per unit (b)	0.4 hour	0.5 hour
Contribution margin per welding hour (a) ÷ (b)	$228.00 per hour	$215.20 per hour

When direct labor is assumed to be a variable cost, the conclusion is reversed from the case in which direct labor is assumed to be a fixed cost—the WVD drums appear to be a better use of the constraint than the bike frames. The assumption about the behavior of direct labor really does matter.

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Case 13-32 (continued)

Solution assuming direct labor is a variable cost

	(a) Quantity	(b) Unit Contri-bution Margin	(c) Welding Time per Unit	(a) × (c) Total Welding Time	Balance of Weld-ing Time	(a) × (b) Total Contri-bution
Total hours available					2,000	
WVD Drums—make....................	5,000	$91.20	0.4	2,000	0	$456,000
Bike frames produced.................	0	$107.60	0.5	0	0	0
WVD Drums—buy	1,000	$10.25				10,250
Total contribution margin............						466,250
Less: Contribution margin from present operations: 5,000 drums × $91.20 CM per drum ...						456,000
Increased contribution margin and net operating income						$ 10,250

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Case 13-32 (continued)

5. The case strongly suggests that direct labor is fixed: “The bike frames could be produced with existing equipment and personnel.” Nevertheless, it would be a good idea to examine how much labor time is really needed under the two opposing plans.

	Production	*Direct Labor-Hours Per Unit*	*Total Direct Labor-Hours*
Plan 1:			
Bike frames	1,600	1.6*	2,560
WVD drums	3,000	0.2**	600
			3,160
Plan 2:			
WVD drums	5,000	0.2**	1,000

* $28.80 ÷ $18.00 per hour = 1.6 hour
** $3.60 ÷ $18.00 per hour = 0.2 hour

Some caution is advised. Plan 1 assumes that direct labor is a fixed cost. However, this plan requires 2,160 more direct labor-hours than Plan 2 and the present situation. At 40 hours per week a typical full-time employee works about 1,900 hours a year, so the added workload is equivalent to more than one full-time employee. Does the plant really have that much idle time at present? If so, and if shifting workers over to making bike frames would not jeopardize operations elsewhere, then Plan 1 is indeed the better plan. However, if taking on the bike frame as a new product would lead to pressure to hire another worker, more analysis is in order. It is still best to view direct labor as a fixed cost, but taking on the frames as a new product could lead to a jump in fixed costs of about $34,200 (1,900 hours × $18 per hour)—assuming that the remaining 260 hours could be made up using otherwise idle time. See the additional analysis on the next page.

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Contribution margin from Plan 1:	
Bike frames produced (1,600 × $136.40)	218,240
WVD Drums—make (3,000 × $94.80)	284,400
WVD Drums—buy (3,000 × $10.25)	30,750
Total contribution margin	533,390
Less: Additional fixed labor costs	34,200
Net effect of Plan 1 on net operating income	$499,190
Contribution margin from Plan 2:	
WVD Drums—make (5,000 × $94.80)	$474,000
WVD Drums—buy (1,000 × $10.25)	10,250
Net effect of Plan 2 on net operating income	$484,250

If an additional direct labor employee would have to be hired, Plan 1 is still optimal.

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Group Exercise 13-33

1. A manufacturing overhead rate of 500% of direct labor means that the total manufacturing overhead is five times as large as the total direct labor. It also means that for every $1 of direct labor a product incurs, it is charged for $5 of manufacturing overhead.

2. If a product requires a large amount of direct labor, the overhead applied to that product will make that product expensive relative to products that require less direct labor.

3. When products are outsourced, any common fixed manufacturing overhead or joint costs that had been allocated to the outsourced products must be allocated to the remaining products. As a consequence, their apparent costs rise.

4. Labor cost is a declining percentage of total cost in many industries and approaches insignificant levels in some. Rather than obsess on reducing labor costs, it may be better to attack overhead costs, which are much more substantial, or to concentrate time and effort on improving the product or tapping new markets. The potential competitive advantage from lower labor costs is not as important as it once was and is transitory—competitors can always go overseas too. In addition, locating production overseas increases transportation costs and time delays in shipping goods and may increase coordination problems between marketing and production. Moreover, the company may not have as much control over quality when production is moved to a new location.

5. As mentioned in part (3) above, when products are outsourced, the apparent costs of the remaining products almost inevitably rise as fixed overhead costs are spread over a smaller base. As a consequence, the remaining products often become candidates for outsourcing as well. Of course, the second wave of outsourcing leads to further increases in the costs of the remaining products. This vicious cycle can lead managers to eventually move all production out of the country.

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