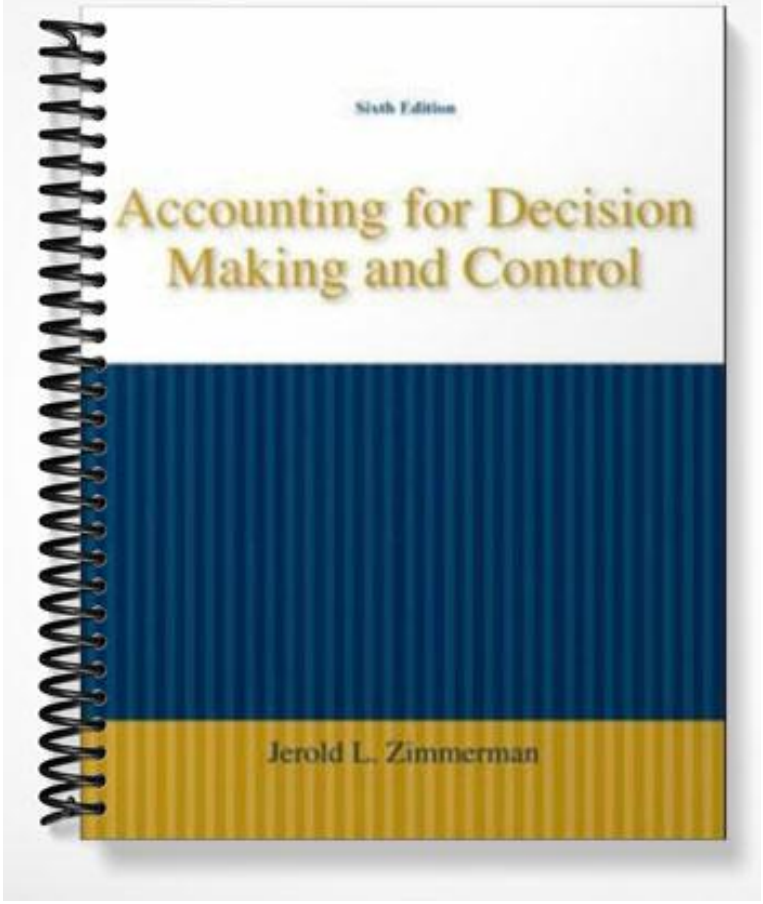
TEST BANK


Sixth Edition
Accounting for Decision Making and Control
Jerold L. Zimmerman

CHAPTER 2
THE NATURE OF COSTS

P 2-1: **Solution to Darien Industries** (CMA adapted) (10 minutes)
[Relevant costs and benefits]

Current cafeteria income		
Sales	$12,000	
Variable costs (40% × 12,000)	(4,800)	
Fixed costs	(4,700)	
Operating income		$2,500
Vending machine income		
Sales (12,000 × 1.4)	$16,800	
Darien's share of sales		
(.16 × $16,800)		2,688
Increase in operating income		$ 188

P 2-2: **Negative Opportunity Costs** (10 minutes)
[Opportunity cost]

Yes, when the most valuable alternative to a decision is a net cash outflow that would have occurred is now eliminated. The opportunity cost of that decision is negative (an opportunity benefit). For example, suppose you own a house with an in-ground swimming pool you no longer use or want. To dig up the pool and fill in the hole costs $3,000. You sell the house instead and the new owner wants the pool. By selling the house, you avoid removing the pool and you save $3,000. The decision to sell the house includes an opportunity benefit (a negative opportunity cost) of $3,000.

P 2-3: **Solution to NPR** (10 minutes)
[Opportunity cost of radio listeners]

The quoted passage ignores the opportunity cost of listeners' having to forego normal programming for on-air pledges. While such fundraising campaigns may have a low out-of-pocket cost to NPR, if they were to consider the listeners' opportunity cost, such campaigns may be quite costly.

P 2–4: **Solution to Silky Smooth Lotions** (15 minutes)
[Break even with multiple products]

Given that current production and sales are: 2,000, 4,000, and 1,000 cases of 4, 8, and 12 ounce bottles, construct of lotion *bundle* to consist of 2 cases of 4 ounce bottles, 4 cases of 8 ounce bottles, and 1 case of 12 ounce bottles. The following table calculates the breakeven number of lotion bundles to break even and hence the number of cases of each of the three products required to break even.

Per Case	**4 ounce**	**8 ounce**	**12 ounce**	**Bundle**
Price	$36.00	$66.00	$72.00	
Variable cost	$13.00	$24.50	$27.00	
Contribution margin	$23.00	$41.50	$45.00	
Current production	2000	4000	1000	
Cases per bundle	2	4	1	
Contribution margin per bundle	$46.00	$166.00	$45.00	$257.00
Fixed costs				$771,000
Number of bundles to break even				3000
Number of cases to break even	6000	12000	3000	

P 2–5: **Solution to J. P. Max Department Stores** (15 minutes)
[Opportunity cost of retail space]

	Home Appliances	Televisions
Profits after fixed cost allocations	$64,000	$82,000
Allocated fixed costs	7,000	8,400
Profits before fixed cost allocations	71,000	90,400
Lease Payments	72,000	86,400
Forgone Profits	– $1,000	$ 4,000

We would rent out the Home Appliance department, as lease rental receipts are more than the profits in the Home Appliance Department. On the other hand, profits generated by the Television Department are more than the lease rentals if leased out, so we continue running the TV Department. However, neither is being charged inventory holding costs, which could easily change the decision.

Also, one should examine externalities. What kind of merchandise is being sold in the leased store and will this increase or decrease overall traffic and hence sales in the other departments?

P 2–6: **Solution to Executive Stock Options** (15 minutes)
[Opportunity cost of stock options]

The statement that there is "no cost to the company" is wrong. As soon as this stock option is granted, the number of shares having claims on the firm's future cash flows increases by the expected likelihood that this option will be exercised. Existing shareholders' claims on the future cash flows have been diluted. Thus, there is an opportunity cost imposed on the existing shareholders by issuing stock options to directors. They are not free. There is no cash outlay to the firm when stock options are issued; accounting earnings are not affected by issuing stock options (as long as they are issued at or above the current stock price), but there is a cost to the shareholders.

P 2-7: **Solution to Bidwell Company** (CMA adapted) (15 minutes)
[Simple break-even analysis]

a. $$\text{Breakeven} = \frac{\text{Fixed Costs}}{\text{Contribution Margin}}$$

$$= \frac{\$210,000}{(\$10 - \$7)} = 70{,}000 \text{ units}$$

b. $$[10Q - 7Q - 210{,}000](1 - .4) = 90{,}000$$
$$(3Q - 210{,}000)(.6) = 90{,}000$$
$$3Q = 150{,}000 + 210{,}000$$
$$Q = 120{,}000$$

c. $$\text{Breakeven} = \frac{\$241{,}500}{\$3/\text{unit}} = 80{,}500 \text{ units}$$

P 2-8: **Solution to Vintage Cellars** (15 minutes)
[Average versus marginal cost]

a. The following tabulates total, marginal and average cost.

Quantity	Average Cost	Total Cost	Marginal Cost
1	$12,000	$12,000	
2	10,000	20,000	$8,000
3	8,600	25,800	5,800
4	7,700	30,800	5,000
5	7,100	35,500	4,700
6	7,100	42,600	7,100
7	7,350	51,450	8,850
8	7,850	62,800	11,350
9	8,600	77,400	14,600
10	9,600	96,000	18,600

b. Marginal cost intersects average cost at minimum average cost (MC=AC=$7,100). Or, at between 5 and 6 units AC = MC = $7,100.

c. At four units, the opportunity cost of producing and selling one more unit is $4,700. At four units, total cost is $30,800. At five units, total cost rises to $35,500. The incremental cost (i.e., the opportunity cost) of producing the fifth unit is $4,700.

d. Vintage Cellars maximizes profits ($) by producing and selling seven units.

Quantity	Average Cost	Total Cost	Total Revenue	Profit
1	$12,000	$12,000	$9,000	-$3,000
2	10,000	20,000	18,000	-2,000
3	8,600	25,800	27,000	1,200
4	7,700	30,800	36,000	5,200
5	7,100	35,500	45,000	9,500
6	7,100	42,600	54,000	11,400
7	7,350	51,450	63,000	11,550
8	7,850	62,800	72,000	9,200
9	8,600	77,400	81,000	3,600
10	9,600	96,000	90,000	-6,000

P 2-9: **Solution to Sunnybrook Farms** (CMA adapted) (15 minutes)
[Incremental costs and revenues of extending retail store hours]

Annual Sunday incremental costs	$24,960
÷ 52 weeks	
Weekly Sunday incremental costs	$ 480
Sunday sales to cover incremental costs	
480 ÷ (.2)	$ 2,400
Sunday sales to cover lost sales during	
the week 2,400 ÷ (1 – .6)	$ 6,000

Check:

Sunday sales	$ 6,000
Additional Sales due to Sunday	
($6,000 × 40%)	$ 2,400
Gross Margin on additional sales	
($2,400 × 20%)	$ 480
× 52 Weeks	$24,960

P 2-10: **Solution to Taylor Chemicals** (15 minutes)
[Relation between average, marginal, and total cost]

a. Marginal cost is the cost of the next unit. So, producing two cases costs an additional $400, whereas to go from producing two cases to producing three cases costs an additional $325, and so forth. So, to compute the total cost of producing say five cases you sum the marginal costs of 1, 2, …, 5 cases and add the fixed costs ($500 + $400 + $325 + $275 + $325 + $1000 = $2825). The following table computes average and total cost given fixed cost and marginal cost.

Quantity	Marginal Cost	Fixed Cost	Total Cost	Average Cost
1	$500	$1000	$1500	$1500.00
2	400	1000	1900	950.00
3	325	1000	2225	741.67
4	275	1000	2500	625.00
5	325	1000	2825	565.00
6	400	1000	3225	537.50
7	500	1000	3725	532.14
8	625	1000	4350	543.75
9	775	1000	5125	569.44
10	950	1000	6075	607.50

b. Average cost is minimized when seven cases are produced. At seven cases, average cost is $532.14.

c. Marginal cost always intersects average cost at minimum average cost. If marginal cost is above average cost, average cost is increasing. Likewise, when marginal cost is below average cost, average cost is falling. When marginal cost equals average cost, average cost is neither rising nor falling. This only occurs when average cost is at its lowest level (or at its maximum).

P 2-11: Solution to Emrich Processing (15 minutes)
[Negative opportunity costs]

Opportunity costs are usually positive. In this case, opportunity costs are negative (opportunity benefits) because the firm can avoid disposal costs if they accept the rush job.

The original $1,000 price paid for GX-100 is a sunk cost. The opportunity cost of GX-100 is -$400. That is, Emrich will <u>increase</u> its cash flows by $400 by accepting the rush order because it will avoid having to dispose of the remaining GX-100 by paying Environ the $400 disposal fee.

How to price the special order is another question. Just because the $400 disposal fee was built into the previous job does not mean it is irrelevant in pricing this job. Clearly, one factor to consider in pricing this job is the reservation price of the customer proposing the rush order. The $400 disposal fee enters the pricing decision in the following way: Emrich should be prepared to **pay** up to $399 less any out-of-pocket costs to get this contract.

P 2–12: Solution to Gas Prices (15 minutes)
["Price gouging" or increased opportunity cost?]

The opportunity cost of the oil in process was higher after the invasion and thus the oil companies were justified in raising prices as quickly as they did. For example, suppose the oil company had one barrel of oil purchased at $15. This barrel was refined and processed for another $5 of cost and then the refined products from the barrel sold for $21. Replacing that barrel requires the oil company to pay another $15 per barrel on top of the $15 per barrel it is already paying. Therefore, in order to replace the old barrel, the prices of the refined products must be raised as soon as the crude oil price rises.

However, accounting treats the *realized holding gain* on the old oil as an accounting profit, not as an opportunity cost. Therefore, the income statement of oil companies with large stocks of in-process crude will show accounting profits, unless they can somehow defer these profits. Switching to income-decreasing accounting methods and writing off obsolete equipment will help the oil companies avoid the political embarrassment of reporting the holding gains. In January 1990, the large oil companies received significant adverse media publicity when they reported large increases in fourth-quarter profits.

It is useful having discussed this problem to ask the following question: What happens to oil companies in the reverse situation when a large, unexpected price drop occurs? Suppose the oil company purchased old barrels for $15 and sold the refined products for $21. New barrels now can be purchased for $10. The company would like to keep selling refined products at $21, but competition from other oil companies will push the price of refined products down. Depending on how quickly the price of refined products fall, the oil companies will report smaller (maybe even negative) accounting earnings as their inventory of $15 oil gets refined and sold, but at lower prices.

P 2–13: Solution to Penury Company (15 minutes)
[Break-even analysis with multiple products]

a. Breakeven when products have separate fixed costs:

	Line K	Line L
Fixed costs	$40,000	$20,000
Divided by contribution margin	$0.60	$0.20
Breakeven in units	66,667 units	100,000 units
Times sales price	$1.20	$0.80
Breakeven in sales revenue	$80,000	$80,000

b. Cost sharing of facilities, functions, systems, and management. That is, the existence of economies of scope allows common resources to be shared. For example, a smaller purchasing department is required if K and L are produced in the same plant and share a single purchasing department than if they are produced separately with their own purchasing departments.

c. Breakeven when products have common fixed costs and are sold in bundles with equal proportions:

At breakeven we expect:

Contribution from K + Contribution from L = Fixed costs

$0.60 Q + $0.20 Q = $50,000

where Q = number of units sold of K = number of units sold of L

$$\$0.80\ Q = \$50{,}000$$
$$Q = 62{,}500 \text{ units}$$

Product	Break-even Units	Price	Break-even Sales
K	62,500	$1.20	$75,000
L	62,500	$0.80	$50,000

P 2-14: Solution to University Tuition Benefits (15 minutes)
[Opportunity cost of faculty and staff tuition benefits: tax incentives]

a. It does not "cost" the University of Pennsylvania $7 million to send employee children to Penn and other schools. By offering this benefit, Penn is able to employ higher quality staff and faculty at a lower cost than if this benefit were not offered. Because this benefit is not taxed, Penn is able to give its employees $1 of benefits (tuition) that would cost the employees $2 (before personal taxes) if they had to pay the tuition themselves (assuming a 50 percent tax rate). Thus, employees are willing to accept up to $2 of lower wages for each $1 of tuition benefit.

Also, if the employee's child attends the parent's institution, the cost to the institution is not the full amount of the tuition, if there is excess capacity in the classroom. However, given that all higher education is subsidized through either endowment or state aid, then the tuition does not cover the full cost of education. Adding 100 additional students each year, in the long run can cause the institution to forego admitting tuition paying students.

b. Probably not. Case Western will either have to increase wages or see a reduction in faculty and staff quality. These tuition benefits are tax free. As long as some of the tax benefits are shared between Case Western and its employees (not all the tax savings accrue to the employees), then Case Western is worse off by cutting the tuition benefit. Moreover, cutting its tuition benefit for employee children who attend its graduate schools increases the price of its programs to these students. At the margin, some students will switch to other graduate programs. As with all price increases, fewer students will attend Case Western, and those that do will be of lower quality.

P 2–15: Solution to Volume and Profits (15 minutes)
[Cost-volume-profit]

a. False.

b. Write the equation for firm profits:

$$\text{Profits} = P \times Q - (FC - VC \times Q) = Q(P - VC) - FC$$

$$= Q(P - VC) - (FC \div Q)Q$$

Notice that average fixed costs per unit (FC÷Q) falls as Q increases, but with more volume, you have more fixed cost per unit such that (FC÷Q) × Q = FC. That is, the decline in average fixed cost per unit is exactly offset by having more units.

Profits will increase with volume even if the firm has no fixed costs, as long as price is greater than variable costs. Suppose price is $3 and variable cost is $1. If there are no fixed costs, profits increase $2 for every unit produced. Now suppose fixed cost is $50. Volume increases from 100 units to 101 units. Profits increase from $150 ($2 ×100 - $50) to $152 ($2 × 101 - $50). The change in profits ($2) is the contribution margin. It is true that average unit cost declines from $1.50 ([100 × $1 + $50]÷100) to $1.495 ([101 × $1 + $50]÷101). However, this has nothing to do with the increase in profits. The increase in profits is due solely to the fact that the contribution margin is positive.

Alternatively, suppose price is $3, variable cost is $3, and fixed cost is $50. Contribution margin in this case is zero. Doubling output from 100 to 200 causes average cost to fall from $3.50 ([100 × $3 + $50]÷100) to $3.25 ([200 × $3 + $50]÷200), but profits are still zero.

P 2-16: Solution to American Cinema (20 minutes)
[Breakeven analysis for an operating decision]

a. Both movies are expected to have the same ticket sales in weeks one and two, and lower sales in weeks three and four.

Let Q_1 be the number of tickets sold in the first two weeks, and Q_2 be the number of tickets sold in weeks three and four. Then, profits in the first two weeks, π_1, and in weeks three and four, π_2, are:

$$\pi_1 = .1(6.5Q_1) - \$2{,}000$$

$$\pi_2 = .2(6.5Q_2) - \$2{,}000$$

"I Do" should replace "Paris" if

$\pi_1 > \pi_2$, or

$.65Q_1 - 2{,}000 > 1.3Q_2 - 2{,}000$, or

$Q_1 > 2Q_2$.

In other words, they should keep "Paris" for four weeks unless they expect ticket sales in weeks one and two of "I Do" to be twice the expected ticket sales in weeks three and four of "Paris."

b. Taxes of 30 percent do not affect the answer in part (a).

c. With average concession profits of $2 per ticket sold,

$\pi_1 = .65Q_1 + 2Q_1 - 2{,}000$

$\pi_2 = 1.30Q_2 + 2Q_2 - 2{,}000$

$\pi_1 > \pi_2$ if

$2.65Q_1 > 3.3Q_2$

$Q_1 > 1.245Q_2$

Now, ticket sales in the first two weeks need only be about 25 percent higher than in weeks three and four to replace "Paris" with "I Do."

P 2-17: **Solution to Home Auto Parts** (20 minutes)
[Opportunity cost of retail display space]

a. The question involves computing the opportunity cost of the special promotions being considered. If the car wax is substituted, what is the forgone profit from the dropped promotion? And which special promotion is dropped? Answering this question involves calculating the contribution of each planned promotion. The opportunity cost of dropping a planned promotion is its forgone contribution: (retail price less unit cost) × volume. The table below calculates the expected contribution of each of the three planned promotions.

Planned Promotion Displays For Next Week			
	End-of-Aisle	Front Door	Cash Register
Item	Texcan Oil	Wiper blades	Floor mats
Projected volume (week)	5,000	200	70
Sales price	69¢/can	$9.99	$22.99
Unit cost	62¢	$7.99	$17.49
Contribution margin	7¢	$2.00	$5.50
Contribution (margin × volume)	$350	$400	$385

Texcan oil is the promotion yielding the lowest contribution and therefore is the one Armadillo must beat out. The contribution of Armadillo car wax is:

Selling price	$2.90
less: Unit cost	$2.50
Contribution margin	$0.40
× expected volume	800
Contribution	$ 320

Clearly, since the Armadillo car wax yields a lower contribution margin than all three of the existing planned promotions, management should not change their planned promotions and should reject the Armadillo offer.

b. With 50 free units of car wax, Armadillo's contribution is:

Contribution from 50 free units (50 × $2.90)			$145
Contribution from remaining 750 units:			
Selling price	$2.90		
less: Unit cost	$2.50		
Contribution margin		$0.40	
× expected volume		750	300
Contribution			$445

With 50 free units of car wax, it is now profitable to replace the oil display area with the car wax. The opportunity cost of replacing the oil display is its forgone contribution ($350), whereas the benefits provided by the car wax are $445.

Additional discussion points raised

(i) This problem introduces the concept of the opportunity cost of retail shelf space. With the proliferation of consumer products, supermarkets' valuable scarce commodity is shelf space. Consumers often learn about a product for the first time by seeing it on the grocery shelf. To induce the store to stock an item, food companies often give the store a number of free cases. Such a giveaway compensates the store for allocating scarce shelf space to the item.

(ii) This problem also illustrates that retail stores track contribution margins and volumes very closely in deciding which items to stock and where to display them.

(iii) One of the simplifying assumptions made early in the problem was that the sale of the special display items did not affect the unit sales of competitive items in the store. Suppose that some of the Texcan oil sales came at the expense of other oil sales in the store. Discuss how this would alter the analysis.

P 2–18: **Solution to Measer** (20 minutes)
[Average versus variable cost]

"Beware of unit costs." If you focus solely on the unit cost numbers in the problem, you are likely to be misled.

In the long run, the firm should shut down because it cannot cover fixed costs. However, if the firm has already incurred or is liable for fixed factory and administration costs, then it should continue to operate if it can cover variable costs. Notice the assumption regarding timing. Fixed costs are *assumed* to have been incurred whereas variable costs are assumed not to have been incurred yet. Given these assumptions, the loss-minimizing rate of output is 11 million units:

	Rate of Production and Sale (000's units)			
	10,000	11,000	12,000	13,000
Sales @ $4.50/unit	$45,000	$49,500	$54,000	$58,500
Total Costs	58,000	62,400	67,000	71,600
Profit (Loss)	($13,000)	($12,900)	($13,000)	($13,100)

Notice, minimizing average unit costs is not the basis for choosing output levels. Average unit costs are minimized at 13 million units.

An alternative way to solve the problem is to calculate contribution margin, as below:

	Output Levels			
	10,000	11,000	12,000	13,000
Variable Cost	$43,000	$47,400	$52,000	$56,600
Average Variable Cost/unit	$4.30	$4.31	$4.33	$4.35
Contribution margin/unit	$.20	$.19	$.17	$.15
Contribution margin (units × output level)	$2,000	$2,090	$2,040	$1,950

The preceding table indicates that maximizing contribution margin (not contribution margin per unit) also gives the right answer. At 11 million units $2,090 is being generated towards covering fixed costs.

Minimizing average variable cost gives the wrong answer.

P 2-19: **Solution to Affording a Hybrid** (20 minutes)
[Breakeven analysis]

a. The $1,500 upfront payment is irrelevant since it applies to both alternatives. To find the breakeven mileage, *M*, set the monthly cost of both vehicles equal:

$$\$499 + M\left(\frac{\$3.00}{50}\right) = \$399 + M\left(\frac{\$3.00}{25}\right)$$

$\$100 = M(.12 - .06)$

$\mathbf{M} = \$100/.06 = 1{,}666.66$ miles per month

Miles per year $= 1{,}666.66 \times 12 = 20{,}000$

b. $$\$499 + M\left(\frac{\$4.00}{50}\right) = 399 + M\left(\frac{\$4.00}{25}\right)$$

$\$100 = M(.16 - .08)$

$M = \$100/.08 = 1{,}250$ miles per month

Miles per year $= 1{,}250 \times 12 = 15{,}000$ miles per year

P 2–20: **Solution to Fast Photo** (20 minutes)
[Cost behavior]

Matt's intuition is correct regarding the behavior of fixed costs. As the table below shows, average fixed costs per unit falls from $6 per unit in Plant A to $4.62 in plant D. However, unlike the usual textbook assumption that variable costs per unit are constant, these plants exhibit increasing variable costs per unit. Plant A has average variable costs per roll of $3.90 and this rises to $5.42 per roll in plant D. The increase in variable costs per unit more than offsets the lower fixed costs per roll. Thus, profits fall as volume increases in plants B through D. One likely reason for the increasing variable cost per roll is higher labor costs due to overtime. If the high-volume plants add extra work shifts and if there are wage shift differentials between day and night work, average variable costs will increase. Finally, average variable costs per unit will increase with volume if plant congestion forces the firm to hire workers whose sole job is managing the congestion (i.e., searching for misplaced orders, expediting work flows, etc.)

	Plant A	Plant B	Plant C	Plant D
Number of rolls processed	50,000	55,000	60,000	65,000
Variable costs (000s)	195	242	298	352
Fixed costs (000s)	300	300	300	300
Average fixed cost per unit	$6.00	$5.45	$5.00	$4.62
Average variable cost per unit	$3.90	$4.40	$4.97	$5.42

P 2-21: **Solution to MedView** (20 minutes)
[Break-even Analysis]

a. The brochure gives the break-even point and the question asks us to calculate variable cost per unit. Or,

$$BE = \frac{\text{Fixed Cost}}{\text{Price} - \text{Variable Cost}}$$

Substituting in the known quantities yields:

$$45 = \frac{\$18{,}000}{\$475 - \text{Variable Cost}}$$

Solving for the unknown variable cost per unit gives

Variable cost = $75/scan

b. The brochure is overlooking the additional fixed costs of office space and additional variable (or fixed) costs of the operator, utilities, maintenance, insurance and litigation, etc. Also overlooked is the required rate of return (cost of capital). Calculating the break-even point for the machine rental fee is very misleading.

P 2–22: Solution to Manufacturing Cost Classification (20 minutes)
[Period versus product costs]

	Period Cost	Product Cost	Direct Labor	Direct Material	Over-head
Advertising expenses for DVD	x				
Depreciation on PCs in marketing dept.	x				
Fire insurance on corporate headquarters	x				
Fire insurance on plant		x			x
Leather carrying case for the DVD		x		x	
Motor drive (externally sourced)		x		x	
Overtime premium paid assembly workers		x			x
Plant building maintenance department		x			x
Plant security guards		x			x
Plastic case for the DVD		x		x	
Property taxes paid on corporate office	x				
Salaries of public relations staff	x				
Salary of corporate controller	x				
Wages of engineers in quality control dept.		x			x
Wages paid assembly line employees		x	x		
Wages paid employees in finished goods warehouse	x				

P 2–23: Solution to Australian Shipping (20 minutes)
[Negative transportation costs]

a. Recommendation: The ship captain should be indifferent (at least financially) between using stone or wrought iron as ballast. The total cost (£550) is the same.

Stone as ballast	
Cost of purchasing and loading stone	£40
Cost of unloading and disposing of stone	15
	£55
Ton required	× 10
Total cost	£550

Wrought iron as ballast		
Number of bars required:		
10 tons of ballast × 2,000 pounds/ton	20,000 pounds	
Weight of bar	÷ 20 pounds/bar	
	1,000 bars	
Loss per bar (£1.20 – £0.90)		£0.30
× number of bars		1,000
		£300
Cost of loading bars (£15 ×10)		150
Cost of unloading bars (£10 ×10)		100
Total cost		£550

b. The price is lower in Sydney because the supply of wrought iron relative to demand is greater in Sydney because of wrought iron's use as ballast. In fact, in equilibrium, ships will continue to import wrought iron as ballast as long as the relative price of wrought iron in London and Sydney make it cheaper (net of loading and unloading costs) than stone.

P 2-24: **Solution to iGen3** (20 minutes)
[Cost-volume-profit and breakeven on a lease contract]

a and b. Breakeven number of impressions under Options A and B:

	Option A	**Option B**
Monthly fixed lease cost	$10,000	$0
Labor/month	5,000	5,000
Total fixed cost/month	$15,000	$5,000
Variable lease cost/impression	$0.01	$0.03
Ink/impression	0.02	0.02
Total variable cost	$0.03	$0.05
Price/impression	$0.08	$0.08
Contribution margin/impression	$0.05	$0.03
Breakeven number of impressions	300,000	166,667

c. The choice of Option A or B depends on the expected print volume ColorGrafix forecasts. Choosing among different cost structures should not be based on breakeven but rather which one results in lower total cost. Notice the two options result in equal cost at 500,000 impressions:

$$\begin{aligned} \$15{,}000 + \$0.03\,Q &= \$5{,}000 + \$0.05\,Q \\ \$10{,}000 &= \$0.02 \\ Q &= 500{,}000 \end{aligned}$$

Therefore, if ColorGrafix expects to produce more than 500,000 impressions it should choose Option A and if fewer than 500,000 impressions are expected ColorGrafix should choose Option B.

d. At 520,000 expected impressions, Option A costs $30,600 ($15,000 + .03 × 520,000), whereas Option B costs $31,000 ($5,000 + .05 × 520,000). Therefore, Option A costs $400 less than Option B. However, Option A generates much more operating leverage ($10,000/month), thereby increasing the expected costs of financial distress (and bankruptcy). Since ColorGrafix has substantial financial leverage, they should at least consider if it is worth spending an additional $400 per month and choose Option B to reduce the total amount of leverage (operating and financial) in the firm. Without knowing precisely the magnitude of the costs of financial distress, one can not say definitively if the $400 additional cost of Option B is worthwhile.

P 2-25: **Solution to Adapt, Inc.** (20 minutes)
[Cost-volume-profit and operating leverage]

a. NIAT = (PQ – VQ –F)(1-T) and (PQ – VQ) / PQ = 70%

Where:
NIAT = Net income after taxes
P = Price
Q= Quantity
V= variable cost per unit
F = Fixed cost
T= Tax rate

$$
\begin{aligned}
\$1.700 &= (\$6.200 - VQ - F)(1 - 0.4) \\
2.833 &= 6.200 - VQ - F \\
(PQ - VQ) / PQ &= 70\% \\
1 - VQ / PQ &= .70 \\
VQ / PQ &= .30 \\
VQ &= .30\ PQ = .30(6.200) = 1.860 \\
2.833 &= 6.200 - 1.860 - F \\
F &= 1.507
\end{aligned}
$$

b. Knowing DigiMem's fixed costs informs Adapt, Inc. about DigiMem's operating leverage. Knowing DigiMem's operating leverage helps Adapt design pricing strategies in terms of how DigiMem is likely to respond to price cuts. The higher DigiMem's operating leverage, the more sensitive DigiMem's cash flows are to downturns. If DigiMem has a lot of operating leverage, they will not be able to withstand a long price war. Also, knowing DigiMem's fixed costs is informative about how much capacity they have and hence what types of strategies they may be pursuing in the future.

P 2-26: **Solution to Exotic Roses** (25 minutes)
[Breakeven analysis]

a. Fixed costs total $27,000 per year and variable costs are $1.50 per plant. The breakeven number of potted roses is found by solving the following equation for Q:

Profits = $15 Q - $1.50 Q - $27,000 = 0
Or Q = $27,000 / ($15 - $1.50) = $27,000 / $13.50 = 2,000 plants

b. To make $10,000 of profits before taxes per year, solve the following equation for Q:

Profits = $15 Q - $1.50 Q - $27,000 = $10,000
Or Q = $37,000 / ($15 - $1.50) = $37,000 / $13.50 = 2,740.74 plants

c. To make $10,000 of profits AFTER taxes per year, solve the following equation for Q:

Profits = [$15 Q - $1.50 Q - $27,000] × (1 - 0.35) = $10,000
= [$15 Q - $1.50 Q - $27,000] = $10,000 / 0.65 = $15,384.62
Or Q = $42,384.62 / $13.50 = 3,139.60 plants

P 2-27: Solution to Oppenheimer Visuals (25 minutes)
[Choosing the optimum technology and "all costs are variable in the long run"]

a. The following table shows that Technology 2 yields the highest firm value:

			Technology 1		Technology 2	
Q	Price	Revenue	Total cost	Profit	Total cost	Profit
60	$760	$45600	$46000	$-400	$40000	$5600
65	740	48100	47000	1100	42000	6100
70	720	50400	48000	2400	44000	6400
75	700	52500	49000	3500	46000	6500
80	680	54400	50000	4400	48000	6400
85	660	56100	51000	5100	50000	6100
90	640	57600	52000	5600	52000	5600
95	620	58900	53000	5900	54000	4900
100	600	60000	54000	6000	56000	4000
105	580	60900	55000	5900	58000	2900
110	560	61600	56000	5600	60000	1600

b. They should set the price at $700 per panel and sell 75 panels per day.

c. The fixed cost of technology 2 of $16,000 per day was chosen as part of the profit maximizing production technology. Oppenheimer could have chosen technology 1 and had a higher fixed cost and lower variable cost. But given the demand curve the firm faces, they chose technology 2. So, at the time they selected technology 2, the choice of fixed costs had not yet been determined and was hence "variable" at that point in time.

P 2–28: Solution to Eastern University Parking (25 minutes)
[Opportunity cost of land]

The University's analysis of parking ignores the opportunity cost of the land on which the surface space or parking building sits. The $12,000 cost of an enclosed parking space is the cost of the structure only. The $900 cost of the surface space is the cost of the paving only. These two numbers do not include the opportunity cost of the land which is being consumed by the parking. The land is assumed to be free. Surface spaces appear cheaper because they consume a lot more “free” land. A parking garage allows cars to be stacked on top of each other, thereby allowing less land to be consumed. The correct analysis would impute an opportunity cost to each potential parcel of land on campus, and then build this cost into both the analysis and parking fees. The differential cost of each parcel would take into account the additional walking time to the center of campus. Remote lots would have a lower opportunity cost of land and would provide less expensive parking spaces.

Another major problem with the University's analysis is that parking prices should be set to allocate a scarce resource to those who value it the highest. If there is an excess demand for parking (i.e., queues exist), then prices should be raised to manage the queue and thereby allocate the scarce resource. Basing prices solely on costs does not guarantee that any excess supply or demand is eliminated.

Other relevant considerations in the decision to build a parking garage include:

1. The analysis ignores the effect of poor/inconvenient parking on tuition revenues.
2. Snow removal costs are likely lower, but other maintenance costs are likely to be higher with a parking garage.

The most interesting aspect of this question is "Why have University officials systematically overlooked the opportunity cost of the land in their decision-making process?" One implication of past University officials’ failure to correctly analyze the parking situation is the "dumb-administrator" hypothesis. Under this scenario, one concludes that all past University presidents were ignorant of the concept of opportunity cost and therefore failed to assign the "right" cost to the land.

The way to understand why administrators will not build a parking garage is to ask what will happen if a garage is built and priced to recover cost. The cost of the covered space will be in excess of $1,200 per year. Those students, faculty, and staff with a high opportunity cost of their time (who tend to be those with higher incomes) will opt to pay the significantly higher parking fee for the garage. Lower-paid faculty will argue the inequity of allowing the "rich" the convenience of covered parking while the “poor” are relegated to surface lots. Arguments will undoubtedly be made by some constituents that parking spots should not be allocated using a price system which discriminates against the poor but rather parking should be allocated based on "merit" to be determined by a faculty committee. Presidents of universities have risen to their positions by developing a keen sense of how faculty, students, and staff will react to various proposals. An alternative to the "dumb-administrator" hypothesis is the "rational self-interested administrator" hypothesis. Under this hypothesis, the parking garage is not built because the administrators are unwilling to bear the internal political ramifications of such a decision.

Finally, taxes play an important role in the University's decision not to build a parking garage. If faculty are to pay the full cost of the garage, equilibrium wage rates will have to rise to make the faculty member as well off at Eastern University paying for parking than at another university where parking is cheaper. Because employees are unable to deduct parking fees from their taxes, the University will have to increase salaries by the amount of the parking fees plus the taxes on the fees to keep the faculty indifferent about staying or leaving the University. Therefore, a parking garage paid for by the faculty (which means paid by the University) causes the government to raise more in taxes. The question then comes down to: is the parking garage the best use of the University's resources?

P 2-29: **Solution to William Company** (CMA adapted) (25 minutes)
[Using Cost-volume-profit as a decision rule]

a.

Model	Variable Cost per Box	Total Fixed Cost
Economy	$.43	$ 8,000
Regular	.35	11,000
Difference	$.08	$ 3,000

Volume at which both machines produce the same profit $= \dfrac{\text{Fixed cost differential}}{\text{Variable cost differential}}$

$= \dfrac{\$3{,}000}{\$.08}$

$= 37{,}500$ boxes

b. A decision rule would have to include the Super Model:

	Variable Cost per Box	Total Fixed Cost
Regular	$.35	$11,000
Super	.26	20,000
	$.09	$ 9,000

Volume at which Regular and Super produce the same profit $= \dfrac{\$9{,}000}{\$.09}$

$= 100{,}000$ boxes

Therefore, the decision rule is as shown below.

Anticipated Annual Sales Between	Use Model
0–37,500	Economy
37,500–100,000	Regular
100,000 and above	Super

The decision rule places volume well within the capacity of each model.

c. No, management cannot use theater capacity or average boxes sold because the number of seats per theater does not indicate the number of patrons attending, nor the popcorn-buying habits in different geographic locations. Each theater likely has a different average "boxes sold per seat" with significant variations. The decision rule does not take into account variations in demand that could affect model choice.

P 2-30: Solution to Mastich Counters (25 minutes)
[Opportunity cost to the firm of workers deferring vacation time]

At the core of this question is the opportunity cost of workers deferring vacation.

The new policy was implemented because management believed it was costing the firm too much money when workers left with accumulated vacation and were paid. However, these workers had given Mastich in effect a loan. By not taking their vacation time as accrued, they stayed in their jobs and worked, allowing Mastich to increase its output without hiring additional workers, and without reducing output or quality. Mastich was able to produce more and higher quality output with fewer workers. Suppose a worker is paid $20 per hour this year and $20.60 next year. By deferring one vacation hour one year, the worker receives $20.60 when the vacation hour is taken next year. As long as average worker salary increases are less than the firm's cost of capital, the firm is better off by workers accumulating vacation time. The firm receives a loan from its workers at less than the firm's cost of capital.

Under the new policy, and especially during the phase-in period, Mastich has difficulty meeting production schedules and quality standards as more workers are now on vacation at any given time. To overcome these problems, the size of the work force will have to increase to meet the same production/quality standards. If the size of the work force stays the same, but more vacation time is taken, output/quality will fall.

Manager A remarked that workers were refreshed after being forced to take vacation. This is certainly an unintended benefit. But it also is a comment about how some supervisors are managing their people. If workers are burned out, why aren't their supervisors detecting this and changing job assignments to prevent it? Moreover, how is burnout going to be resolved after the phase-in period is over and workers don't have excess accumulated vacation time?

The new policy reduces the workers' flexibility to accumulate vacation time, thereby reducing the attractiveness of Mastich as an employer. Everything else equal, workers will demand some offsetting form of compensation or else the quality of Mastich's work force will fall.

Many of the proposed benefits, namely reducing costs, appear illusory. The opportunity costs of the new policy are reduced output, schedule delays, and possible quality problems. If workers under the new policy were forfeiting a significant number of vacation hours, these lost hours "profit" the firm. But, as expected from rational workers, very few vacation hours are being forfeited (as mentioned by Manager C).

However, there is one very real benefit of the new policy – less fraud and embezzlement. One key indicator of fraud used by auditors is an employee who never takes a vacation. Forced vacations mean other people have to cover the person's job. During these periods, fraud and embezzlement often are discovered. Another benefit of this new policy is it reduces the time employees will spend lobbying their supervisors for extended vacations (in excess of three to four weeks). Finally, under the existing policy, employees tend to take longer average vacations (because workers have more accumulated vacation time). When a worker takes a long vacation, it is more likely the employee's department will hire a temporary or "float" person to fill in. With shorter vacations, the work of the person on vacation is performed by the remaining employees. Thus, the new policy reduces the slack (free time) of the work force and results in higher productivity.

P 2-31: **Solution to Optometry Practice** (25 minutes)
[Break-even analysis]

Hiring the optometrist generates two income streams, examination revenue and eyeglass and contact sales. Each exam is expected to produce the following additional revenue:

	Frequency (1)	Profits (2)	Expected Profits (1) × (2)
Eyeglasses	60%	$90	$54
Contact lens	20%	$65	$13
Expected Profits from sales per exam			$67

The break-even point is calculated as follows:

Contribution margin per exam:	
Exam fee	$ 45
Expected gross margin on sales	$ 67
Contribution margin	$112
Fixed costs:	
Optometrist	$63,000
Occupancy costs	1,200
Equipment	330
Office staff	23,000
Total fixed costs	$87,530

$$\text{Break even volume of exams} = \frac{\text{Total fixed costs}}{\text{Contribution margin}}$$

$$= \frac{\$87{,}530}{\$112}$$

$$= 781.5 \text{ exams}$$

Break even volume as a fraction of capacity

$$= \frac{781.5 \text{ exams}}{2 \times 40 \times 48}$$

$$= 20.3\%$$

P 2–32: Solution to JLE Electronics (25 minutes)
[Maximize contribution margin per unit of scarce resource]

Notice that the new line has a maximum capacity of 25,200 minutes (21 ×20 × 60) which is less than the time required to process all four orders. The profit maximizing production schedule occurs when JLE selects those boards that have the largest contribution margin per minute of assembly time. The following table provides the calculations:

	CUSTOMERS			
	A	**B**	**C**	**D**
Price	$38	$42	$45	$50
Variable cost per unit	23	25	27	30
Contribution margin	$15	$17	$18	$20
Number of machine minutes	3	4	5	6
Contribution margin/minute	5	4.25	3.6	3.33

Customers A, B, and C provide the highest contribution margins per minute and should be scheduled ahead of customer D.

	CUSTOMERS			
	A	**B**	**C**	**D**
Number of boards requested	2500	2300	1800	1400
Number of boards scheduled to be produced in the next 21 days	2500	2300	1700*	0

* 1700 [25,200 – (2,500 × 3) – (2,300 × 40]/5

P 2–33: **Solution to News.com** (25 minutes)
[Breakeven and operating leverage increases risk]

a. and b. Breakeven number of hits:

	NetCom	Globalink
Price	$0.05	$0.05
Variable cost	0.01	0.02
Contribution margin	$0.04	$0.03
Fixed cost	$3,000	$2,000
Breakeven number of hits	75,000	66,667

c. The choice among ISPs depends on the expected number of hits. The two ISP's have the same cost at 100,000 hits per month:

$$\$3{,}000 + \$0.01Q = \$2{,}000 + \$0.02Q$$

$$Q = 100{,}000$$

If the number of hits exceeds 100,000 per month, NetCom is cheaper. If the number of hits is less than 100,000, Globalink is cheaper.

d. If demand fluctuates with general economy-wide factors, then the risk of News.com is not diversifiable and the variance (and covariance) of the two ISP's will affect News.com's risk. For example, the table below calculates News.com's profits if they use NetCom or Globalink and demand is either high or low. Notice that News.com has the same expected profits ($1,000 per month) from using either ISP. However, the variance of profits (and hence risk) is higher under Net.Com than under Globalink. Therefore, News.com should hire Globalink. Basically, with lower fixed costs, but higher variable costs per hit, News.com's profits don't fluctuate as much with Globalink as they do with Net.Com.

	NetCom	NetCom	Globalink	Globalink
Hits	50,000	150,000	50,000	150,000
Revenue	$2,500	$7,500	$2,500	$7,500
Fixed Cost	3,000	3,000	2,000	2,000
Variable Cost	500	1,500	1,000	3,000
Profits	-$1,000	$3,000	-$500	$2,500
Expected profits	$1,000		$1,000	

P 2–34: **Solution to Kinsley & Sons** (25 minutes)
[Opportunity cost of cannibalized sales]

a. The decision to undertake the additional advertising and marketing campaign depends on how one considers the cannibalized sales from catalog. Additional web profits from the program will be $4 million. But half of these will be from existing catalog purchases. Thus, the net new profits are only $2 million. In this case, undertaking the project is not profitable as documented by the following calculations:

Net new incremental web profits	$4.0
Incremental catalog profits	0.6
Cost of ad campaign	(2.8)
Lost profits from catalog sales	(2.0)
Net Loss	($0.2)

However, if we do not undertake the marketing campaign, we have no assurance that our competitors will not pursue an aggressive web campaign for their web sites. Thus, we may lose the $2 million of catalog sales profits whether we undertake this campaign or not. If this is the case, we should undertake the campaign because we will lose the $2 million anyway. In this case, the calculation becomes:

Net new incremental web profits	$4.0
Incremental catalog profits	0.6
Cost of ad program	(2.8)
Net Gain	$1.8

b. The critical assumption involves whether the $2.0 million of lost catalog sales is an opportunity cost of this campaign. If we believe that our competitors will not expand their web marketing, and hence we will not lose these $2 million profits from catalog, then this $2 million **is** an opportunity cost of the web marketing campaign. On the other hand, if we expect our competitors to launch web marketing campaigns and this $2 million profits from catalog would have been lost whether or not we undertake the campaign, the $2 million is **not** an opportunity cost of our campaign.

P 2-35: Solution to Littleton Imaging (25 minutes)
[Breakeven analysis]

a. Breakeven:

Fee	$250
Film	-55
Lease	-45
Contribution margin	$150
Fixed costs per month:	
Office rent	$1,400
Receptionist	2,400
2 technicians	6,400
CAT scanner lease	1,200
Office furniture, telephone & equipment	600
Radiologist	15,000
Total	$27,000
Breakeven (fixed cost/contribution margin)	180

b. To calculate the number of sessions required to yield an after-tax profit of $5,000 (with a 40 percent tax rate), solve the following equation for Q (number of sessions):

$\$5{,}000 = (CM \times Q - FC) \times (1\text{-}T)$
$\$5{,}000 / 0.60 + FC = CM \times Q$

Or,

$Q = (\$5{,}000 / .060 + FC) / CM$
$Q = (\$8{,}333.33 + \$27{,}000) / \$150$
$Q = \$35{,}333.33 / \$150$
$Q = 235.56$ sessions

c. To calculate the breakeven price, given Dr. Gu expects to conduct 200 sessions per month, solve the following equation for F (fee per session):

$200 \times F = \$55 \times 200 + \$45 \times 200 + \$27{,}000$
$200 \times F = \$100 \times 200 + \$27{,}000$
$200 \times F = \$20{,}000 + \$27{,}000$
$F = \$47{,}000 / 200$
$F = \$235$

P 2-36: **Solution to Candice Company** (CMA adapted) (30 minutes)
[Break-even analysis of new technologies]

a. $$\text{Break-even units} = \frac{\text{Total fixed costs}}{\text{Unit contribution margin}}$$

	Method A		Method B	
Selling price		$30.00		$30.00
Variable costs:				
Raw materials	$5.00		$5.60	
Direct labor	6.00		7.20	
Variable overhead	3.00		4.80	
Variable selling	2.00	16.00	2.00	19.60
Contribution margin		$14.00		$10.40
Traceable fixed manufacturing costs		$2,440,000		$1,320,000
Incremental selling expenses		500,000		500,000
Total fixed costs		$2,940,000		$1,820,000
Divided by:				
Contribution margin		$ 14.00		$ 10.40
Break-even units		210,000		175,000

b. The choice of production methods depends on the level of expected sales. Candice Company would be indifferent between the two manufacturing methods at the volume (x) for which total costs are equal.

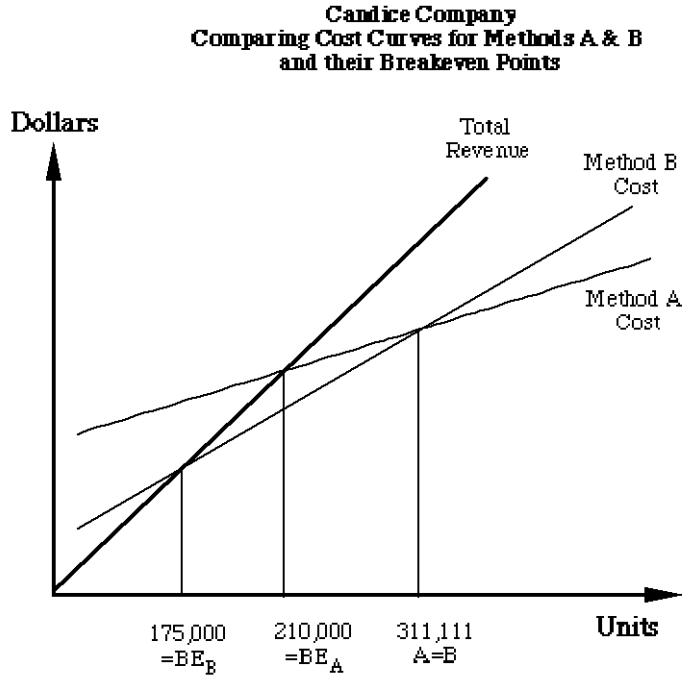
$$\$16x + \$2{,}940{,}000 = \$19.60x + \$1{,}820{,}000$$

$$\$3.60x = \$1{,}120{,}000$$

$$x = 311{,}111 \text{ units}$$

In a world of certainty, if management expects to produce fewer than 311,111 units it would choose method B. Above 311,111 units they would prefer method A. The figure below illustrates this situation. The two break-even points for the two manufacturing methods occur at 210,000 and 175,000 units. However, it is the point where the two cost curves intersect (311,111 units) that is relevant. Method B has lower total costs up to 311,111 units and then method A has lower costs beyond this volume.

With uncertainty, the problem becomes more complicated because the two methods affect operating leverage differently. Operating leverage affects risk, cost of capital, and expected tax payments (to the extent that marginal tax rates vary with profits). Basically, the production method with the lower break-even volume has the lower systematic risk and thus the lower discount rate.[1]



P 2–37: **Solution to Mat Machinery** (30 minutes)
[Determining the best alternative use of a special order]

Contribution of each alternative:

	Sell to Raytell Corp.	Sell as a Standard Model	Sell As Is
Sales price	$68,000	$64,500	$55,000
Less discount	--	1,290	--
Net sales price	$68,000	$63,210	$55,000

[1] P. Lederer and V. Singhal, "Effect of Cost Structure and Demand Risk in Justification of New Technologies," *Journal of Manufacturing and Operations Management* 1 (1988), pp. 339-371.

Less	Additional costs						
	Materials	$5,000		$6,500		—	
	Labor	6,000		2,000		—	
	Overhead (50% DL)	3,000	14,000	1,000	9,500	—	—
			$54,000		$53,710		$55,000
Less	Commissions		1,360		632		550
	Contribution		$52,640		$53,078		$54,450

Therefore, the "sell as is" for $55,000 is the best alternative. Notice that fixed factory overhead does not enter the analysis, as these costs are not relevant to any of the alternatives.

P 2–38: Solution to Internal Support Services (30 minutes)
[Opportunity cost of an internal service department and pricing it]

Internal Support Systems illustrates the important connection between how informal, internal contracts (in this case for consulting services) affect incentives and ultimately the cost and sourcing of resource allocation decisions. This problem involves addressing the question: Is $50 an hour the opportunity cost to the firm of providing internal services? This problem illustrates that "adverse selection" results if the internal price ($50) is not set at opportunity cost. By using a blended rate of $50, the clients are cream skimming. Clients are using T.Q. for complicated jobs (where the existing market price exceeds $50) and then going outside for the bulk of the work. Users should be charged actual rates, not blended rates.

T.Q. should assess how competitive his department is compared with the outside. What is causing the disparity between his rate of $50.00 and a rate of $30.00 on the outside? Are any of these costs controllable? On the other hand, *maybe* the firm is overpaying T.Q.'s people for what they are getting.

Due to widely fluctuating demands from internal clients, T.Q.'s department is staffed for the peak demand periods. This will cause a high charge rate due to inefficient operation at other times. Unless T.Q. wishes to trim his staffing levels, he may never be competitive.

A solution may be for T.Q. to perform work outside the corporation. This will force his department to come face-to-face with competitive realities. It would also help T.Q.'s department maintain a steady flow of design work. A major issue to be addressed with this approach is the drastic change in incentives given to department personnel.

The corporation may wish to subsidize T.Q.'s department so that it is more attractive to use. The rationale for this is that the subsidy represents fixed costs that will not disappear even if T.Q.'s department is eliminated. Another rationale is that T.Q.'s department provides the corporation some strategic advantage (i.e., positive externalities) in the marketplace that is not readily apparent to some internal clients.

Ultimately, the firm must address the central question of whether the internal support services provided by T.Q.'s department is better secured internally or externally. What are the benefits to the firm of having these services provided in-house relative to the cost of securing these services from outside vendors?

P 2-39: Solution to G. Demopoulos & Son Inc. (30 minutes)
[Opportunity cost of a backup delivery truck]

There are three mutually exclusive uses of the truck: (a) use it to expand the fleet, (b) sell it, or (c) use it as a replacement vehicle. Each alternative is evaluated below. All calculations assume that the ninth truck will not break down.

a. If the truck is used for expansion the net cash flow is:

Additional annual contribution (see below)	$29,400
less: additional truck rental ($90/day × 20 days × 8 trucks)	$14,400
Annual cash flow of expansion	$15,000

If the truck is used in expansion:

Revenues		$59,800[1]
Cost:		
Driver's Comp.	$21,000	
Gasoline Expense	$ 3,600[2]	
Truck Maintenance	$ 6,000[3]	
Expected Rental Cost	$ 1,800[4]	
Total Costs		$30,400
Profit		$29,400 per year

[1] $2.00/item ×115 items ×5 days ×52 weeks = $59,800 per year
[2] $2,400/8 trucks ×12 months
[3] $4,000/8 trucks ×12 months
[4] 20 days × $90/day

Only variable costs are considered, as fixed costs are irrelevant in this incremental analysis.

b. If the truck is sold:

Interest on the proceeds = 12% ×$10,000	$ 1,200
less: additional truck rentals	($14,400)
Decline in cash flow	($13,200)

c. If the truck is used as a replacement vehicle:

Assume the probability that any given truck breaks down in any given day is independent of other trucks breaking down. Furthermore, assume 260 working days per year (52 ×5).

Probability that any truck breaks down in a day = 20/260 = 1/13

Next, calculate the expected frequency of days when 0, 1, 2, 3, ..., 8 trucks break down and additional rental trucks are required. This requires estimating the probability that N trucks are broken down in any given day, which is a standard probability theory problem:

$$\text{P(N broken)} = \frac{8!}{N!(8-N)!}\left(\frac{1}{13}\right)^{N}\left(\frac{12}{13}\right)^{8-N}$$

The following table computes the probabilities and expected frequencies:

(1) # of Trucks Broken	(2) Probability N Broken	(3) Expected # of Trucks Broken (1 × 2)	(4) Expected # of Broken Truck Days (3 × 260)	(5) Expected Cost of Renting Outside Extra Trucks*
0	.527	0	0	0
1	.351	.351	91.366	0
2	.102	.205	53.297	$2,398
3	.017	.051	13.324	799
4	.002	.007	1.851	125
5	.000	.001	.154	11
6	.000	.000	.008	1
7	.000	.000	.000	0
8	.000	.000	.000	0
	1.000		160.000	$3,334

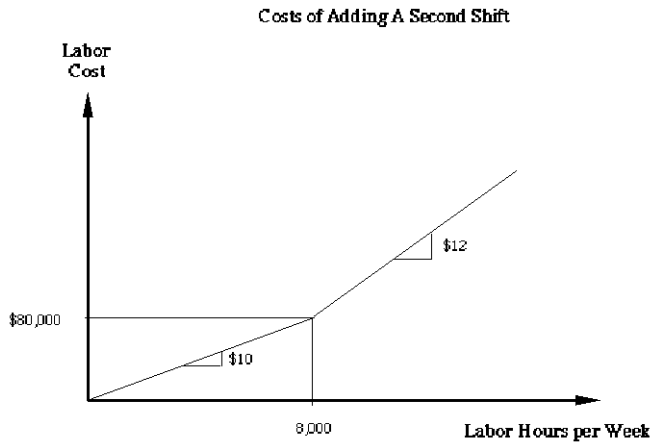
* (# of trucks broken –1) × Prob(# broken trucks) × 260 days × $90/day.

If GDS keeps the truck, the expected rental is $3,334 instead of $14,400, or a savings of about $11,000.

Therefore, do not sell the truck but rather use it to add a new route.

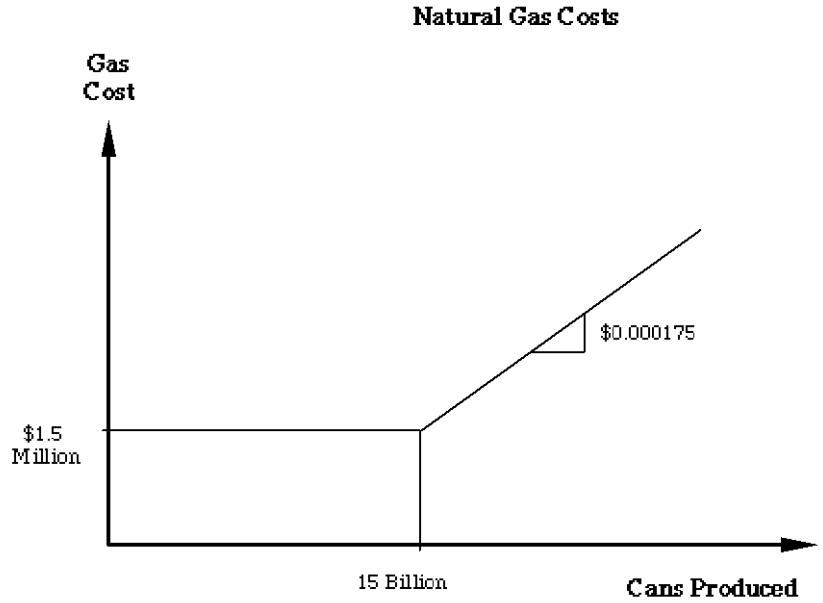
P 2-40: Solution to Cost Behavior Patterns (30 minutes)
[Graphing cost behavior patterns]

a.

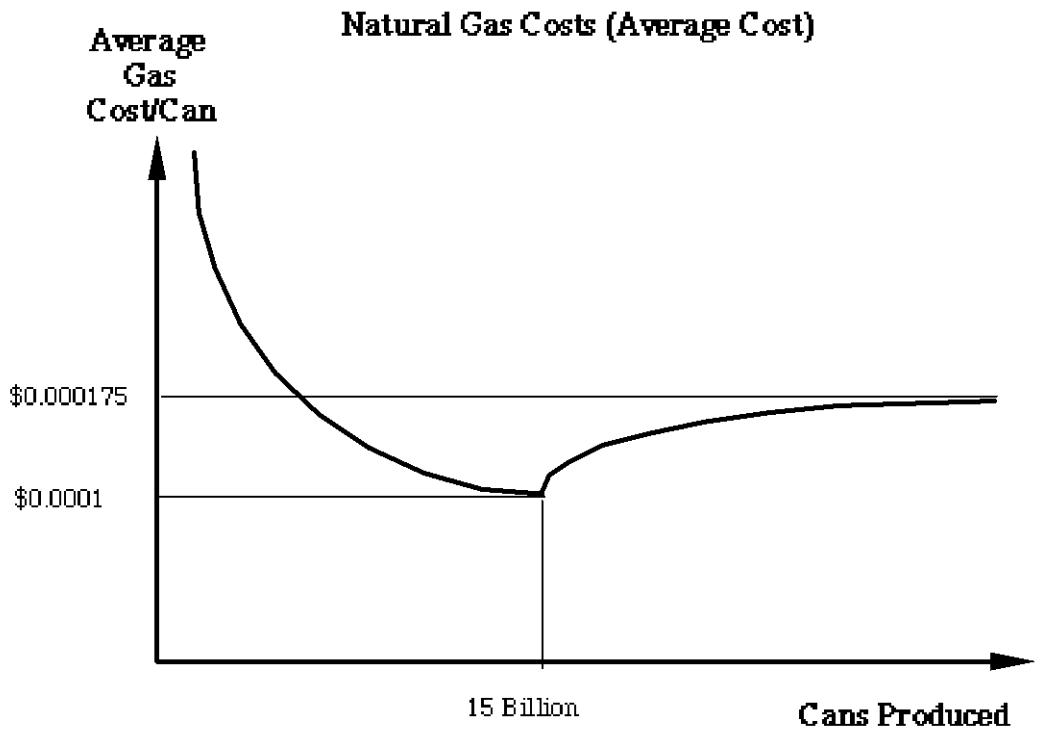


b.

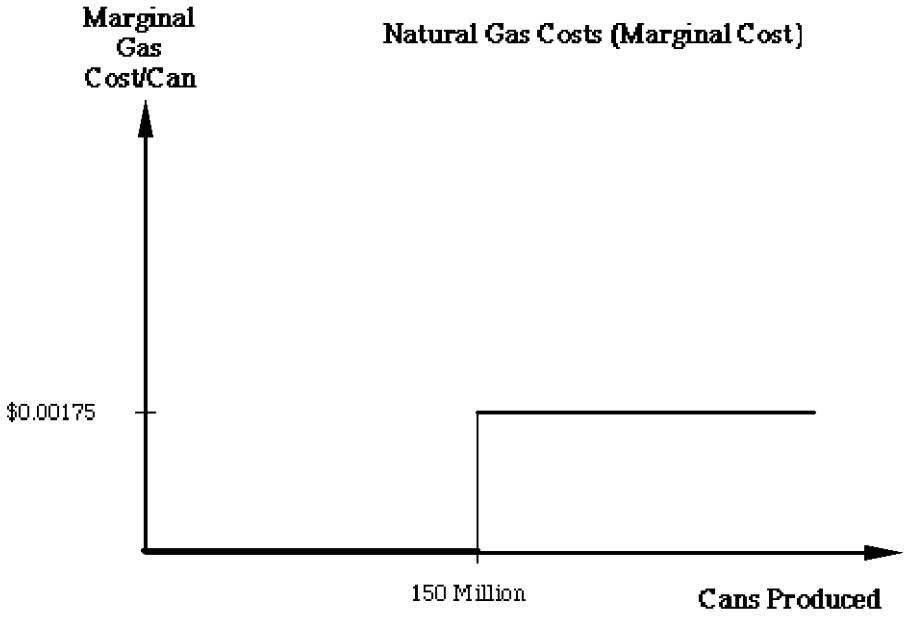
1000 cans	=	ten cubic feet of gas
100 cans	=	one cubic foot of gas
1 can	=	0.01 cu.ft
Marginal cost/can	=	0.01cu.ft/can × $0.175/cu.ft = $0.00175



c. The question does not specify whether to plot marginal gas cost per can or average gas cost per can. Therefore, there are two possible answers.



Marginal gas cost per can is:



P 2-41: Solution to Royal Holland Line (30 minutes)
[Break-even analysis]

a. Before the break-even point can be calculated, the variable cost per passenger is computed as:

$$\text{Variable cost per passenger} = \frac{\$324,000}{1,200}$$

$$= \$270$$

$$\text{Contribution margin per passenger} = \$1,620 - \$270$$

$$= \$1,350$$

$$\text{Break-even number of passengers} = \frac{\text{Fixed cost}}{\text{Contribution margin}}$$

$$= \frac{\$607,500}{1,350}$$

$$= 450 \text{ passengers}$$

b. The cost of the ship itself is not included. The weekly opportunity cost of the Mediterranean cruise is not using the ship elsewhere. One alternative use is to sell the ship and invest the proceeds. Since no other information is provided regarding alternative uses of the ship and assuming there are no capital gains taxes on the sale proceeds, the weekly opportunity cost of the ship is:

Sales proceeds	$371,250,000
× Interest rate	10%
	$37,125,000
÷ number of weeks/year	50
Weekly opportunity cost	$ 742,500

c. The revised break-even including the cost of the ship:

$$\text{Total fixed costs} = \$607,500 + 742,500$$

$$= \$1,350,000$$

$$\text{Break-even} = \frac{\$1,350,000}{1,350} = 1,000 \text{ passengers}$$

d. Let C = contribution margin from additional sales

$$900 = \frac{1,350,000}{1,350 + C}$$

$$900(1,350 + C) = 1,350,000$$

$$900C = 1,350,000 - 1,350 \times 900$$

$$C = \frac{1,350,000}{900} - 1,350$$

$$C = \$150$$

Additional purchases per passenger $= \frac{\$150}{.5} = \$300.$

P 2-42: Solution to Cards Unlimited (30 minutes)
[Calculating opportunity costs of international alternatives]

a. The following table first summarizes the data presented in the problem and then calculates the contribution margin of the international alternatives. After converting the sales prices and selling and distribution costs to U.S. dollars, selling the 100,000 cards in Italy yields the highest contribution margin.

Notice fixed costs do not enter the analysis since they do not vary with the number of cards processed.

	U.S.	Australia	England	Italy
Currency	dollar	dollar	pound	euro
Exchange rate	1.00	1.34	0.65	1.60
Selling price	0.31	0.43	0.21	.550
Selling & distribution costs	0.09	0.14	0.06	.160
Dollar Amounts				
Selling price	$0.310	$0.321	$0.323	$0.344
Cards	0.080	0.080	0.080	0.080
Variable packaging cost	0.040	0.040	0.040	0.040
Selling & distribution costs	0.090	0.104	0.092	0.100
Contribution margin per card	$0.100	$0.096	$0.111	$0.124

b. The following table indicates it is better to keep the price at $0.31 and let the Wal-Mart sales drop to 800,000 cards. The contribution from the lost 100,000 cards that would have been sold to Wal-Mart is replaced by selling cards to the next best foreign chain, England.

	Reject Proposal	Accept Proposal
Price	$ 0.310	$ 0.30
Wal-Mart sales (cards)	800,000	900,000
Contribution margin per card	× 0.100	× 0.090
Wal-Mart contribution	$ 80,000	$ 81,000
Plus English contribution	1,110	0
Total contribution	$ 91,110	$ 81,000

P 2–43: Solution to Roberts Machining (30 minutes)
[Describing the opportunity set and determining opportunity costs]

a. The opportunity set consists of:

1. Use die to produce #1160 racks and then scrap the die.
2. Use die to produce #1160 racks, but do not scrap the die.
3. Do not produce #1160 racks. Scrap the die immediately.
4. Sell the die to Easton.
5. Do not produce and do not scrap die.

b. Cash flows of each alternative (assuming GTE does not sue Roberts for breaching contract and ignoring discounting):

1. Use die to produce #1160 racks and then scrap the die

Accounting profit	$358,000
Add back cost of die	49,000
Scrap	6,800
Net cash flow	$413,800

2. Use die to produce #1160 racks, but do not scrap the die

Accounting profit	$358,000
Add back cost of die	49,000
Net cash flow	$407,000

3. Do not produce #1160 racks. Scrap the die immediately

Net cash flow	$6,800

4. Sell the die to Easton

Payment from Easton	$588,000
Less lost future profits	-192,000
Net cash flow	$396,000

5. Do not produce and do not scrap die

Net cash flow	$0

c. Opportunity cost of each alternative:

1. Use die to produce #1160 racks and then scrap the die	$407,000
2. Use die to produce #1160 racks, but do not scrap the die	$413,800
3. Do not produce $1160 racks. Scrap the die immediately	$413,800
4. Sell the die to Easton	$413,800
5. Do not produce and do not scrap die	$413,800

d. Roberts should reject Easton's offer and produce the #1160 rack as specified in its contract. This alternative has the lowest opportunity cost (or equivalently, it has the greatest net cash flow).

P 2-44: **Solution to Doral Rentals** (30 minutes)
[All costs are variable in the long run, breakeven, and profit maximization]

a. The fraction of sprayers Amos has to rent each week to breakeven:

Weekly lease cost per sprayer	$27.00
Rental price	$38.00
Cleaning cost	2.00
Contribution margin per rental	$36.00
Fraction of rentals per week to break even ($27/$36)	75%

Suppose Doral leases 10 units and rents 75% of them each week. Then he has:

Rental income: (75% × 10 × $38)	$285.00
Less:	
Lease cost (10 × $27)	(270.00)
Cleaning cost on rented sprayers (75% × 10 × $2)	(15.00)
Profit	$0.00

b. No, Amos is ignoring the opportunity cost of his time spent leasing and renting the sprayers. He could be spending this time marketing his other rentals. He should also consider the additional rentals of his other items (punch bowls) from customers coming into his store to rent sprayers as a potential benefit of the sprayers.

c. With fixed costs of advertising and labor, the breakeven number of rentals is:

Fixed costs per week (advertising and labor)		$65.00
Rental price per sprayer	$38.00	
Less: cleaning cost	2.00	
Contribution margin per sprayer rented	$36.00	
Likelihood of rental	× 0.90	
Expected cash flow from each sprayer leased		$32.40
Less: lease cost per sprayer		($27.00)
Expected contribution margin per rental		$5.40
Breakeven number of rentals per month ($65/$5.40)		12.04

d. Amos wants to maximize profits, so

$$\text{Profits} = P \times Q - V \times Q - FC$$

$$= (69 - Q)Q - 29Q - \$65$$

$$= 69Q - Q^2 - 29Q - 65$$

$$= 40Q - Q^2 - 65$$

Taking the derivative and setting it to zero to find the maximum profits :

$$40 - 2Q = 0$$

Or, $Q^* = 20$ sprayers

An alternative way to solve for the maximum profits is by using a table and searching for the maximum profits:

Number of Sprayers	Price	Revenue	Lease Cost	Cleaning Cost	Fixed Cost	Total Cost	Profit
10	$59	$590	$270	$20	$65	$355	$235
15	54	810	405	30	65	500	310
16	53	848	432	32	65	529	319
17	52	884	459	34	65	558	326
18	51	918	486	36	65	587	331
19	50	950	513	38	65	616	334
20	49	980	540	40	65	645	335
21	48	1008	567	42	65	674	334
22	47	1034	594	44	65	703	331
23	46	1058	621	46	65	732	326
24	45	1080	648	48	65	761	319
25	44	1100	675	50	65	790	310

The profit maximizing number of sprayers is 20.

P 2-45: Solution to Fuller Aerosols (30 minutes)
[Breakeven and production planning with capacity constraints]

a. Breakeven volumes

Fuller Aerosols
Breakeven Volumes

	AA143	AC747	CD887	FX881	HF324	KY662
Fixed cost	$900	$240	$560	$600	$1,800	$600
Price	$37.00	$54.00	$62.00	$21.00	$34.00	$42.00
Variable cost	28.00	50.00	48.00	17.00	28.00	40.00
Contribution margin	$9.00	$4.00	$14.00	$4.00	$6.00	$2.00
Breakeven volume	100	60	40	150	300	300

b. With 70 hours (or 4200 minutes) of capacity per week, all the products can be manufactured.

Fuller Aerosols
Minutes on the Fill Line to Produce All Products

	AA143	AC747	CD887	FX881	HF324	KY662	Total Minutes
Fill time per case (minutes)	3	4	5	2	3	4	
Cases ordered	300	100	50	200	400	200	
Minutes	900	400	250	400	1200	800	3950

An aerosol product should only be produced if its contribution margin times the number of units sold exceeds its fixed costs.

Fuller Aerosols
Breakeven Volumes

	AA143	AC747	CD887	FX881	HF324	KY662
Contribution margin	$9.00	$4.00	$14.00	$4.00	$6.00	$2.00
Cases ordered	300	100	50	200	400	200
Contribution	$2,700	$400	$700	$800	$2400	$400
Fixed cost	900	240	560	600	1,800	600
Profit (loss)	$1,800	$160	$140	$200	$600	-$200

c. Given a capacity constraint on the aerosol fill line, products should be produced that maximize the contribution margin per minute of fill time. The following table lists the order in which the products should be produced and the quantity of each produced. Products AA143, CD887, FX881, and HF324 are produced to meet demand. After producing these four products to meet demand this leaves 250 minutes of fill line time to produce 62 cases out of the 100 ordered AC747. Making 62 cases of AC747 generates contribution of $248 (62 x $4) which just barely covers its fixed costs of $240. And KY662 is not produced because it has the lowest contribution margin per minute of fill time and even if meeting all orders, it does not cover fixed costs.

Fuller Aerosols
Production Schedule with Only 3,000 Minutes (50 hours × 60 minutes/hour) of Fill Line Time

	AA143	AC747	CD887	FX881	HF324	KY662	Minutes Available
Fill time per case (minutes)	3	4	5	2	3	4	
Cases ordered	300	100	50	200	400	200	
Minutes	900	400	250	400	1200	800	
Contribution margin	$9.00	$4.00	$14.00	$4.00	$6.00	$2.00	
Contribution margin/min	$3.00	$1.00	$2.80	$2.00	$2.00	$0.50	
Most to least profitable Product per minute	1	5	2	3	3	6	
Total minutes available							3,000
Minutes used to meet demand for AA143	900						2,100
Minutes used to meet demand for CD887			250				1,850
Minutes used to meet demand for FX881 and HF324				400	1200		250
Minutes used to meet demand for AC747		250					0
Cases manufactured	300	62.5	50	200	400	0	

P 2-46: **Solution to Amy's Boards** (35 minutes)
[Break-even analysis — short-run versus long-run]

The major goals of this problem are to demonstrate how fixed costs first become fixed and second to illustrate the relation between fixed costs and capacity. Before the snow boards are purchased in part (a), they are a variable cost. (In the long run, all costs are variable.) However, once purchased, the boards are a fixed cost. The number of boards purchased determines the shop's total capacity, which is fixed, until she either buys more boards or sells used boards.

a. Number of boards to break-even:

Fixed Costs	
Store rent (net of sublet, $7,200 - $1,600)	$ 5,600
Salaries, advertising, office expense	26,000
	$31,600
Contribution margin per board per year:	
Revenue per week	$75
Refurbishing cost	-7
Contribution margin per board per week	$68
×number of weeks	20
Seasonal contribution margin from 100% rental	$1,360
× likelihood of rental	80%
Expected seasonal contribution margin per board	$1,088
Net cost per board ($550 – $250)	300
Net contribution per board per year	$ 788
Break-even number of boards ($31,600 ÷ $788)	40.10

b. Expected profit with 50 boards:

Expected seasonal contribution margin per board (from part a)	$ 1,088
× number of boards	50
Expected contribution margin	$54,400
Less:	
Cost of boards ($300 × 50)	(15,000)
Fixed costs	(31,600)
Expected profit	$ 7,800

c. Break-even number of rentals with 50 boards:

Total fixed costs	
Store rent	$ 5,600
Salaries, advertising, and office expense	26,000
Boards and boots (net of resale, $300 × 50)	15,000
	$46,600
Contribution margin per board per week	$68
Break-even number of rentals $\frac{\$46,600}{\$68}$	685.29
Total possible number of rentals (50 boards × 20 weeks)	1,000
Break-even fraction of boards rented each week	68.5%

d. In the long run, all costs are variable. However, once purchased, the boards are a fixed cost. The reason for the difference is Amy has about ten more boards than the break-even number calculated in part (a). In part (a), before the boards are purchased, they are a variable cost. She can buy any number of boards she wants and pay a proportionately higher cost for them and rent them all 80 percent of the time. Therefore the cost of the boards is a variable cost with respect to the number of rentals. It is subtracted from the revenue in calculating the contribution margin per board. Once you buy the boards, their cost becomes fixed. Instead of being included in calculating contribution margin, it is included in the fixed cost (numerator of the breakeven volume).

P 2-47: Solution to Blue Sage Mountain (35 minutes)
[Costs and pricing decisions-Appendix A]

a. Table of prices, quantities, revenues, costs, and profits:

Quantity	Price	Total Revenue	Total Cost	Total Profit
100	$510	$51,000	$79,000	-$28,000
200	490	98,000	88,000	10,000
300	470	141,000	97,000	44,000
400	450	180,000	106,000	74,000
500	430	215,000	115,000	100,000
600	410	246,000	124,000	122,000
700	390	273,000	133,000	140,000
800	370	296,000	142,000	154,000
900	350	315,000	151,000	164,000
1,000	330	330,000	160,000	170,000
1,100	310	341,000	169,000	172,000
1,200	290	348,000	178,000	170,000
1,300	270	351,000	187,000	164,000
1,400	250	350,000	196,000	154,000
1,500	230	345,000	205,000	140,000
1,600	210	336,000	214,000	122,000
1,700	190	323,000	223,000	100,000
1,800	170	306,000	232,000	74,000
1,900	150	285,000	241,000	44,000
2,000	130	260,000	250,000	10,000

b. Profits are maximized when the price is set at $310 and 1,100 boards are sold.

c. If fixed costs fall from $70,000 to $50,000, prices should not be changed because a price of $310 and 1,100 boards continue to maximize profits as illustrated below:

Quantity	Price	Total Revenue	Total Cost	Total Profit
100	$510	$51,000	$59,000	-$8,000
200	490	98,000	68,000	30,000
300	470	141,000	77,000	64,000
400	450	180,000	86,000	94,000
500	430	215,000	95,000	120,000
600	410	246,000	104,000	142,000
700	390	273,000	113,000	160,000
800	370	296,000	122,000	174,000
900	350	315,000	131,000	184,000
1,000	330	330,000	140,000	190,000
1,100	310	341,000	149,000	192,000
1,200	290	348,000	158,000	190,000
1,300	270	351,000	167,000	184,000
1,400	250	350,000	176,000	174,000
1,500	230	345,000	185,000	160,000
1,600	210	336,000	194,000	142,000
1,700	190	323,000	203,000	120,000
1,800	170	306,000	212,000	94,000
1,900	150	285,000	221,000	64,000
2,000	130	260,000	230,000	30,000

d. If variable costs fall from \$90 to \$50 per board, prices should be lowered to \$290 per board to maximize profits as illustrated below:

Quantity	Price	Total Revenue	Total Cost	Total Profit
100	\$510	\$51,000	\$75,000	-\$24,000
200	490	98,000	80,000	18,000
300	470	141,000	85,000	56,000
400	450	180,000	90,000	90,000
500	430	215,000	95,000	120,000
600	410	246,000	100,000	146,000
700	390	273,000	105,000	168,000
800	370	296,000	110,000	186,000
900	350	315,000	115,000	200,000
1,000	330	330,000	120,000	210,000
1,100	310	341,000	125,000	216,000
1,200	290	348,000	130,000	218,000
1,300	270	351,000	135,000	216,000
1,400	250	350,000	140,000	210,000
1,500	230	345,000	145,000	200,000
1,600	210	336,000	150,000	186,000
1,700	190	323,000	155,000	168,000
1,800	170	306,000	160,000	146,000
1,900	150	285,000	165,000	120,000
2,000	130	260,000	170,000	90,000

P 2–48: Solution to Gold Mountain Ski Resort (45 minutes)
[Analyze reasonableness of an investment using breakeven]

a. Recommendation: Reject immediately.

Given the fixed and variable cost structure provided by the client, I calculate that breakeven volume of the venture is 82 percent of the chair lift's annual capacity (see analysis below).

Each daily pass generates \$58 of contribution margin. With total fixed cost of \$12.4 million (\$8.3 million of financing cost plus \$4.1 million of operating cost), they must sell 213,793 daily passes to break even. This number of passes requires 427,586 lifts. But their triple-person chair lift, if operating full, can only produce 518,400 lifts per year. It is likely that during weekends and holidays there will be long lift lines, uncharacteristic of a high-end ski resort, further reducing demand.

Early in the morning and late afternoons and at the beginning and end of the season, they are unlikely to have sufficient demand to operate the lift at the 82 percent of capacity necessary to breakeven, let alone generate a profit.

Number of skiers per chair		3
Chairs per hour		180
Hours per day		8
Daily pass		$60
Annual fixed cost of the ski resort		
Financing costs	$ 8,300,000	
Operating costs	$ 4,100,000	
	$12,400,000	
Variable costs per skier-day		
Additional cost per 100 skier-days		$ 200
Skier days		÷100
		$ 2.00
Contribution margin per skier-day		$58.00
Breakeven number of skier days		
Fixed cost		$12,400,000
÷ Contribution margin		$58.00
Breakeven skier days		213,793
Chair lifts to breakeven		
Breakeven skier days		213,793
Number of ski runs per skier-day		2
Chair lifts to breakeven		427,586
Chair lift Capacity		
Hours per day		8
Skiers lifted per hour		540
Skier-lifts per day		4,320
× Number of ski days/season		120
Ski runs per season		518,400
Breakeven lifts as a percentage of lift capacity		
Chair lifts to breakeven		427,586
Capacity of lift		518,400
		82%

b. Based on the revised facts, I would change my recommendation to, Gather additional information.

With the four-person chair lift, the number of daily passes to break even rises slightly (see below). However, the capacity of the chair lift increases more, thereby reducing the breakeven capacity to 62 percent. The resort has more capacity at peak times. However, while this additional capacity reduces lift lines at peak load periods, it also causes the slopes to be more congested, making the ski resort less attractive. I suggest we gather more data from competitive high-end resorts regarding the number of skiers per run per hour at peak times.

Total fixed cost	$ 12,475,000
Contribution margin	÷ $58
Breakeven number of skiers	215,086
Chair lifts to breakeven	
Breakeven skier days	215,086
Number of ski runs per skier-day	2
Chair lifts to breakeven	430,172
Chair lift Capacity	
Hours per day	8
Skiers lifted per hour	720
Skier-lifts per day	5,760
× Number of ski days/season	120
Ski runs per season	691,200
Breakeven lifts as a percentage of lift capacity	
Chair lifts to breakeven	430,172
Capacity of lift	691,200
	62%

Case 2–1: Solution to Old Turkey Mash (50 minutes)
[Period versus Product Costs]

a. This question involves whether the costs incurred in the aging process (oak barrels and warehousing costs) are period costs (and written off) or product costs (and capitalized as part of the inventory value). The table below shows the effect on income of capitalizing all the warehousing costs and then writing them off when the whiskey is sold.

	Base Year	Year 1	Year 2	Year 3
Revenues	$6,000,000	$6,000,000	$6,000,000	$6,000,000
less:				
Cost of Goods Sold:				
bbls distilled @ $100/bbl	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Oak barrels	750,000	750,000	750,000	750,000
Warehouse rental	1,000,000	1,000,000	1,000,000	1,000,000
Warehouse direct costs	2,500,000	2,500,000	2,500,000	2,500,000
Net Income before taxes	$ 750,000	$ 750,000	$ 750,000	$ 750,000
Income taxes (30%)	225,000	225,000	225,000	225,000
Net Income after taxes	$ 525,000	$ 525,000	$ 525,000	$ 525,000
Increase in income from capitalizing aging costs	$000	$203,000	$504,000	$903,000

Since all the additional expansion costs are now being capitalized into inventory, profits are higher by the amount of the capitalized costs less the increase in taxes.

b. The present financial statements based on treating aging cost as period costs show an operating loss. This loss more closely represents the operating cash flows of the firm. Unless the bank is dumb, the bank will want to see a statement of cash flows in addition to the income statement. If the firm computes net income with the aging costs treated as product costs, net income is higher. But is the banker really fooled?

If the firm is able to sell the additional production as it emerges from the aging process, then the following income statements will result for years 3 to 10:

	Year 3	Year 4	Year 5	Year 6	Year 7
Revenues	$6,000,000	$6,000,000	$6,000,000	$7,200,000	$8,400,000
less:					
Cost of Goods Sold:					
(gallons sold × $2.50)	1,000,000	1,000,000	1,000,000	1,200,000	1,400,000
Oak barrels	1,200,000	1,350,000	1,500,000	1,500,000	1,500,000
Warehouse rental	1,240,000	1,400,000	1,600,000	1,760,000	1,880,000
Warehouse direct costs	3,100,000	3,500,000	4,000,000	4,400,000	4,700,000
Net Income before taxes	(540,000)	(1,250,000)	(2,100,000)	(1,660,000)	(1,080,000)
Income taxes (30%)	162,000	375,000	630,000	498,000	324,000
Net Income after taxes	($ 378,000)	($ 875,000)	($1,470,000)	($1,162,000)	($ 756,000)

	Year 8	Year 9	Year 10
Revenues	$9,600,000	$10,800,000	$12,000,000
less:			
Cost of Goods Sold:			
(gallons sold × $2.50)	1,600,000	1,800,000	2,000,000
Oak barrels	1,500,000	1,500,000	1,500,000
Warehouse rental	1,960,000	2,000,000	2,000,000
Warehouse direct costs	4,900,000	5,000,000	5,000,000
Net Income before taxes	(360,000)	500,000	1,500,000
Income taxes (30%)	108,000	(150,000)	(450,000)
Net Income after taxes	($ 252,000)	$ 350,000	$1,050,000

Notice that by year 10, the firm's profits are twice what the old base profits were. Ultimately, the decision by the banker to continue lending to Old Turkey will depend on the banker's expectation that the additional production will be sold, not on how the accounting profits are recognized on the books.

The decision to report aging costs as product costs depends on the following questions:

• Will taxes be affected? If the treatment of aging costs is changed for reporting purposes, will the IRS require the firm to use the same method for taxes? If so, this will increase the firm's tax liability and further increase the cash drain the firm faces. Therefore, expert tax advice is needed.

• Will the bank be fooled by the positive income numbers even though a cash drain is occurring? The bank's decision to continue to lend to the firm depends on its assessment of the firm's ultimate ability to sell the increased quantities produced at the same or higher prices. Independent of how the firm reports its current earnings, the wisdom of the decision to double production depends on whether the overseas markets for the product exist.
• The bank may in fact want the firm to treat aging costs as product costs and thereby increase reported profits to satisfy bank regulatory reviews. Regulators look closely at outstanding loans and the documentation provided by the borrowers to their banks. Submitting income statements with reported losses may cause the regulators to question this loan, thereby imposing costs on the bank.

Advice: First, find out if the firm can continue to write off aging costs as period expenses for taxes while capitalizing these costs for financial reporting purposes. If the tax rules are such that the firm can keep separate books, then take both sets of income statements and the cash flow statements to the bank and find out which set of statements they feel more accurately reflects the firm's financial condition.

Case 2-2: Solution to Mowerson Division (CMA adapted) (60 minutes)
[Opportunity cost of make/buy decisions]

In this problem, specific identification of opportunity costs is required.

a. Joseph Wright should have analyzed the costs and savings that Mowerson would realize for a period greater than one year (2007). For instance, Wright should have considered the fact that Mowerson expects production volume to steadily increase over the next three years. Under these circumstances, the difference between Mowerson's standard cost for manufacturing PCBs and Tri-Star's price for PCBs becomes increasingly important. A decision of this type is dependent on events in the future, i.e., differing income streams, production plans, and production capabilities. Furthermore, this is a long-term decision, which means that more than one year should be considered. Once Mowerson dismisses the assembly technicians, it would not be able to rehire them immediately. By incorporating more than 2007 costs and revenues, Mowerson should also use discounted cash flow techniques to recognize the time value of money.

b.

	(i) Appropriate/Inappropriate		(ii) Correct/Incorrect
1.	Appropriate. Mowerson will no longer have to pay these wages.	1.	Correct. This is the cost associated with the 40 technicians who will no longer work at Mowerson.
2.	Inappropriate. The Assembly Supervisor will continue to be employed by Mowerson for two years.	2.	Incorrect. Cost will continue to be incurred by Mowerson and only the amount should be included in Wright's analysis, that is salary less the benefits provided by the supervisor.
3.	Appropriate but only to the extent of the outside rental space. The cost associated with the main plant floor space is inappropriate because Mowerson is still using this space.	3.	Incorrect. Only the amount related to the outside rental space (1,000 × $9.50 = $9,500) should be included. The cost associated with the floor space in the main plant will continue.
4.	Inappropriate. Although the purchasing clerk is on temporary assignment to a special project, the clerk's employment at Mowerson will continue.	4.	Incorrect. There will be no savings associated with the purchasing clerk, except for any value added by the clerk to the special project.
5.	Appropriate. Mowerson will realize this savings from the reduction in purchase orders issued.	5.	Correct based on the information provided.
6.	Inappropriate. Mowerson has included the cost of incoming freight in direct material cost and Tri-Star has included the cost of delivery in its price. Therefore, any differential in freight expense is accounted for in Item 7.	6.	Incorrect. Any savings or additional costs associated with freight expense will be included in Item 7.
7.	Appropriate. Any differential between the in-house cost to manufacture and the purchase cost should be accounted for in Wright's analysis.	7.	Incorrect. The correct amount should be $2,975,000 [($60.00–30.25) × 100,000]. The only relevant manufacturing costs are direct material ($24.00) and variable overhead ($6.25) as fixed overhead will continue to be incurred irrespective of the decision and direct labor costs have already been considered as a savings in Item 1.
8.	Appropriate. The junior engineer represents an addition to the staff.	8.	Correct based on the information provided.
9.	Appropriate. The quality control inspector represents an addition to the staff.	9.	Correct based on the information provided.
10.	Appropriate. The increase in the safety stock represents additional cost to Mowerson.	10.	Incorrect. Mowerson currently maintains a safety stock of 1,800 boards so a more correct amount is $4,800 as calculated below. However, the correct safety stock level really cannot be determined without knowing the consequences of a stockout, i.e., the cost of a stockout must be compared to the additional storage cost.

Percentage of Time Tri-Star Deliveries Will be Late	Probability (1)	Safety Stock of PCBs (2)	Expected Value (1) × (2)
4%	.30	2,500	750
6%	.40	4,000	1,600
8%	.25	6,000	1,500
10%	.05	7,000	350

New safety stock level	4,200
Current level	1,800
Increase in safety stock	2,400
Cost per unit	$2
Additional cost	$4,800

c. In evaluating its manufacturing decision, Mowerson should consider information about Tri-Star's:

- financial stability
- credit rating
- reputation for product quality and ability to meet quoted deliveries
- potential price increases in the future
- capacity levels
- competition, i.e., other potential sources of supply besides Tri-Star.

Case 2–3: Solution to Puttmaster (60 minutes)
[Opportunity cost of lost sales]

The profit-maximizing number of infomercials requires trading off the additional sales of Puttmasters sold via infomercials against the cost of the infomercials and the cost of the lost sales from retail outlets. Each Puttmaster sold via the infomercial yields the following contribution margin:

Selling price	$69.95
Shipping and handling fee	15.95
Total revenue	$85.90
Less:	
Manufacturing cost	9.55
Shipping	5.80
Answering fee	2.00
Contribution margin	$68.55

Innovative Sports' contribution margin for each unit sold to the distributor is:

Selling price	$30.85
Less:	
Manufacturing cost	9.55
Contribution margin	$21.30

Since every 10 Puttmasters sold via infomercials reduces retail store sales by two units, 10 infomercials cause $42.60 (2 × $21.30) of lost contribution margin from retail sales. Therefore, each infomercial sale has an opportunity cost of $4.26 ($42.60 ÷ 10). Hence, the net contribution margin of each infomercial sale is:

Contribution margin	$68.55
Less:	
Contribution margin (retail sale)	4.26
Net contribution margin	$64.29

To breakeven on each infomercial, Innovative Sports must sell 13,143 Puttmasters ($845,000 ÷ $64.29).

The following table calculates the expected number of Puttmasters to be sold from repeated showings of the infomercial assuming that each showing generates 90 percent of unit sales as the previous showing.

Showing Number	Units Sold
1	22,000
2	19,800
3	17,820
4	16,038
5	14,434
6	12,990

Innovative Sports will want to continue to purchase infomercial TV spots as long as each 30-minute spot continues to produce total contribution margin in excess of the infomercial's cost ($845,000) after taking into account the affect of the infomercial on reducing retail sales. From the above table, we see that five infomercials produce sales in excess of the 13,143 breakeven point. Therefore, the profit-maximizing number of infomercials is five.

The following table confirms this conclusion.

Infomercial Number	Units Sold	Total Contribution	Cost of Infomercial	Profit from Infomercial	Cumulative Profit
1	22,000	$1,414,380	$845,000	$569,380	$569,380
2	19,800	1,272,942	845,000	427,942	997,322
3	17,820	1,145,648	845,000	300,648	1,297,970
4	16,038	1,031,083	845,000	186,083	1,484,053
5	14,434	927,975	845,000	82,975	1,567,028
6	12,991	835,177	845,000	-9,823	1,557,205
7	11,692	751,660	845,000	-93,340	1,463,864
8	10,523	676,494	845,000	-168,506	1,295,358
9	9,470	608,844	845,000	-236,156	1,059,202

Cumulative profits reach a maximum at five infomercials.