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 revenue) is the change in cost (or revenue) 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 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. Sunk costs and costs that will not differ regardless of whether the line is retained or discontinued are irrelevant.

13-8 Not necessarily. An apparent net 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 The danger is that such allocations can make a product line (or other segment of an organization) appear to be unprofitable, whereas in fact the line 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 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 manufacturing costs that are incurred up to the 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 the joint products that emerge from the process. 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.

Exercise 13-1 (15 minutes)

		Case 1		*Case 2*	
	Item	*Relevant*	*Not Relevant*	*Relevant*	*Not Relevant*
a.	Sales revenue	X			X
b.	Direct materials	X		X	
c.	Direct labor	X			X
d.	Variable manufacturing overhead	X			X
e.	Book value—Model A3000 machine		X		X
f.	Disposal value—Model A3000 machine		X	X	
g.	Depreciation—Model A3000 machine		X		X
h.	Market value—Model B3800 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

Exercise 13-2 (20 minutes)

1. Fixed cost per mile ($3,500* ÷ 10,000 miles) ... $0.35
   Variable operating cost per mile 0.08
   Average cost per mile $0.43

* Depreciation	$2,000
Insurance	960
Garage rent	480
Automobile tax and license	60
Total	$3,500

2. The variable operating costs would be relevant in this situation. The depreciation would not be relevant since it relates to a sunk cost. However, any decrease in the resale value of the car due to its use would be relevant. The automobile tax and license costs would be incurred whether Samantha decides to drive her own car or rent a car for the trip during Spring break and are therefore irrelevant. It is unlikely that her insurance costs would increase as a result of the trip, so they are irrelevant as well. The garage rent is relevant only if she could avoid paying part of it if she drives her own car.

3. When figuring the incremental cost of the more expensive car, the relevant costs would be the purchase price of the new car (net of the resale value of the old car) and the increases in the fixed costs of insurance and automobile tax and license. The original purchase price of the old car is a sunk cost and is therefore irrelevant. The variable operating costs would be the same and therefore are irrelevant. (Students are inclined to think that variable costs are always relevant and fixed costs are always irrelevant in decisions. This requirement helps to dispel that notion.)

Exercise 13-3 (30 minutes)

1. No, the housekeeping program should not be discontinued. It is actually generating a positive program segment margin and is, of course, providing a valuable service to seniors. Computations to support this conclusion follow:

Contribution margin lost if the housekeeping program is dropped		$(80,000)
Fixed costs that can be avoided:		
Liability insurance	$15,000	
Program administrator's salary	37,000	52,000
Decrease in net operating income for the organization as a whole		$(28,000)

Depreciation on the van is a sunk cost and the van has no salvage value since it would be donated to another organization. The general administrative overhead is allocated and none of it would be avoided if the program were dropped; thus it is not relevant to the decision.

The same result can be obtained with the alternative analysis below:

	Current Total	*Total If House-keeping Is Dropped*	*Difference: Net Operating Income Increase or (Decrease)*
Revenues	$900,000	$660,000	$(240,000)
Less variable expenses	490,000	330,000	160,000
Contribution margin	410,000	330,000	(80,000)
Less fixed expenses:			
Depreciation*	68,000	68,000	0
Liability insurance	42,000	27,000	15,000
Program administrators' salaries	115,000	78,000	37,000
General administrative overhead	180,000	180,000	0
Total fixed expenses	405,000	353,000	52,000
Net operating income (loss)	$ 5,000	$(23,000)	$ (28,000)

*Includes pro-rated loss on disposal of the van if it is donated to a charity.

Exercise 13-3 (continued)

2. To give the administrator of the entire organization a clearer picture of the financial viability of each of the organization's programs, the general administrative overhead should not be allocated. It is a common cost that should be deducted from the total program segment margin. Following the format introduced in Chapter 12 for a segmented income statement, a better income statement would be:

	Total	*Home Nursing*	*Meals on Wheels*	*House-keeping*
Revenues	$900,000	$260,000	$400,000	$240,000
Less variable expenses	490,000	120,000	210,000	160,000
Contribution margin	410,000	140,000	190,000	80,000
Less traceable fixed expenses:				
Depreciation	68,000	8,000	40,000	20,000
Liability insurance	42,000	20,000	7,000	15,000
Program administrators' salaries	115,000	40,000	38,000	37,000
Total traceable fixed expenses	225,000	68,000	85,000	72,000
Program segment margins	185,000	$ 72,000	$105,000	$ 8,000
General administrative overhead	180,000			
Net operating income (loss)	$ 5,000			

Exercise 13-4 (30 minutes)

1.

	Per Unit Differential Costs		15,000 units	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$20		$300,000
Direct materials	$ 6		$ 90,000	
Direct labor	8		120,000	
Variable manufacturing overhead	1		15,000	
Fixed manufacturing overhead, traceable[1]	2		30,000	
Fixed manufacturing overhead, common	0	0	0	0
Total costs	$17	$20	$255,000	$300,000
Difference in favor of continuing to make the parts	$3		$45,000	

[1] Only the supervisory salaries can be avoided if the parts are purchased. The remaining book value of the special equipment is a sunk cost; hence, the $3 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 parts internally.

2.

	Make	*Buy*
Cost of purchasing (part 1)		$300,000
Cost of making (part 1)	$255,000	
Opportunity cost—segment margin forgone on a potential new product line	65,000	
Total cost	$320,000	$300,000
Difference in favor of purchasing from the outside supplier	$20,000	

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

Exercise 13-5 (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 10 bracelets*
Incremental revenue	$349.95	$3,499.50
Incremental costs:		
Variable costs:		
Direct materials	143.00	1,430.00
Direct labor	86.00	860.00
Variable manufacturing overhead	7.00	70.00
Special filigree	6.00	60.00
Total variable cost	$242.00	2,420.00
Fixed costs:		
Purchase of special tool		465.00
Total incremental cost		2,885.00
Incremental net operating income		$ 614.50

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.

Exercise 13-6 (30 minutes)

1.

	A	B	C
(1) Contribution margin per unit	$18	$36	$20
(2) Direct labor cost per unit	$12	$32	$16
(3) Direct labor rate per hour	8	8	8
(4) Direct labor-hours required per unit (2) ÷ (3)	1.5	4.0	2.0
Contribution margin per direct labor-hour (1) ÷ (4)	$12	$ 9	$10

2. The company should concentrate its labor time on producing product A:

	A	B	C
Contribution margin per direct labor-hour	$12	$9	$10
Direct labor-hours available	× 3,000	× 3,000	× 3,000
Total contribution margin	$36,000	$27,000	$30,000

Although product A has the lowest contribution margin per unit and the second lowest contribution margin ratio, it has the highest contribution margin per direct labor-hour. Since labor time seems to be the company's constraint, this measure should guide management in its production decisions.

3. The amount Banner Company should be willing to pay in overtime wages for additional direct labor time depends on how the time would be used. If there are unfilled orders for all of the products, Banner would presumably use the additional time to make more of product A. Each hour of direct labor time generates $12 of contribution margin over and above the usual direct labor cost. Therefore, Banner should be willing to pay up to $20 per hour (the $8 usual wage plus the contribution margin per hour of $12) for additional labor time, but would of course prefer to pay far less. The upper limit of $20 per direct labor hour signals to managers how valuable additional labor hours are to the company.

Exercise 13-6 (continued)

If all the demand for product A has been satisfied, Banner Company would then use any additional direct labor-hours to manufacture product C. In that case, the company should be willing to pay up to \$18 per hour (the \$8 usual wage plus the \$10 contribution margin per hour for product C) to manufacture more product C.

Likewise, if all the demand for both products A and C has been satisfied, additional labor hours would be used to make product B. In that case, the company should be willing to pay up to \$17 per hour to manufacture more product B.

Exercise 13-7 (10 minutes)

	Product X	*Product Y*	*Product Z*
Sales value after further processing	$80,000	$150,000	$75,000
Sales value at split-off point	50,000	90,000	60,000
Incremental revenue	30,000	60,000	15,000
Cost of further processing	35,000	40,000	12,000
Incremental profit (loss)......................	$(5,000)	20,000	3,000

Products Y and Z should be processed further, but not Product X.

Exercise 13-8 (30 minutes)

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

Fuel and upkeep on boat per trip........	$25
Junk food consumed during trip*........	8
Snagged fishing lures	7
Total	$40

* The junk food consumed during the trip may not be completely relevant. Even if Steve were not going on the trip, he would still have to eat. The amount by which the cost of the junk food exceeds the cost of the food he would otherwise consume would be the relevant amount.

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

2. If he fishes for the same amount of time as he did on his last trip, 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 catch the last fish. The costs are really incurred in order to be able to catch fish and would be the same whether one, two, three, or a dozen fish were actually caught. Fishing, not catching fish, costs money. All of the costs are basically fixed with respect to how many fish are actually caught during any one fishing trip, except possibly the cost of snagged lures.

3. In a decision of whether to give up fishing altogether, nearly all of the costs listed by Steve's wife are relevant. If he did not fish, he would not need to pay for boat moorage, new fishing gear, a fishing license, fuel and upkeep, junk food, or snagged lures. In addition, he would be able to sell his boat, the proceeds of which would be considered relevant in this decision. The original cost of the boat, which is a sunk cost, would not be relevant.

Exercise 13-8 (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 are relevant when we compute the cost of catching a particular fish; some of them are relevant when we compute the cost of a fishing trip; and nearly all of them are relevant when we consider the cost of not giving up fishing. What is even more confusing is that Wendy is correct; the average cost of a salmon is $167, even though the cost of actually catching any one fish is essentially zero. It may not make sense from an economic standpoint to have salmon fishing as a hobby, but as long as Steve is out in the boat fishing, he might as well catch as many fish as he can.

Exercise 13-9 (30 minutes)

No, the overnight cases should not be discontinued. The computations are:

Contribution margin lost if the cases are discontinued		$(260,000)
Less fixed costs that can be avoided if the cases are discontinued:		
Salary of the product line manager	$ 21,000	
Advertising	110,000	
Insurance on inventories	9,000	140,000
Net disadvantage of dropping the cases		$(120,000)

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

	Keep Overnight Cases	*Drop Overnight Cases*	*Difference: Net Operating Income Increase or (Decrease)*
Sales	$450,000	$ 0	$(450,000)
Less variable expenses:			
Variable manufacturing expenses	130,000	0	130,000
Sales commissions	48,000	0	48,000
Shipping	12,000	0	12,000
Total variable expenses	190,000	0	190,000
Contribution margin	260,000	0	(260,000)
Less fixed expenses:			
Salary of line manager	21,000	0	21,000
General factory overhead	104,000	104,000	0
Depreciation of equipment	36,000	36,000	0
Advertising—traceable	110,000	0	110,000
Insurance on inventories	9,000	0	9,000
Purchasing department expenses	50,000	50,000	0
Total fixed expenses	330,000	190,000	140,000
Net operating loss	$ (70,000)	$(190,000)	$(120,000)

Exercise 13-10 (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		*20,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$23.50		$470,000
Cost of making:				
Direct materials	$ 4.80		$ 96,000	
Direct labor	7.00		140,000	
Variable manufacturing overhead	3.20		64,000	
Fixed manufacturing overhead	4.00 *		80,000	
Total cost	$19.00	$23.50	$380,000	$470,000

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

The $150,000 rental value of the space being used to produce part R-3 represents an opportunity cost of continuing to produce the part internally. Thus, the completed analysis would be:

	Make	*Buy*
Total cost, as above	$380,000	$470,000
Rental value of the space (opportunity cost)	150,000	
Total cost, including opportunity cost	$530,000	$470,000
Net advantage in favor of buying	$60,000	

Problem 13-11 (30 minutes)

1. Contribution margin lost if the tour is discontinued ....

1. Contribution margin lost if the tour is discontinued		$(2,100)
Less tour costs that can be avoided if the tour is discontinued:		
Tour promotion	$600	
Fee, tour guide	700	
Fuel for bus	125	
Overnight parking fee, bus................................	50	
Room & meals, bus driver and tour guide	175	1,650
Net decrease in profits if the tour is discontinued		$ (450)

The following costs are not relevant to the decision:

Cost	*Reason*
Salary of bus driver	The drivers are all on salary and there would be no change in the number of drivers on the payroll.
Depreciation of bus	Depreciation due to wear and tear is negligible and there would be no change in the number of buses in the fleet.
Liability insurance, bus	There would be no change in the number of buses in the fleet.
Bus maintenance & preparation	There would be no change in the size of the maintenance & preparation staff.

Problem 13-11 (continued)

Alternative Solution:

	Keep the Tour	*Drop the Tour*	*Difference: Net Operating Income Increase or (Decrease)*
Ticket revenue	$3,000	$ 0	$(3,000)
Less variable expenses	900	0	900
Contribution margin	2,100	0	(2,100)
Less tour expenses:			
Tour promotion	600	0	600
Salary of bus driver	350	350	0
Fee, tour guide	700	0	700
Fuel for bus	125	0	125
Depreciation of bus	450	450	0
Liability insurance, bus	200	200	0
Overnight parking fee, bus	50	0	50
Room & meals, bus driver and tour guide	175	0	175
Bus maintenance and preparation	300	300	0
Total tour expenses	2,950	1,300	1,650
Net operating loss	$ (850)	$(1,300)	$ (450)

2. The goal of increasing average seat occupancy could be accomplished by dropping tours like the Historic Mansions tour with lower-than-average seat occupancies. This could reduce profits in at least two ways. First, the tours that are eliminated could have contribution margins that exceed their avoidable costs (such as in the case of the "Historic Mansions" tour in part 1). If so, then eliminating these tours would reduce the company's total contribution margin more than it would reduce total costs, and profits would decline. Second, these tours might be acting as "magnets" that draw tourists to other, more profitable tours.

Problem 13-12 (60 minutes)

1. Contribution margin lost if the Bath Department is dropped:

Lost from the Bath Department	$700,000
Lost from the Kitchen Department (10% × $2,400,000)	240,000
Total lost contribution margin	940,000
Less avoidable fixed costs ($900,000 – $370,000)	530,000
Decrease in overall net operating income	$410,000

2. Merifulon should be processed further:

Sales value after further processing	$60,000
Sales value at the split-off point	40,000
Incremental revenue from further processing	20,000
Cost of further processing	13,000
Profit from further processing	$ 7,000

The $10,000 in allocated common costs (1/3 × $30,000) will be the same regardless of which alternative is selected, and hence is not relevant to the decision.

3. The company should accept orders first for Z, second for X, and third for Y. The computations are:

	X	*Y*	*Z*
(a) Direct materials required per unit	$24.00	$15.00	$9.00
(b) Cost per pound	$3.00	$3.00	$3.00
(c) Pounds required per unit (a) ÷ (b)	8	5	3
(d) Contribution margin per unit	$32.00	$14.00	$21.00
Contribution margin per pound of materials used (d) ÷ (c)	$4.00	$2.80	$7.00

Problem 13-12 (continued)

Since Z 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 this constrained resource, 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 X ▪uses more material (the constrained resource) than does product Y, but yet it is preferred over product Y. *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.*

4.

	Relevant Costs	
Item	*Make*	*Buy*
Direct materials (60,000 @ $4.00)................	$240,000	
Direct labor (60,000 @ $2.75)......................	165,000	
Variable manufacturing overhead (60,000 @ $0.50)	30,000	
Fixed manufacturing overhead, traceable (1/3 of $180,000)....................................	60,000	
Cost of purchasing from outside supplier (60,000 @ $10).......................................		$600,000
Total cost...	$495,000	$600,000

The two-thirds of the traceable fixed manufacturing overhead costs that cannot be eliminated, and all of the common fixed manufacturing overhead costs, are irrelevant.

The company would save $105,000 per year by continuing to make the parts itself.

Problem 13-12 (continued)

5. Monthly profits would be increased by $9,000:

	Per Unit	*Total for 2,000 Units*
Incremental revenue	$12.00	$24,000
Incremental costs:		
Variable costs:		
Direct materials	2.50	5,000
Direct labor	3.00	6,000
Variable manufacturing overhead	0.50	1,000
Variable selling and administrative	1.50	3,000
Total variable cost	$ 7.50	15,000
Fixed costs:		
None affected by the special order		0
Total incremental cost		15,000
Incremental net operating income		$ 9,000

6. The relevant cost is $1.50 (the variable selling and administrative costs). All other variable costs are sunk, since the units have already been produced. The fixed costs would not be relevant, since they would not be affected by the sale of leftover units.

Problem 13-13 (15 minutes)

1.

	Per 16-Ounce T-Bone
Revenue from further processing:	
Selling price of one filet mignon (6 ounces × \$3.60 per pound/16 ounces per pound)	\$1.35
Selling price of one New York cut (8 ounces × \$2.90 per pound/16 ounces per pound)	1.45
Total revenue from further processing	2.80
Less revenue from one T-bone steak	2.25
Incremental revenue from further processing	0.55
Less cost of further processing	0.20
Profit per pound from further processing	\$0.35

2. The T-bone steaks should be processed further into the filet mignon and the New York cut. This will yield \$0.35 per pound in added profit for the company. The \$0.55 "profit" per pound for T-bone steak mentioned in the problem statement is not relevant to the decision, since it contains allocated joint costs. The company will incur the allocated joint costs regardless of whether the T-bone steaks are sold outright or processed further; thus, this cost should be ignored in the decision.

Problem 13-14 (45 minutes)

1. Product MJ-7 yields a contribution margin of \$14 per gallon (\$35 – \$21 = \$14). If the plant closes, this contribution margin will be lost on the 22,000 gallons (11,000 gallons per month × 2 = 22,000 gallons) 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 (\$14 per gallon × 22,000 gallons)		\$(308,000)
Costs avoided by closing the plant for two months:		
Fixed manufacturing overhead cost (\$230,000 – \$170,000 = \$60,000; \$60,000 × 2 months = \$120,000)	\$120,000	
Fixed selling costs (\$310,000 × 10% × 2 months)	62,000	182,000
Net disadvantage of closing, before start-up costs		(126,000)
Add start-up costs		(14,000)
Disadvantage of closing the plant		\$(140,000)

No, the company should not close the plant; it should continue to operate at the reduced level of 11,000 gallons produced and sold each month. Closing will result in a \$140,000 greater loss over the two-month period than if the company continues to operate. Additional factors are the potential loss of goodwill among the customers who need the 11,000 gallons of MJ-7 each month and the adverse effect on employee morale. By closing down, the needs of customers will not be met (no inventories are on hand), and their business may be permanently lost to another supplier.

Problem 13-14 (continued)

Alternative Solution:

	Plant Kept Open	*Plant Closed*	*Difference—Net Operating Income Increase (Decrease)*
Sales (11,000 gallons × \$35 per gallon × 2)	\$ 770,000	\$ 0	\$(770,000)
Less variable expenses (11,000 gallons × \$21 per gallon × 2)	462,000	0	462,000
Contribution margin	308,000	0	(308,000)
Less fixed costs:			
Fixed manufacturing overhead cost (\$230,000 × 2; \$170,000 × 2)	460,000	340,000	120,000
Fixed selling cost (\$310,000 × 2; \$310,000 × 90% × 2)	620,000	558,000	62,000
Total fixed cost	1,080,000	898,000	182,000
Net operating loss before start-up costs	(772,000)	(898,000)	(126,000)
Start-up costs		(14,000)	(14,000)
Net operating loss	\$ (772,000)	\$(912,000)	\$(140,000)

Problem 13-14 (continued)

2. Ignoring the additional factors cited in part (1) above, Hallas Company should be indifferent between closing down or continuing to operate if the level of sales drops to 12,000 gallons (6,000 gallons per month) over the two-month period. The computations are:

Cost avoided by closing the plant for two months (see above)	$182,000
Less start-up costs	14,000
Net avoidable costs	$168,000

$$\frac{\text{Net avoidable costs}}{\text{Contribution margin per gallon}} = \frac{\$168{,}000}{\$14 \text{ per gallon}}$$

$$= 12{,}000 \text{ gallons}$$

Verification:

	Operate at 12,000 Gallons for Two Months	*Close for Two Months*
Sales (12,000 gallons × $35 per gallon)	$ 420,000	$ 0
Less variable expenses (12,000 gallons × $21 per gallon)	252,000	0
Contribution margin	168,000	0
Less fixed expenses:		
Manufacturing overhead ($230,000 and $170,000 × 2 months)	460,000	340,000
Selling ($310,000 and $279,000 × 2 months)	620,000	558,000
Total fixed expenses	1,080,000	898,000
Start-up costs	0	14,000
Total costs	1,080,000	912,000
Net operating loss	$ (912,000)	$(912,000)

Problem 13-15 (60 minutes)

1. The fixed overhead costs are common and will remain the same regardless of whether the cartridges are produced internally or purchased outside. Hence, they are not relevant. The variable manufacturing overhead cost per box of pens is $0.30, as shown below:

Total manufacturing overhead cost per box of pens	$0.80
Less fixed manufacturing overhead ($50,000 ÷ 100,000 boxes)	0.50
Variable manufacturing overhead cost per box	$0.30

The total variable cost of producing one box of Zippo pens is:

Direct materials	$1.50
Direct labor	1.00
Variable manufacturing overhead	0.30
Total variable cost per box	$2.80

If the cartridges for the Zippo pens are purchased from the outside supplier, then the variable cost per box of Zippo pens would be:

Direct materials ($1.50 × 80%)	$1.20
Direct labor ($1.00 × 90%)	0.90
Variable manufacturing overhead ($0.30 × 90%)	0.27
Purchase of cartridges	0.48
Total variable cost per box	$2.85

The company should reject the outside supplier's offer. Producing the cartridges internally costs $0.05 less per box of pens than purchasing them from the supplier.

Problem 13-15 (continued)

Another approach to the solution is:

Cost avoided by purchasing the cartridges:	
Direct materials ($1.50 × 20%)	$0.30
Direct labor ($1.00 × 10%)	0.10
Variable manufacturing overhead ($0.30 × 10%)	0.03
Total costs avoided	$0.43
Cost of purchasing the cartridges	$0.48
Cost savings per box by making cartridges internally	$0.05

Note that the avoidable cost of $0.43 above represents *the cost of making one box of cartridges internally*.

2. The company would not want to pay any more than $0.43 per box, since it can make the cartridges for this amount internally.

3. The company has three alternatives for obtaining the necessary cartridges. It can:

   #1 Produce all cartridges internally.
   #2 Purchase all cartridges externally.
   #3 Produce 100,000 boxes internally and purchase 50,000 boxes externally.

Problem 13-15 (continued)

The costs under the three alternatives are:

Alternative #1—Produce all cartridges internally:	
Variable costs (150,000 boxes × $0.43 per box)	$64,500
Fixed costs of adding capacity	30,000
Total cost	$94,500
Alternative #2—Purchase all cartridges externally:	
Variable costs (150,000 boxes × $0.48 per box)	$72,000
Alternative #3—Produce 100,000 boxes internally, and purchase 50,000 boxes externally:	
Variable costs:	
100,000 boxes × $0.43 per box	$43,000
50,000 boxes × $0.48 per box	24,000
Total cost	$67,000

Or, in terms of total cost per box of pens, the answer would be:

Alternative #1—Produce all cartridges internally:	
Variable costs (150,000 boxes × $2.80 per box)	$420,000
Fixed costs of adding capacity	30,000
Total cost	$450,000
Alternative #2—Purchase all cartridges externally:	
Variable costs (150,000 boxes × $2.85 per box)	$427,500
Alternative #3—Produce 100,000 boxes internally, and purchase 50,000 boxes externally:	
Variable costs:	
100,000 boxes × $2.80 per box	$280,000
50,000 boxes × $2.85 per box	142,500
Total cost	$422,500

Thus, the company should accept the outside supplier's offer, but only for 50,000 boxes of cartridges.

Problem 13-15 (continued)

4. In addition to cost considerations, Bronson should take into account the following factors:
   a) The ability of the supplier to meet required delivery schedules.
   b) The quality of the cartridges purchased from the supplier.
   c) Alternative uses of the capacity that is used to make the cartridges.
   d) The ability of the supplier to supply cartridges if volume increases in future years.
   e) The problem of alternative sources of supply if the supplier proves undependable.

Problem 13-16 (30 minutes)

1. Incremental revenue:		
Fixed fee (10,000 pairs × 4 mk per pair)	40,000	mk
Reimbursement for costs of production: (Variable production cost of 16 mk plus fixed overhead cost of 5 mk equals 21 mk per pair; 10,000 pairs × 21 mk per pair)	210,000	
Total incremental revenue	250,000	
Incremental costs:		
Variable production costs (10,000 pairs × 16 mk per pair)	160,000	
Increase in net operating income	90,000	mk

2. Sales revenue through regular channels (10,000 pairs × 32 mk per pair)	320,000	mk
Sales revenue from the army (above)	250,000	
Decrease in revenue received	70,000	
Less variable selling expenses avoided if the army's offer is accepted (10,000 pairs × 2 mk per pair)	20,000	
Net decrease in net operating income with the army's offer	50,000	mk

Problem 13-17 (45 minutes)

1. The simplest approach to the solution is:

Gross margin lost if the store is closed		$(228,000)
Less costs that can be avoided:		
Direct advertising	$36,000	
Sales salaries	45,000	
Delivery salaries	7,000	
Store rent	65,000	
Store management salaries (new employee would not be hired to fill vacant position at another store)	15,000	
General office salaries	8,000	
Utilities	27,200	
Insurance on inventories (2/3 × $9,000)	6,000	
Employment taxes*	9,000	218,200
Decrease in company net operating income if the Downtown Store is closed		$(9,800)

*Salaries avoided by closing the store:

Sales salaries	$45,000
Delivery salaries	7,000
Store management salaries	15,000
General office salaries	8,000
Total salaries	75,000
Employment tax rate	× 12%
Employment taxes avoided	$ 9,000

2. The Downtown Store should not be closed. If the store is closed, overall company net operating income will decrease by $9,800 per quarter.

Problem 13-17 (continued)

3. The Downtown Store should be closed if $200,000 of its sales are picked up by the Uptown Store. The net effect of the closure will be an increase in overall company net operating income by $65,000 per quarter:

Gross margin lost if the Downtown Store is closed	$(228,000)
Gross margin gained at the Uptown Store:	
$200,000 × 43%	86,000
Net loss in gross margin..	(142,000)
Costs that can be avoided if the Downtown Store is closed	
(part 1)	218,200
Net advantage of closing the Downtown Store	$ 76,200

Problem 13-18 (60 minutes)

1. The $2.00 per unit general overhead cost is not relevant to the decision, since the total general company overhead cost will be the same regardless of whether the company decides to make or buy the subassemblies. Also, the depreciation on the old equipment is not a relevant cost since it represents a sunk cost and the old equipment is worn out and must be replaced. The cost of supervision is relevant since this cost can be avoided by buying the subassemblies.

	Differential Costs Per Unit		*Total Differential Costs for 40,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price		$8.00		$320,000
Direct materials	$2.75		$110,000	
Direct labor ($4.00 × 0.75)	3.00		120,000	
Variable overhead ($0.60 × 0.75)	0.45		18,000	
Supervision	0.75		30,000	
Equipment rental*	1.50		60,000	
Total	$8.45	$8.00	$338,000	$320,000
Difference in favor of buying	$0.45		$18,000	

* $60,000 per year ÷ 40,000 units per year = $1.50 per unit

Problem 13-18 (continued)

2. a. Notice that unit costs for both supervision and equipment rental will change if the company needs 50,000 subassemblies each year. These fixed costs will be spread over a larger number of units, thereby decreasing the cost per unit.

	Differential Costs Per Unit		*Total Differential Costs—50,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price		$8.00		$400,000
Direct materials	$2.75		$137,500	
Direct labor	3.00		150,000	
Variable overhead	0.45		22,500	
Supervision ($30,000 ÷ 50,000 units)	0.60		30,000	
Equipment rental ($60,000 ÷ 50,000 units)	1.20		60,000	
Total	$8.00	$8.00	$400,000	$400,000
Difference	$0		$0	

The company would be indifferent between the two alternatives if 50,000 subassemblies were needed each year.

Problem 13-18 (continued)

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

	Differential Costs Per Unit		*Total Differential Costs—60,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price		$8.00		$480,000
Direct materials	$2.75		$165,000	
Direct labor	3.00		180,000	
Variable overhead	0.45		27,000	
Supervision ($30,000 ÷ 60,000 units)	0.50		30,000	
Equipment rental ($60,000 ÷ 60,000 units)	1.00		60,000	
Total	$7.70	$8.00	$462,000	$480,000
Difference in favor of making	$0.30		$18,000	

The company should purchase the new equipment and make the subassemblies if 60,000 units per year are needed.

Problem 13-18 (continued)

3. Other factors that the company should consider include:
   a. Will volume in future years be increasing, or will it remain constant at 40,000 units per year? (If volume increases, then buying the new equipment becomes more desirable, as shown in the computations above.)
   b. Can quality control be maintained if the subassemblies are purchased from the outside supplier?
   c. Does the company have some other profitable use for the space now being used to produce the subassemblies? Does production of the subassemblies require use of a constrained resource?
   d. Will the outside supplier be dependable in meeting shipping schedules?
   e. Can the company begin making the subassemblies again if the supplier proves to be undependable, or are there alternative suppliers?
   f. If the outside supplier's offer is accepted and the need for subassemblies increases in future years, will the supplier have the capacity to provide more than 40,000 subassemblies per year?

Problem 13-19 (45 minutes)

1.

Selling price per unit	$40
Less variable expenses per unit*	24
Contribution margin per unit	$16

*$9.50 + $10.00 + $2.80 + $1.70 = $24.00

Increased unit sales (80,000 × 25%)	20,000
Contribution margin per unit	× $16
Incremental contribution margin	$320,000
Less added fixed selling expense	150,000
Incremental net operating income	$170,000

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

2.

Variable production cost per unit	$22.30
Import duties, etc. ($14,000 ÷ 20,000 units)	0.70
Shipping cost per unit	1.50
Break-even price per unit	$24.50

3. If the plant operates at 25% of normal levels, then only 5,000 units will be produced and sold during the three-month period:

80,000 units per year × 3/12 = 20,000 units.
20,000 units × 25% = 5,000 units produced and sold.

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

Contribution margin lost if the plant is closed (5,000 units × $16 per unit*)		$(80,000)
Fixed costs that can be avoided if the plant is closed:		
Fixed manufacturing overhead cost ($400,000 × 3/12 = $100,000; $100,000 × 40%)	$40,000	
Fixed selling cost ($360,000 × 3/12 = $90,000; $90,000 × 1/3)	30,000	70,000
Net disadvantage of closing the plant		$(10,000)

*$40.00 – ($9.50 + $10.00 + $2.80 + $1.70) = $16.00

Problem 13-19 (continued)

Alternative approach:

	Keep the Plant Open	*Close the Plant*
Sales (5,000 units × $40 per unit)	$ 200,000	$ 0
Less variable expenses		
(5,000 units × $24 per unit)	120,000	0
Contribution margin	80,000	0
Less fixed expenses:		
Fixed manufacturing overhead cost:		
$400,000 × 3/12	100,000	
$400,000 × 3/12 × 60%		60,000
Fixed selling expense:		
$360,000 × 3/12	90,000	
$360,000 × 3/12 × 2/3		60,000
Total fixed expenses	190,000	120,000
Net operating income (loss)	$(110,000)	$(120,000)

4. The relevant cost is $1.70 per unit, which is the variable selling expense per Zet. Since the blemished 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 remain the same regardless of whether or not the blemished units are sold. The variable selling expense may or may not be relevant—depending on how the blemished units are sold. For example, the units may be sold through a liquidator without incurring the normal variable selling expense.

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

Variable production costs	$22.30
Fixed manufacturing overhead cost ($400,000 × 70% = $280,000; $280,000 ÷ 80,000 units)	3.50
Variable selling expense ($1.70 × 60%)	1.02
Total avoidable cost	$26.82

To be acceptable, the outside manufacturer's quotation must be *less* than $26.82 per unit.

Problem 13-20 (45 minutes)

1. Only the avoidable costs are relevant in a decision to drop the Kensington product line. These costs are:

Direct materials	£ 32,000
Direct labor	200,000
Fringe benefits (30% of labor)	60,000
Variable manufacturing overhead	30,000
Royalties (5% of sales)	24,000
Product-line managers' salaries	8,000
Sales commissions (10% of sales)	48,000
Fringe benefits (30% of salaries and commissions)	16,800
Shipping	10,000
Advertising	15,000
Total avoidable cost	£443,800

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 up 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 Kensington product line would have no effect on total general administrative expenses.

Problem 13-20 (continued)

Having determined the costs that can be avoided if the Kensington product line is dropped, we can now make the following computation:

Sales revenue lost if the Kensington line is dropped......	£480,000
Less costs that can be avoided (see above)..................	443,800
Decrease in overall company net operating income if the Kensington line is dropped.................................	£ 36,200

Thus, the Kensington line should not be dropped unless the company can find more profitable uses for the resources consumed by the Kensington line.

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

	Variable	*Fixed*
Direct materials..	£ 32,000	
Direct labor..	200,000	
Fringe benefits (30% of labor).....................	60,000	
Variable manufacturing overhead	30,000	
Royalties (5% of sales)...............................	24,000	
Product-line managers' salaries		£ 8,000
Sales commissions (10% of sales)................	48,000	
Fringe benefits (30% of salaries and commissions)...........	14,400	2,400
Shipping	10,000	
Advertising...		15,000
Total cost..	£418,400	£25,400

The Kensington product line 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.

Problem 13-20 (continued)

The contribution margin ratio is computed as follows:

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

$$= \frac{£480{,}000 - £418{,}400}{£480{,}000} = 12.83\% \text{ (rounded)}$$

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

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

$$= \frac{£25{,}400}{0.1283} = £198{,}000 \text{ (rounded)}$$

Therefore, as long as the sales revenue from the Kensington product line exceeds £198,000, 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.

Problem 13-21 (45 minutes)

1.

	Marcy	*Tina*	*Cari*	*Lenny*	*Sewing Kit*
Direct labor cost per unit ..	$ 4.80	$ 3.00	$ 8.40	$ 6.00	$ 2.40
Direct labor-hours per unit* (a)	0.40	0.25	0.70	0.50	0.20
Selling price	$35.00	$24.00	$22.00	$18.00	$14.00
Less variable costs:					
Direct materials	3.50	2.30	4.50	3.10	1.50
Direct labor	4.80	3.00	8.40	6.00	2.40
Variable overhead	1.60	1.00	2.80	2.00	0.80
Total variable costs...........	9.90	6.30	15.70	11.10	4.70
Contribution margin (b)	$25.10	$17.70	$ 6.30	$ 6.90	$ 9.30
Contribution margin per DLH (b) ÷ (a)...............	$62.75	$70.80	$ 9.00	$13.80	$46.50

* Direct labor cost per unit ÷ $12.00 per direct labor-hour

2.

Product	*DLH Per Unit*	*Estimated Sales (units)*	*Total DLHs*
Marcy	0.40	26,000	10,400
Tina	0.25	42,000	10,500
Cari	0.70	40,000	28,000
Lenny	0.50	46,000	23,000
Sewing Kit	0.20	450,000	90,000
Total DLHs required........			161,900

3. Since the Cari doll has the lowest contribution margin per labor hour, its production should be reduced by 17,000 dolls (11,900 excess DLHs ÷ 0.70 DLH per doll = 17,000 dolls). Thus, production and sales of the Cari doll will be reduced to 23,000 dolls for the year.

Problem 13-21 (continued)

4. Since the additional capacity would be used to produce the Cari doll, the company should be willing to pay up to \$21.00 per DLH (\$12.00 usual labor rate plus \$9.00 contribution margin per DLH) for added labor time. Thus, the company could employ workers for overtime at the usual time-and-a-half rate of \$18.00 per hour (\$12.00 × 1.5 = \$18.00) 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.

   Technical 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 \$12.00 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, if labor is not fixed and is not the constraint, including labor cost in the calculation of the contribution margin may lead to incorrect rankings of the products.

Problem 13-22 (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 honey is:

Selling price of a container of honey drop candies	$4.40
Selling price of three-quarters of a pound of honey ($3.00 × 3/4)	2.25
Incremental revenue per container	$2.15

   The incremental variable costs are:

Decorative container	$0.40
Other ingredients	0.25
Direct labor	0.20
Variable manufacturing overhead	0.10
Commissions (5% × $4.40)	0.22
Incremental variable cost per container	$1.17

   Therefore, the incremental contribution margin is $0.98 per container ($2.15 – $1.17). The cost of purchasing the honeycombs is not relevant since those costs are incurred regardless of whether the honey is sold outright or processed further into candies.

2. The only avoidable fixed costs of the honey drop candies are the master candy maker's salary and the fixed portion of the salesperson's compensation. Therefore, the number of containers of the candy that must be sold each month to justify continued processing of the honey into candies is determined as follows:

Master candy maker's salary	$3,880
Salesperson's fixed compensation	2,000
Avoidable fixed costs	$5,880

$$\frac{\text{Avoidable fixed costs}}{\text{Incremental CM per container}} = \frac{\$5{,}880}{\$0.98 \text{ per container}} = 6{,}000 \text{ containers}$$

Problem 13-22 (continued)

If the company can sell more than 6,000 containers of the candies each month, then profits will be higher than if the honey were simply sold outright. If the company cannot sell at least 6,000 containers of the candies each month, then profits will be higher if the company discontinues making honey drop candies. To verify this, we show below the total contribution to profits of sales of 5,000, 6,000, and 7,000 containers of candies, contrasted to sales of equivalent amounts of honey. For example, instead of selling 4,500 pounds of honey, this same amount of honey can be processed into 6,000 containers of candy.

Sales of candies:			
Containers sold per month	5,000	6,000	7,000
Sales revenue @ $4.40 per container	$22,000	$26,400	$30,800
Less incremental variable costs @ $1.17 per container	5,850	7,020	8,190
Incremental contribution margin	16,150	19,380	22,610
Less avoidable fixed costs	5,880	5,880	5,880
Total contribution to profits	$10,270	$13,500	$16,730
Sales of equivalent amount of honey:			
Pounds sold per month*	3,750	4,500	5,250
Sales revenue @ $3.00 per pound	$11,250	$13,500	$15,750

* 5,000 containers × 3/4 pounds per container = 3,750 pounds
6,000 containers × 3/4 pounds per container = 4,500 pounds
7,000 containers × 3/4 pounds per container = 5,250 pounds

If there is a choice between selling 3,750 pounds of honey or selling 5,000 containers of candies, profits would be higher selling the honey outright ($11,250 versus $10,270). The company should be indifferent between selling 4,500 pounds of honey or 6,000 containers of candy. In either case, the contribution to profits would be $13,500. On the other hand, if faced with a choice of selling 5,250 pounds of honey or 7,000 containers of candies, profits would be higher processing the honey into candies ($16,730 versus $15,750).

Case 13-23 (60 minutes)

1. The original cost of the facilities at Ashton is a sunk cost and should be ignored in any decision. The decision being considered here is whether to continue operations at Ashton. The only relevant costs are the future facility costs that would be affected by this decision. If the facility were shut down, the Ashton facility has no resale value. In addition, if the Ashton 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 Ashton 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 Ashton facility are:

Increase in rent at Pocatello and Idaho Falls	$400,000
Decrease in local administrative expenses	(60,000)
Net increase in costs	$340,000

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

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

Case 13-23 (continued)

Financial Performance
After Shutting Down the Ashton Facility
Great Basin Region

	Total
Revenues	$20,000,000
Operating expenses:	
Direct labor	12,200,000
Variable overhead	400,000
Equipment depreciation	2,100,000
Facility expenses*	1,500,000
Local administrative expenses**	390,000
Regional administrative expenses	400,000
Corporate administrative expenses	1,600,000
Total operating expense	18,590,000
Net operating income	$ 1,410,000

* $2,000,000 – $900,000 + $400,000 = $1,500,000
** $450,000 – $60,000 = $390,000

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

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

   a) By recommending closing the Ashton facility, Braun will have to violate the Competence Standard, which stipulates that recommendations should be based on appropriate analysis of relevant and reliable information.

Case 13-23 (continued)

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

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

d) Braun 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.

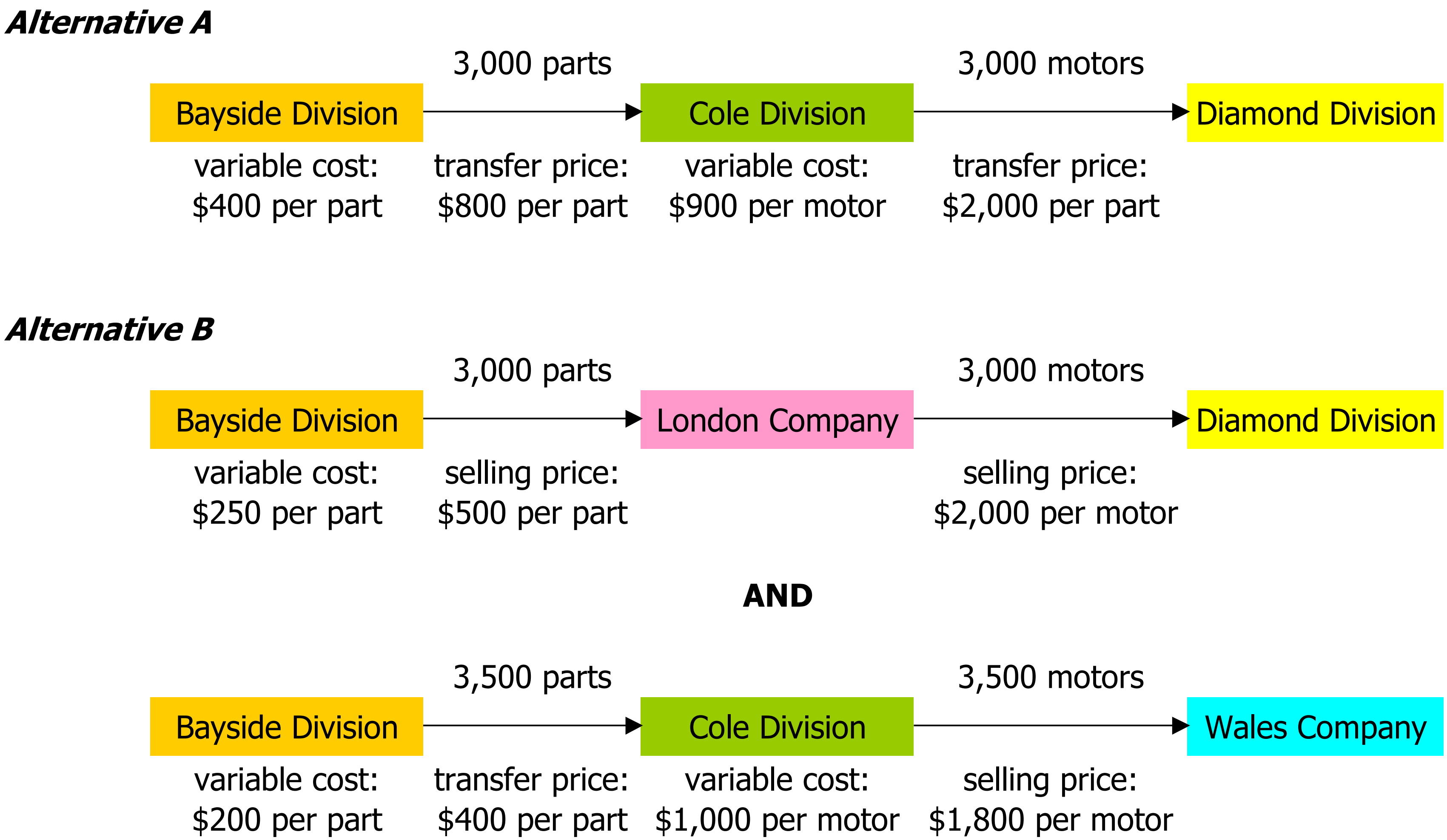
In sum, it is difficult to describe the recommendation to close the Ashton facility as ethical behavior. In Braun's defense, however, it is not fair to hold him responsible for the mistake made by his predecessor.

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 Ashton facility. As argued in part (1) above, the real cost of using the Ashton facility at this point 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.

Case 13-24 (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.



Case 13-24 (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 Bayside Division's plant and the Cole 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.

Bayside's plant:
Diamond Division order:
3,000 motors × 3.5 hours per motor = 10,500 hours.
Wales Company order:
3,500 motors × 3.0 hours per motor = 10,500 hours.

Cole's plant:
Diamond Division order:
3,000 motors × 7.0 hours per motor = 21,000 hours.
Wales Company order:
3,500 motors × 6.0 hours per motor = 21,000 hours.

1. The Cole Division would accept the order from the Wales Company. Computations to support this conclusion follow:

Expected contribution margin from the Diamond Division order:

Sales revenue to Cole Division (3,000 motors × $2,000 per motor)		$6,000,000
Less variable costs:		
Transfer price to Bayside Division (3,000 parts × $800 per part)	$2,400,000	
Other variable costs (3,000 motors × $900 per motor)	2,700,000	5,100,000
Contribution margin		$ 900,000

Case 13-24 (continued)

Expected contribution margin from the Wales Company order:

Sales revenue to Cole Division		
(3,500 motors × $1,800 per motor)		$6,300,000
Less variable costs:		
Transfer price to Bayside Division		
(3,500 parts × $400 per part)	$1,400,000	
Other variable costs		
(3,500 motors × $1,000 per motor).....	3,500,000	4,900,000
Contribution margin		$1,400,000

Thus, the Cole Division will net $500,000 ($1,400,000 – $900,000) more in contribution margin by accepting the order from Wales Company.

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 Cole Division accepts the order from Wales Company, Diamond Division will need to acquire its motors from London Company rather than from Cole 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 Diamond Division is $1,300 per motor, the variable costs of Bayside Division plus the variable costs of Cole Division. The total cost of the motors would be $3,900,000 (3,000 motors @ $1,300 per motor). This is restated in slightly different form below:

   Alternative A

   Diamond Division acquires motors from Cole Division, which acquires parts from Bayside Division

Bayside Division's variable expenses	
(3,000 parts × $400 per part)...............................	$1,200,000
Cole Division's variable expenses	
(3,000 motors × $900 per motor).........................	2,700,000
Total cost of Alternative A	$3,900,000

Case 13-24 (continued)

Alternative B

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

Part 1: Diamond Division's purchase of motors

Diamond Division's payment to London Company	
(3,000 motors × $2,000 per motor)	$6,000,000
London Company's payments to Bayside Division	
(3,000 parts × $500 per part)...............................	(1,500,000)
Bayside Division's variable expenses	
(3,000 parts × $250 per part)...............................	750,000
Total cost (a)...	$5,250,000

Part 2: Wale Company's purchase of motors

Wales Company's payments to Cole Division	
(3,500 motors × $1,800 per motor)	$6,300,000
Cole Division's variable expenses	
(3,500 motors × $1,000 per motor)	(3,500,000)
Bayside Division's variable expenses	
(3,500 motors × $200 per motor).........................	(700,000)
Total contribution margin (b)..................................	$2,100,000
Net cost to the company of Alternative B (a) – (b)....	$3,150,000

Since the $3,150,000 cost of Alternative B is less than the $3,900,000 cost of Alternative A, it is the preferred alternative.

Case 13-25 (90 minutes)

1. The lowest price Jenco could bid for the one-time special order of 25,000 pounds (25 lots) without losing money would be $34,750—the relevant cost of the order, as shown below.

Direct materials:	
CW-3: 400 pounds per lot × 25 lots = 10,000 pounds. Substitute CN-5 on a one-for-one basis to its total of 5,500 pounds. If CN-5 is not used in this order, it will be salvaged for $500. Therefore, the relevant cost is	$ 500
The remaining 4,500 pounds would be CW-3 at a cost of $0.90 per pound	4,050
JX-6: 300 pounds per lot × 25 lots = 7,500 pounds at $0.60 per pound	4,500
MZ-8: 200 pounds per lot × 25 lots = 5,000 pounds at $1.60 per pound	8,000
BE-7: 100 pounds per lot × 25 lots = 2,500 pounds at $0.55 per pound, the amount Jenco could realize by selling BE-7 [$0.65 market price – $0.10 handling charge]	1,375
Total direct materials cost	$18,425
Direct labor: 30 DLH per lot × 25 lots = 750 direct labor-hours. Because only 400 hours can be scheduled during regular time this month, overtime would have to be used for the remaining 350 hours.	
400 DLHs × $14.00 per DLH	$ 5,600
350 DLHs × $21.00 per DLH	7,350
Total direct labor cost	$12,950
Overhead: This special order will not increase fixed overhead costs. Therefore, only the variable overhead is relevant.	
750 DLHs × $4.50 per DLH	$ 3,375
Total relevant cost of the special order	$34,750

2. In this part, we calculate the price for recurring orders of 25,000 pounds (25 lots) using the company's rule of marking up its full manufacturing cost. This is probably not the best pricing policy to follow, but is a common practice in business.

   Direct materials: Because of the possibility that future orders would exhaust existing inventories of CN-5 and BE-7 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.

CW-3: 10,000 pounds × $0.90 per pound	$ 9,000
JX-6: 7,500 pounds × $0.60 per pound	4,500
MZ-8: 5,000 pounds × $1.60 per pound	8,000
BE-7: 2,500 pounds × $0.65 per pound	1,625
Total direct materials cost	$23,125

   Direct labor: 60% (i.e., 450 DLHs) of the production of a batch can be done on regular time; but the remaining production (i.e., 300 DLHs) must be done on overtime.

Regular time 450 DLHs × $14.00 per DLH	$ 6,300
Overtime premium 300 DLHs × $21.00 per DLH	6,300
Total direct labor cost	$12,600

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

Manufacturing overhead applied: 750 DLH × $12.00 per DLH	$ 9,000

Full manufacturing cost	$44,725
Markup (40% × $44,725)	17,890
Selling price (full manufacturing cost plus markup)	$62,615

Case 13-26 (45 minutes)

1. Yes, milling of flour should be discontinued if the price remains at $625, but not for the reason given by the sales manager. The reason it should be discontinued is that the *added* contribution margin that can be obtained from milling a ton of cracked wheat into flour is *less* than the contribution margin that can be obtained from using the milling capacity to produce another ton of cracked wheat and selling it as cereal. The analysis is:

Selling price per ton of cracked wheat	$490
Less variable expenses ($390 materials and $20 labor)	410
Contribution margin per ton of cracked wheat	$ 80

Added revenue from further milling of cracked wheat into flour ($625 – $490)	$135
Less costs of further milling ($80 materials and $20 labor)*	100
Contribution margin per ton of flour	$ 35

* The overhead costs are not relevant, since they are fixed and will remain the same whether the milling capacity is used to produce cracked wheat or flour.

Therefore, the company makes more money using its milling capacity to produce cracked wheat than flour.

2. Since the demand for the two products is unlimited and both require the same amount of milling time, the company should process the cracked wheat into flour only if the contribution margin for flour is at least as large as the contribution margin for cracked wheat. In algebraic form:

Added revenue from milling cracked wheat into flour	-	Costs of further processing	3	Contribution margin of cracked wheat

(Selling price of flour - $490) - $100 3 $80

Selling price of flour 3 $80 + $490 + $100 = $670

Therefore, the selling price of flour should be at least $670; otherwise, the mill should be used to produce cracked wheat.

Case 13-27 (60 minutes)

1. Continuing to obtain covers from its own Greenville Cover Plant would allow Mobile Seating Corporation to maintain its current level of control over the quality of the covers and the timing of their delivery. Keeping the Greenville Cover Plant open also allows Mobile Seating Corporation more flexibility than purchasing the coverings from outside suppliers. Mobile Seating Corporation could more easily alter the coverings' design and change the quantities produced, especially if long-term contracts are required with outside suppliers. Mobile Seating Corporation should also consider the economic impact that closing Greenville Cover will have on the community and how this might affect Mobile Seating Corporation'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		$8,000,000
Labor:		
Direct	$6,700,000	
Supervision	400,000	
Indirect plant	1,900,000	9,000,000
Differential pension expense ($1,600,000 – $700,000)		900,000
Total annual relevant costs		$17,900,000

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

Depreciation—equipment	$1,300,000
Depreciation—building	2,100,000
Continuing pension cost	700,000
Plant manager and staff	600,000
Corporate allocation	1,700,000
Total annual continuing costs	$6,400,000

Case 13-27 (continued)

The amounts for depreciation are not relevant to the decision because they are sunk costs. Moreover, whether the plant is closed or continues to operate, all of the remaining book value of the equipment and buildings will eventually be written off. A total of $700,000 of the annual pension expense 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 Restin and her staff would continue with Mobile Seating Corporation and administer the three remaining plants. The corporate allocation is not relevant because it represents allocated fixed costs incurred outside the Greenville Cover Plant that presumably would not change if the plant were closed.

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 ($8,000,000 × 25%)	$2,000,000
Employment assistance	800,000
Total nonrecurring costs	$2,800,000

These two costs are relevant to the decision because they will be incurred only if the plant is closed. The $2,000,000 salvage value of the equipment and buildings offsets these costs.

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

	First Year	*Other Years*
Cost of purchasing the covers outside	$(21,000,000)	$(21,000,000)
Annual costs avoided by closing the plant (Part 2a)	17,900,000	17,900,000
Cost of closing the plant (first year non-recurring costs)	(2,800,000)	
Salvage value of buildings and equipment	2,000,000	
Net advantage (disadvantage) of closing the plant	$ (3,900,000)	$ (3,100,000)

Case 13-27 (continued)

4. Factors that should be considered by Mobile Seating Corporation 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 Greenville Cover Plant in future years.
   e. The value of the time Restin and her staff would have spent managing the Greenville Cover Plant.
   f. The morale of Mobile Seating Corporation employees at other plants.

Case 13-28 (120 minutes)

1. The product margins computed by the accounting department for the drums and mountain 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 pretty much useless for making this decision.

Case 13-28 (continued)

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 XSX Drums	XSX Drums	Mountain Bike Frames
Selling price	$154.00	$154.00	$65.00
Less variable costs:			
Materials	120.00	44.50	17.50
Variable manufacturing overhead	0.00	1.05	0.60
Variable selling and administrative	0.85	0.85	0.40
Total variable cost	120.85	46.40	18.50
Contribution margin	$ 33.15	$107.60	$46.50

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	
	XSX Drums	Mountain Bike Frames
Contribution margin per unit (above) (a)	$107.60	$46.50
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b)	$134.50 per hour	$232.50 per hour

Case 13-28 (continued)

Since the contribution margin per unit of the constrained resource (i.e., welding time) is larger for the mountain bike frames than for the XSX drums, the frames make the most profitable use of the welding machine. Consequently, the company should manufacture as many mountain bike frames as possible up to demand and then use any leftover capacity to produce XSX drums. Buying the drums from the outside supplier can fill any remaining unsatisfied demand for XSX 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	
Mountain bike frames produced	3,500	$ 46.50	0.20	700	1,300	$162,750
XSX Drums—make	1,625	107.60	0.80	1,300	0	174,850
XSX Drums—buy	1,375	33.15				45,581
Total contribution margin						383,181
Less: Contribution margin from present operations: 2,500 drums × $107.60 CM per drum						269,000
Increased contribution margin and net operating income						$114,181

Case 13-28 (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

		Manufactured	
	Purchased XSX Drums	*XSX Drums*	*Mountain Bike Frames*
Selling price	$154.00	$154.00	$65.00
Less variable costs:			
Materials	120.00	44.50	17.50
Direct labor	0.00	4.50	22.50
Variable manufacturing overhead	0.00	1.05	0.60
Variable selling and administrative	0.85	0.85	0.40
Total variable cost	120.85	50.90	41.00
Contribution margin	$ 33.15	$103.10	$24.00

Solution assuming direct labor is a variable cost

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$103.10	$24.00
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b)	$128.88 per hour	$120.00 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 XSX drums appear to be a better use of the constraint than the mountain bike frames. The assumption about the behavior of direct labor really does matter.

Case 13-28 (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 Welding Time	*(a) × (b)* Total Contri- bution
Total hours available					2,000	
XSX Drums—make	2,500	$103.10	0.80	2,000	0	$257,750
Mountain bike frames produced	0	24.00	0.20	0	0	0
XSX Drums—buy	500	33.15				16,575
Total contribution margin						274,325
Less: Contribution margin from present operations: 2,500 drums × $103.10 CM per drum						257,750
Increased contribution margin and net operating income						$ 16,575

Case 13-28 (continued)

5. The case strongly suggests that direct labor is fixed: "The mountain 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:			
Mountain bike frames	3,500	1.25*	4,375
XSX drums	1,625	0.25**	406
			4,781
Plan 2:			
XSX drums	2,500	0.25**	625

* \$22.50 ÷ \$18.00 per hour = 1.25 hours
** \$4.50 ÷ \$18.00 per hour = 0.25 hour

Some caution is advised. Plan 1 assumes that direct labor is a fixed cost. However, this plan requires over 4,000 more direct labor-hours than Plan 2 and the present situation. A full-time employee works about 1,900 hours a year, so the added workload is about equivalent to two full-time employees. Does the plant really have that much idle time at present? If so, and if shifting workers over to making mountain bike frames would not jeopardize operations elsewhere, then Plan 1 is indeed the better plan. However, if taking on the mountain bike frame as a new product would lead to pressure to hire two more workers, 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 would lead to a jump in fixed costs of about \$68,400 (1,900 hours × \$18 per hour × 2). This must be covered by the additional contribution margin or the plan should be rejected. See the additional analysis on the next page.

Case 13-28 (continued)

Contribution margin from Plan 1:	
Mountain bike frames produced (3,500 × $46.50)	$162,750
XSX Drums—make (1,625 × $107.60)	174,850
XSX Drums—buy (1,375 × $33.15)	45,581
Total contribution margin	383,181
Less: Additional fixed labor costs	68,400
Net effect of Plan 1 on net operating income	$314,781
Contribution margin from Plan 2:	
XSX Drums—make (2,500 × $107.60)	$269,000
XSX Drums—buy (500 × $33.15)	16,575
Net effect of Plan 2 on net operating income	$285,575
Net advantage of Plan 1	$ 29,206

Plan 1, introducing the new product, would still be optimal even if two more direct labor employees would have to be hired. The reason for this is subtle. If the company does not make the XSX drums itself, it can still buy them. Thus, using an hour of welding time to make the mountain bike frames does not mean giving up a contribution margin of $128.88 on drums (assuming direct labor is a variable cost). The opportunity cost of using the welding machine to produce mountain bike frames is less than this since a purchased drum can replace a manufactured drum. An amended analysis using the opportunity cost concept appears on the next page.

Case 13-28 (continued)

Amended solution assuming direct labor is fixed

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$74.45*	$46.50
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b)	$93.06 per hour	$232.50 per hour

Amended solution assuming direct labor is a variable cost

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$69.95*	$24.00
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b)	$87.44 per hour	$120.00 per hour

* Net of the $33.15 contribution margin of a purchased drum. If the company does not make a drum, it can purchase one, so the lost contribution from making bike frames rather than drums is less than it otherwise would be.

With this amended approach, assuming direct labor is variable points to the same solution as when direct labor is assumed to be fixed—place the highest priority on making mountain bike frames. This won't always happen.

Group Exercise 13-29

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.