Accounting for Decision Making and Control 10th edition Zimmerman Test Bank

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Chapter 02 Test Bank – Static Key

Multiple Choice Questions

1. Opportunity Costs:

A. must never be negative
B. may be found in financial statements (annual report)
C. reflect the benefit of the next best alternative
D. are pecuniary in nature
E. none of the above

Opportunity costs reflect the benefit of the next best alternative. They may be negative, and may include non-pecuniary elements.

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Remember
Difficulty: 1 Easy
Topic: Characteristics of Opportunity Costs

2. John invested $12,000 in the stock of Hyper Cyber. Eight years later, Hyper Cyber's shares reached $125,000, but John held onto the shares in the belief that their price would double in the next five years. Unfortunately, Hyper Cyber did not double. Instead, the market value of John's shares today is $4,000. If the shares were sold and the proceeds invested in another investment, they would likely earn 5% per annum. Which of the following terms and values is correct?

A. $125,000 is the opportunity cost of selling the shares today
B. $12,000 is a sunk cost
C. $125,000 is a sunk cost and is not relevant
D. $6,250 is the opportunity cost of not selling the shares earlier
E. None of the above

The original purchase price of the shares is a sunk cost, and cannot be changed by subsequent decisions.

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Examples of Decisions Based on Opportunity Costs

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3. Which of the following can be an opportunity cost?

A. Interest on cost of inventory
B. Cost of idle capacity
C. Cost of underutilized labor
D. The decline in an asset's value
E. All of the above

All are examples of opportunity cost.

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Examples of Decisions Based on Opportunity Costs

4. Davos Inc. makes fiberglass ski-boards in Switzerland. Identify the correct matching of terms.

A. Fiberglass is factory overhead
B. Plant real estate taxes are a period cost
C. Depreciation on delivery trucks is a product cost
D. Payroll taxes for workers in the Packaging Department are direct labor
E. None of the above

Payroll taxes for these workers are direct labor. Fiberglass is direct material. Plant real estate taxes are factory overhead. Depreciation on delivery costs is a period cost.

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Understand
Difficulty: 2 Medium
Topic: Direct Costs, Overhead Costs, and Opportunity Costs
Topic: Period versus Product Costs

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5. Pamela in Bamplona makes bull-repellent scent according to a traditional Spanish recipe, which normally sells at €9 (Euros) per unit. Normal production volume is 10,000 ounces per month. Average cost is €5 per ounce, of which €2 is direct material and €1 is variable conversion cost. This product is seasonal. After July, demand for this product drops to 6,000 ounces monthly. In November, Umberto offers to buy 1,800 ounces for €8,100.

If Pamela accepts the order, she must design a special label for Umberto at a cost of €800. Each label will cost 30 cents to make and apply. Pamela should:

A. accept the order, at a gain of €625
B. reject the order, at a loss of €1,875
C. reject the order, at a loss of €2,375
D. accept the order, at a gain of €1,360
E. reject the order, the new selling price is less than the average cost per ounce

Selling price	€ 4.50
Less: Variable cost	− 3.00
Less: Label	− 0.30
Contribution margin per unit	1.20
Times Number of units	1,800
Total Contribution margin	€ 2,160
− Direct fixed costs (design)	− 800
Increase in total contribution margin	€ 1,360

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Copier Example
Topic: Fixed, Marginal, and Average Costs

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6. Pamela in Bamplona makes bull-repellent scent according to a traditional Spanish recipe, which normally sells at €9 (Euros) per unit. Normal production volume is 10,000 ounces per month. Average cost is €5 per ounce, of which €2 is direct material and €1 is variable conversion cost. This product is seasonal. After July, demand for this product drops to 6,000 ounces monthly. In November, Umberto offers to buy 1,800 ounces for €8,100. If Pamela accepts the order, she must design a special label for Umberto at a cost of €800. Each label will cost 30 cents to make and apply.

Now assume that the order is received in July, peak season. If Pamela accepts the order, she will turn away regular customers who order 800 ounces. Pamela should:

A. reject the order, which loses €1,875
B. reject the order as it is less than her cost
C. accept the order if Umberto raises the price higher than €6.41/ounce
D. accept the order if Umberto raises the price higher than €7.41/ounce
E. accept the order if Umberto raises the price by at least $1/ounce

Accepting Umberto's order increases total contribution margin by €1,360. However, turning away regular orders loses total contribution margin of €4,800.

Selling price	€ 9.00	
− Variable cost	− 3.00	normal
Contribution margin per unit	€ 6.00	
Number of units lost	800	ounces
Lost contribution margin	€ 4,800	

Thus the total order price must be increased to at least cover the net loss of €3,440, (€4,800 − €1,360). This net loss divided by 1,800 ounces in the order, requires a price increase of at least €1.91 per unit, giving a minimum price of €6.41.

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Copier Example
Topic: Fixed, Marginal, and Average Costs

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7. Francois French manufactures cheese, which he normally sells at €20/kg, on which sales commission of 5% is paid. Plant capacity is 7,500 kg/month. Income tax is levied at 30%.

Fixed costs		Costs per kg.	
Plant depreciation	€ 8,000	Direct materials	€ 4
Other plant costs	15,000	Direct labor	2
Corporate salaries	10,000	Var. factory O/H	3
Advertising	3,000		

The number of kilograms to sell to break-even is:

A. 3,273
B. 3,600
C. 3,000
D. 2,300
E. none of the above

Break-even quantity = Total Fixed Costs/Contribution margin per unit
= €36,000/€10 = 3,600 kgs

Contribution margin per unit = Price − (Dir Mat + Dir Lab + Var OH) − Sales commission
= €20 − (€4 + €2 + €3) − 5% × €20 = €10

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example

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8. Francois French manufactures cheese, which he normally sells at €20/kg, on which sales commission of 5% is paid. Plant capacity is 7,500 kg/month. Income tax is levied at 30%.

Fixed costs		Costs per kg.	
Plant depreciation	€ 8,000	Direct materials	€ 4
Other plant costs	15,000	Direct labor	2
Corporate salaries	10,000	Var. factory O/H	3
Advertising	3,000		

If sales are 5,000 kgs, which of the following is true?

A. Total contribution margin is €50,000
B. Ratio of total contribution margin to net income before taxes is 3.57
C. Taxes payable are €4,200
D. Operating leverage is 42%
E. All of the above

Total contribution margin (€10 CM × 5,000 kgs)	€ 50,000
− Total fixed cost	− 36,000
Net income before tax	€ 14,000
− Tax @ 30%	− 4,200
Net income after tax	€ 9,800

Ratio of total contribution margin to net income before taxes = €50,000/€14,000 = 3.57

Operating leverage = Total fixed cost/Total cost = €36,000/[5,000 kgs × €10 + €36,000] = 42%.

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Copier Example
Topic: Operating Leverage

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9. Francois French manufactures cheese, which he normally sells at €20/kg, on which sales commission of 5% is paid. Plant capacity is 7,500 kg/month. Income tax is levied at 30%.

Fixed costs		Costs per kg.	
Plant depreciation	€ 8,000	Direct materials	€ 4
Other plant costs	15,000	Direct labor	2
Corporate salaries	10,000	Var. factory O/H	3
Advertising	3,000		

Francois French wants to increase after-tax profits to €35,000. Assuming sufficient demand, which strategy achieves this goal?

A. Sell 7,100 kgs at the present price
B. Pay the dairy €1/kg less and sell 7,500 kgs
C. Sell 8,000 kgs at €20.79/kg
D. Sell 7,500 kgs at the present price and eliminate the sales commission
E. None of the above

While choice c meets the profit target, it exceeds plant capacity. To generate an after tax profit of €35,000 require a before-tax profit of €50,000 (€35,000/.7). So to cover the fixed costs of €36,000 and the after-tax profits of €50,000, the total contribution margin must be €86,000. If the price were set at 20.79 (and assuming you can sell 8,000 kgs at this price) then €20.79 − (€4 + €2 + €3) − €1.04 = €10.75 × 8,000 = €86,000.

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 2 Medium
Topic: Calculating Break-Even and Target Profits

10. The Mojave Water Agency (MWA) sets water policy and water rates for a desert area that faces a severe water shortage. It has 200,000 customers who are charged $100 per month for the first 20,000 cubic feet (cu.ft) and 1 cent per cu.ft thereafter. The average customer bill is $200 per month. It costs the agency ¼ cent per cu.ft to monitor and bill for usage. The MWA wants to cut costs by replacing metered billing with a flat fee which would be added to each property owner's real estate tax bill. Which is true?

A. The proposed policy will be more expensive to operate and will lead to decreased water usage
B. The proposed policy will be cheaper to operate and will lead to increased water usage
C. The proposed policy will be cheaper to operate and will lead to decreased water usage
D. The most that the MWA should pay the County Real Estate Department for handling the proposed billing process is $6,000,000
E. mostly B and D above

The cost of operating the metering, billing and collecting system would be reduced to the fee charged by the County Real Estate Department. For the customer, the bill will be the same regardless of usage, thus usage will increase. It costs the MWA $75 per customer per month to monitor and bill. The most it should pay is the sum that makes it indifferent between doing the billing itself and assigning those responsibilities to the County.

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Analyze
Difficulty: 3 Hard
Topic: Fixed, Marginal, and Average Costs

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11. Hardley sells mamburgers. He faces fixed costs of $18,000 per month and variable production and marketing costs of $2.50 per mamburger. Market research has developed the following demand schedule.

Price	Qty
14	5,000
12	7,000
10	8,000
8	10,000

Which price/volume combination should Hardley choose?

A. Price: $14; Quantity: 5,000
B. Price: $12; Quantity: 7,000
C. Price: $10; Quantity: 8,000
D. Price: $8; Quantity: 10,000
E. Unable to determine

Price	Qty	CM/unit	TCM
14	5,000	11.50	$ 57,500
12	7,000	9.50	$ 66,500
10	8,000	7.50	$ 60,000
8	10,000	5.50	$ 55,500

Hardley should choose the price/volume combination that maximizes total contribution margin (TCM). Selling 7,000 mamburgers at $12, with CM of $9.50, yields TCM of $66,500.

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Copier Example

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12. Bertie's Burritos, a fast food enterprise, wants to understand his cost structure. He collected data, which appears below, to analyze costs using the high-low method.

Month	Volume	Total costs
January	5,000	$2,700
February	7,000	$3,700
March	6,000	$3,400

Which is true?

A. Estimated variable costs are 70 cents per burrito
B. Fixed costs cannot be estimated
C. Estimated fixed costs are $200
D. Total costs at volume of 8,000 are estimated at $4,200
E. C and D only

Using the high-low method, going from 5,000 burritos to 7,000 burritos increases total cost by $1,000. So, each of these additional 2,000 burritos cost $1,000. Hence, each of these burritos have an average variable cost of $0.50. We can plug in the variable cost of $0.50 per burrito into one of the cost functions and solve for fixed cost (FC):

While it is arithmetically true that total costs at volume of 8,000 are estimated at $4,200, 8,000 lies outside the relevant range, defined by the range of data collected. Cost behavior outside the relevant range has not been studied.

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Blooms: Understand
Difficulty: 3 Hard
Topic: Fixed, Marginal, and Average Costs
Topic: Linear Approximations

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Essay Questions

13. Fixed, Variable, and Average Costs

Midstate University is trying to decide whether to allow 100 more students into the university. Tuition is $5,000 per year. The controller has determined the following schedule of costs to educate students:

Number of Students	Total costs
4,000	$ 30,000,000
4,100	30,300,000
4,200	30,600,000
4,300	30,900,000

The current enrollment is 4,200 students. The president of the university has calculated the cost per student in the following manner: $30,600,000/4,200 students = $7286 per student. The president was wondering why the university should accept more students if the tuition is only $5,000.

Required:
a. What is wrong with the president's calculation?
b. What are the fixed and variable costs of operating the university?

Feedback:
a. The president of the university has calculated the average cost of each student. If the decision is to add more students, the president should be looking at the marginal cost of another student. The marginal cost can be approximated by the variable cost as long as the university is below capacity.
b. The cost of adding 100 students is $300,000. Therefore, the variable cost per unit is $300,000/100, or $3,000/student.

AACSB: Analytical Thinking
AACSB: Communication
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Blooms: Understand
Difficulty: 3 Hard
Topic: Fixed, Marginal, and Average Costs

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14. The Elements of Cost Volume Profit

The M Company's variable costs are 75% of the sales price per unit and their fixed costs are $240,000. If the company earned $60,000 before taxes in selling 150,000 units, what was the sales price per unit?

Feedback:
Variable cost per unit = 75% price per unit
Or, V = 0.75 P
Before-tax profit = Total contribution margin less Fixed costs
$60,000 = 150,000 × (P − V) − FC
$60,000 = 150,000 × (P − 0.75P) − $240,000
$300,000 = 150,000 × 0.25P
$300,000 = 37,500 P
P = $8.00

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Apply
Difficulty: 3 Hard
Topic: Linear Approximations

15. Opportunity Costs

The First Church has been asked to operate a homeless shelter in part of the church. To operate a homeless shelter the church must hire a full time employee for $1,200/month to manage the shelter. In addition, the church would have to purchase $400 of supplies/month for the people using the shelter. The space that would be used by the shelter is rented for wedding parties. The church averages about 5 wedding parties a month that pay rent of $200 per party. Utilities are normally $1,000 per month. With the homeless shelter, the utilities will increase to $1,300 per month. If the Church operates the homeless shelter, it receives a cash grant of $1,500 from the city.

What is the opportunity cost to the church of operating a homeless shelter in the church?

Feedback:
The monthly opportunity cost of operating a homeless shelter is:

Full-time employee	$ 1,200
Supplies	400
Use of space (forgone revenue: 5 parties × $200/party)	1,000
Increase in utilities $1,300 - $1,000	300
Less: Cash grant	(1,500)
Total	$ 1,400

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Apply
Difficulty: 3 Hard
Topic: Characteristics of Opportunity Costs
Topic: Opportunity Costs

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16. Fixed and Variable Costs:

The university athletic department has been asked to host a professional basketball game at the campus sports center. The athletic director must estimate the opportunity cost of holding the event at the sports center. The only other event scheduled for the sports center that evening is a fencing match that would not have generated any additional costs or revenues. The fencing match can be held at the local high school, but the rental cost of the high school gym would be $200. The athletic director estimates that the professional basketball game will require 20 hours of labor to prepare the building. Clean-up depends on the number of spectators. The athletic director estimates the time of clean-up to be 2 minutes per spectator. The labor would be hired especially for the basketball game and would cost $16 per hour. Utilities will be $500 greater if the basketball game is held at the sports center. All other costs would be covered by the professional basketball team.

Required:
a. What is the variable cost of having one more spectator?
b. What is the opportunity cost of allowing the professional basketball team to use the sports center if 10,000 spectators are expected?
c. What is the opportunity cost of allowing the professional basketball team to use the sports center if 12,000 spectators are expected?

Feedback:
a. The variable cost of one more spectator is the cost of clean-up:
(2 minutes/60 minutes/hour)($16/hour) = $0.5333

b. The opportunity cost with 10,000 spectators is:

Cost of relocating the fencing match	$ 200
Cost of labor for preparation (20 hours)($16/hour)	320
Cost of additional utilities	500
Cost of clean-up (10,000)($0.53333)	5,333
Total	$ 6,353

c. The opportunity cost with 12,000 spectators is:

Cost of relocating the fencing match	$ 200
Cost of labor for preparation (20 hours)($16/hour)	320
Cost of additional utilities	500
Cost of clean-up (12,000)($0.53333)	6,400
Total	$ 7,420

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Apply
Difficulty: 3 Hard
Topic: Characteristics of Opportunity Costs
Topic: Fixed, Marginal, and Average Costs
Topic: Opportunity Costs

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17. Opportunity Cost of Attracting Industry

The Itagi Computer Company from Japan is looking to build a factory for making Wi-Fi routers in the United States. The company is concerned about the safety and well-being of its employees and wants to locate in a community with good schools. The company also wants the factory to be profitable and is looking for subsidies from potential communities. Encouraging new business to create jobs for citizens is important for communities, especially communities with high unemployment.
Wellville has not been very well since the shoe factory left town. The city officials have been working on a deal with Itagi to get the company to locate in Wellville. Itagi officials have identified a 20 acre undeveloped site. The city has tentatively agreed to buy the site for $50,000 for Itagi and not require any payment of property taxes on the factory by Itagi for the first five years of operation. The property tax deal will save Itagi $3,000,000 in taxes over the five years. This deal was leaked to the local newspaper. The headlines the next day were: "Wellville Gives Away $3,000,000 + to Japanese Company".

Required:
a. Do the headlines accurately describe the deal with Itagi?
b. What are the relevant costs and benefits to the citizens of Wellville of making this deal?

Feedback:
a. The headlines are not an accurate portrayal of the deal with Itagi. The analysis should consider the alternative of not having Itagi come to town. Compared to the alternative, Wellville is only paying $50,000 to buy the land and losing the property taxes on 20 acres of undeveloped land, which is probably quite small.
b. The opportunity benefits to the town of Wellville include increased jobs and increased property taxes after the first five years. The opportunity costs include increased congestion and the cost of increased city services. The problems associated with becoming a larger community should also be considered.

AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Understand
Difficulty: 2 Medium
Topic: Characteristics of Opportunity Costs
Topic: Fixed, Marginal, and Average Costs
Topic: Opportunity Costs

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18. Cost, Volume, Profit Analysis

With the possibility of the US Congress relaxing timber cutting restrictions, a local lumber company is considering an expansion of its facilities. The company believes it can sell lumber for $0.18/board foot. A board foot is a measure of lumber. The tax rate for the company is 30 percent. The company has the following two opportunities:

• Build Factory A with annual fixed costs of $20 million and variable costs of $0.10/board foot. This factory has an annual capacity of 500 million board feet.
• Build Factory B with annual fixed costs of $10 million and variable costs of $0.12/board foot. This factory has an annual capacity of 300 million board feet.

Required:
a. What is the break-even point in board feet for Factory A?
b. If the company wants to generate an after tax profit of $2 million with Factory B, how many board feet would the company have to process and sell?
c. If demand for lumber is uncertain, which factory is riskier?
d. At what level of board feet would the after-tax profit of the two factories be the same?

Feedback:
a. Break-even point of Factory A = $20,000,000/($0.18 − $0.10) = 250,000,000 board-feet
b. To achieve an after-tax profit of $2,000,000:

[$10,000,000 + ($2,000,000/(1 − 0.3))]/($0.18 − $0.12) = 214,285,717 board-feet.

c. Factory A has higher fixed costs, but lower variable costs per unit because of its larger capacity. If the demand for lumber is lower than expected, Factory A will have a more difficult time recovering its fixed costs. The break-even point for factory B is lower than the break-even point for factory A. Therefore, Factory A is the riskier investment.
d. The after-tax profits of the two factories will be the same when:

(1 − 0.3)[($0.18 − $0.10)(Quantity) − $20,000,000]
= (1 − 0.3)[($0.18 − $0.12)(Quantity) − $10,000,000]

Quantity = 500 million board feet

AACSB: Analytical Thinking
AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Decision Making
AICPA: FN Risk Analysis
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits

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19. Cost, Volume, Profit Analysis

Leslie Mittelberg is considering the wholesaling of a leather handbag from Kenya. She must travel to Kenya to check on quality and transportation. The trip will cost $3,000. The cost of the handbag is $10 and shipping to the United States can occur through the postal system for $2 per handbag or through a freight company which will ship a container that can hold up to a 1,000 handbags at a cost of $1,000. The freight company will charge $1,000 even if less than 1,000 handbags are shipped. Leslie will try to sell the handbags to retailers for $20. Assume there are no other costs and benefits.

Required:
a. What is the break-even point shipping through the postal system?
b. How many units must be sold if Leslie uses the freight company and she wants to have a profit of $1,000?
c. At what output level would the two shipping methods yield the same profit?
d. Suppose a large discount store asks to buy an additional 1,000 handbags beyond normal sales. Which shipping method should be used and what is the minimum sales price Leslie should consider in selling those 1,000 handbags?

Feedback:
a. Through the postal system, the variable cost per unit is $10 + $2 or $12. Therefore, the break-even point is:
$3,000/($20 − $12) = 375 handbags

b. The fixed costs through the freight company are $3,000 + $1,000 or $4,000 if fewer than 1,000 bags are purchased. The only variable cost is the $10 purchase cost. To make a profit of $1,000, Leslie must buy and sell: ($4,000 + $1,000)/($20 − $10) = 500 handbags

c. The two methods would yield the same profit for the following quantity of handbags:
($20 − $12)(Quantity) − $3,000 = ($20 − $10)(Quantity) − $4,000
Quantity = 500 handbags

d. The 1,000 handbags will be most cheaply transported by container. Leslie's trip expenses of $3,000 will occur anyway, so they are not relevant for pricing the special order. The incremental cost of the additional 1,000 handbags is the cost of the container ($1,000) and the purchase cost of the handbags ($10/handbag)(1,000 handbags) or a total of $11,000. If the special order has no other effect on long term sales, then Leslie should accept a sales price above the $11,000 incremental cost, or above $11 per bag.

AACSB: Analytical Thinking
AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits

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20. Multiple Product Cost Volume Profit

A company sells three products as shown below:

	Product X	Product Y	Product Z	Total
Units	60,000	140,000	50,000	250,000
Sales	$ 90,000	$ 150,000	$ 60,000	$ 300,000
Variable Costs	$ 63,000	$ 93,000	$ 19,000	$ 175,000
Contribution Margin				$ 125,000
Fixed Costs				$ 100,000

These three products all always sold in fixed proportions. In other words, Product X always accounts for 24% of total sales (60,000/250,000), Product Y always accounts for 56% of total sales (140,000/250,000), and Product Z always accounts for 20% of total sales (50,000/250,000).

Required:

a. How many units of each product need to be sold to break-even?
b. How many units of each product must be sold if the company wants to have a profit of $50,000?

Feedback:

a.
Weighted Contribution Margin per Unit = $125,000/250,000 = $0.50

$100,000 fixed costs/$0.50 weighted Contribution Margin per unit
= 200,000 units in total to break-even

X = 60,000/250,000 = 24% of total units sold
0.24 × 200,000 = 48,000 units

Y = 140,000/250,000 = 56% of total units sold
0.56 × 200,000 = 112,000 units

Z = 50,000/250,000 = 20% of total units sold
0.20 × 200,000 = 40,000 units

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b.
Weighted Contribution Margin per Unit = $125,000/250,000 = $0.50

($100,000 fixed costs + $50,000 target profit) / $0.50 weighted Contribution Margin per unit = 300,000 units in total to earn $50,000

X = 60,000/250,000 = 24% of total units sold
0.24 × 300,000 = 72,000 units

Y = 140,000/250,000 = 56% of total units sold
0.56 × 300,000 = 168,000 units

Z = 50,000/250,000 = 20% of total units sold
0.20 × 200,000 = 60,000 units

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example
Topic: Multiple Products

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21. Make or Buy

A company needs 10,000 units of a component used in producing one of its products. The latest internal accounting reports show that the per unit manufacturing cost to be $150.00, variable manufacturing costs of $110.00 and fixed manufacturing cost of $40. The company recently received an offer from another manufacturer to produce the component for $144.00. If it buys the component on the outside, 40% of the fixed manufacturing cost can be avoided.

Required:
a. If the company buys the component from the outside supplier at $144.00, what is the impact on income?
b. What price would make the company indifferent between making the component internally and having the outside supplier make it?

Feedback:
a. $18,000 ($18.00 per unit more costly to buy on the outside × 10,000 units)

	Make	Buy
Variable Manufacturing Costs	$ 110.00	$ 0.00
Fixed Manufacturing Cost avoided	$ 0.00	$ (16.00)
Purchase Price	$ 0.00	$ 144.00
Total	$ 110.00	$ 128.00

b. $126.00

	Make	Buy
Variable Manufacturing Costs	$ 110.00	$ 0.00
Fixed Manufacturing Cost avoided	$ 0.00	$ (16.00)
Purchase Price	$ 0.00	$ 126.00
Total	$ 110.00	$ 110.00

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Apply
Difficulty: 3 Hard
Topic: Linear Approximations

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22. Cost, Volume, Profit Analysis

Easy Go Company manufactures a line of electric garden tools that are sold in general hardware stores. The company's controller, Amy Tait, has just received the sales forecast for the coming year for Easy Go's three products: weeders, hedge clippers, and leaf blowers. Easy Go has experienced considerable variations in sales volumes and variable costs over the past two years, and Harlow believes the forecast should be carefully evaluated from a cost-volume-profit viewpoint. The preliminary budget information for the next year is presented below.

	Weeders	Hedge Clippers	Leaf Blowers
Unit sales	50,000	50,000	100,000
Unit selling price	$ 28.00	$ 36.00	$ 48.00
Variable manufacturing cost per unit	13.00	12.00	25.00
Variable selling cost per unit	5.00	4.00	6.00

For the next year, Easy Go's fixed factory overhead is budgeted at $2 million, and the company's fixed selling and administrative expenses are forecast to be $600,000. Easy Go has a tax rate of 40 percent.

Required:

a. Determine Easy Go Co.'s budgeted net income for next year.
b. Assuming that the sales mix remains as budgeted, determine how many units of each product Easy Go must sell in order to break even next year.
c. Determine the total dollar sales Easy Go must sell next year in order to earn an after-tax net income of $450,000.
d. After preparing the original estimates, Easy Go determines that its variable manufacturing cost of leaf blowers will increase 20 percent and the variable selling cost of hedge clippers can be expected to increase $1 per unit. However, Easy Go has decided not to change the selling price of either product. In addition, Easy Go learns that its leaf blower is perceived as the best value on the market, and it can expect to sell three times as many leaf blowers as any other product. Under these circumstances, determine how many units of each product Easy Go will have to sell to break even in next year.
e. Explain the limitations of cost-volume-profit analysis that Amy Tait should consider when evaluating Easy Go's next year's budget.

Feedback:
a. Easy Go Co.'s budgeted net income for next year

Easy Go Company
Budgeted Net Income for Next Year

	Weeders	Hedge Clippers	Leaf Blowers	Total
Unit selling price	$ 28.00	$ 36.00	$ 48.00	
Variable manufacturing cost	$ 13.00	$ 12.00	$ 25.00	
Variable selling cost	5.00	4.00	6.00	
Total variable costs	$ 18.00	$ 16.00	$ 31.00	
Contribution margin	$ 10.00	$ 20.00	$ 17.00	
Unit sales	50,000	50,000	100,000	
Total Contribution	$ 500,000	$1,000,000	$ 1,700,000	$ 3,200,000

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Fixed factory overhead	2,000,000
Fixed selling and administrative expense	600,000
Total fixed costs	2,600,000
Income before taxes	600,000
Income taxes @ 40%	240,000
Budgeted net income	$ 360,000

b. The number units of each product Easy Go must sell in order to break even next year:

	Unit Contribution	Sales Proportion	Proportional Contribution
Weeders	$ 10.00	0.25	$ 2.50
Hedge Clippers	20.00	0.25	5.00
Leaf Blowers	17.00	0.50	8.50
Proportional contribution margin/bundle			$ 16.00

$$\text{Total unit sales to break-even} = \frac{\text{Total fixed costs}}{\text{Proportional contribution}}$$

$$= \frac{\$2,600,000}{\$16}$$

$$= 162,500 \text{ units}$$

	Sales Proportion	Total Unit Sales	Product Line Sales
Weeders	0.25	162,500	40,625
Hedge Clippers	0.25	162,500	40,625
Leaf Blowers	0.50	162,500	81,250

c. Total dollar Easy Go must sell next year in order to earn an after-tax net income of $450,000

	Selling Price	Sales Proportion	Proportional Selling Price
Weeders	$ 28.00	0.25	$ 7.00
Hedge Clippers	36.00	0.25	9.00
Leaf Blowers	48.00	0.25	24.00
Proportional selling price			$ 40.00

$$\text{Contribution margin rate} = \frac{\text{Proportional contribution}}{\text{Proportional selling price}}$$

$$= \frac{\$16}{\$40}$$

$$= 40 \text{ percent}$$

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$$\text{Total dollar sales} = \frac{\text{Fixed costs + After-tax income} \div (1 - \text{tax rate})}{\text{Contribution margin rate}}$$

$$= \frac{\$2{,}600{,}000 + \dfrac{\$450{,}000}{0.6}}{0.4}$$

$$= \frac{\$3{,}350{,}000}{0.4}$$

$$= \$8{,}375{,}000$$

d. The Number of units of each product Easy Go will have to sell to break even in next year:

	Unit Contribution	Sales Proportion	Proportional Contribution
Weeders	$ 10.00	0.20	$ 2.00
Hedge Clippers[1]	19.00	0.20	3.80
Leaf Blowers[2]	12.00	0.60	7.20
Total proportional contribution margin			$ 13.00

$$\text{Total unit sales to break-even} = \frac{\text{Total fixed costs}}{\text{Proportional contribution}}$$

$$= \frac{\$2{,}600{,}000}{\$13}$$

$$= 200{,}000 \text{ units}$$

	Sales Proportion	Total Unit Sales	Product Line Sales
Weeders	0.20	200,000	40,000
Hedge Clippers	0.20	200,000	40,000
Leaf Blowers	0.60	200,000	120,000

1. Variable selling costs increase; thus the unit contribution decreases to $19 [$36 − ($12 + 4 + 1)].
2. The variable manufacturing cost increase 20 percent; thus, the unit contribution decreases to $12 [$48 − (1.2 × 25) − 6].

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e. Amy Tait should consider the following limitations when using cost-volume-profit analysis to evaluate Easy Go Company's budget. This type of analysis assumes that:

- all costs are either fixed or variable or can be broken down into fixed and variable components.
- all costs are linear in the relevant range, i.e., variable costs change in total with a change in activity and fixed costs remain the same at all levels of output and sales in the relevant range.
- sales prices will not change and sales demand is unlimited at the unit selling prices.

AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example
Topic: Limitations of Cost-Volume-Profit Analysis
Topic: Multiple Products

23. Break-even and Cost-Volume-Profit with Taxes

DisKing Company sells used DVDs on line. The projected after-tax net income for the current year is $120,000 based on a sales volume of 200,000 DVDs. DisKing has been selling the disks at $16 each. The variable costs consist of the $10 unit purchase price of the disks and a handling cost of $2 per disk. DisKing's annual fixed costs are $600,000 and DisKing is subject to a 40 percent income tax rate.

Required:
a. Calculate DisKing Company's break-even point for the current year in number of DVDs.
b. Calculate the increased after-tax income for the current year if projected unit sales volume increase 10 percent.
c. Management expects that the price DisKing pays for used DVDs to increase 30 percent next year. If the unit selling price remains at $16, calculate the volume of sales in dollars that DisKing Company must achieve in the coming year to maintain the same after-tax net income as projected for the current year.

Feedback:
a.

$$\text{Break-even} = \frac{\$600{,}000}{\$16 - 12} = 150{,}000 \text{ DVDs}$$

b.

Sales 200,000 × 16 × 1.1	$ 3,520,000
Variable Costs 200,000 × 12 × 1.1	(2,640,000)
Fixed Costs	(600,000)
Net income before tax	280,000
Taxes (40%)	(112,000)
Net income after taxes	168,000
Net income @ 200,000 units	120,000
Increase in net income	$ 48,000

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c. Let Q = unit sales. Then,

$$(16Q - 1.3 \times 10Q - 2Q - 600{,}000)\,(60\%) = 120{,}000$$
$$Q - 600{,}000 = 200{,}000$$
$$Q = 800{,}000$$
$$PQ = \$16 \times 800{,}000 = \$12{,}800{,}000$$

AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example
Topic: Limitations of Cost-Volume-Profit Analysis

24. Cost-Volume-Profit of a Make/Buy Decision

Telly Industries is a multiproduct company that currently manufactures 30,000 units of Part MR24 each month. The facilities now being used to produce Part MR24 have a fixed monthly cost of $150,000 and a capacity to produce 84,000 units per month. If Telly were to buy Part MR24 from an outside supplier, the facilities would be idle, but its fixed costs would continue at 40 percent of its present amount. The variable production costs of Part MR24 are $11 per unit.

Required:
a. If Telly Industries continues to use 30,000 units of Part MR24 each month, it would realize a net benefit by purchasing Part MR24 from an outside supplier only if the supplier's unit price is less than how much?
b. If Telly Industries can obtain Part MR24 from an outside supplier at a unit purchase price of $12.875, what is the monthly usage at which it will be indifferent between purchasing and making Part MR24?

Feedback:

a. Each month Telly incurs $150,000 of fixed cost to have capacity to produce 84,000 units. They are only using 30,000 units of that capacity now. If they outsource MR24, they will continue to incur 40% of the fixed costs, or $60,000. However, they save $90,000 ($150,000 − $60,000). Besides saving the fixed costs they save $330,000 of variable costs ($11 × 30,000) or a total cost savings of $420,000. To be indifferent between outsourcing and continuing to produce, the outside price must be $14 ($420,000 ÷ 30,000). An alternative way to solve the problem and get the same answer is:

$$\text{Outside Price} + \frac{\text{40\% of Fixed Cost}}{\text{30,000 Units}} = \text{Variable cost} + \frac{\text{Fixed Cost}}{\text{30,000 Units}}$$

$$P = \$11 + \frac{\$150{,}000}{30{,}000} - \frac{\$150{,}000 \times 40\%}{30{,}000} = \$14.00$$

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b.

$$\$12.875 + \frac{40\% \text{ of Fixed Cost}}{\text{Q Units}} = \$11 + \frac{\$150{,}000}{\text{Q Units}}$$

$12.875Q + $60,000 = $11Q + $150,000
$1.875Q = $90,000
Q = 48,000 units

AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example
Topic: Limitations of Cost-Volume-Profit Analysis

25. Opportunity Cost of Purchase Discounts and Lost Sales

Spring Company manufactures hard drives for computer manufacturers. At the beginning of this year Spring began shipping a much-improved hard drive, Model W899. The W899 was an immediate success and accounted for $5 million in revenues for Spring this year. While the W899 was in the development stage, Spring planned to price it at $130. In preliminary discussions with customers about the W899 design, no resistance was detected to suggestions that the price might be $130. The $130 price was considerably higher than the estimated variable cost of $70 per unit to produce the W899, and it would provide Spring with ample profits.
Shortly before setting the price of the W899, Spring discovered that a competitor had a product very similar to the W899 and was no more than 60 days behind Spring's own schedule. No information could be obtained on the competitor's planned price, although it had a reputation for aggressive pricing. Worried about the competitor, and unsure of the market size, Spring lowered the price of the W899 to $100. It maintained the price although, to Spring's surprise, the competitor announced a price of $130 for its product.
After reviewing the current year's sales of the W899, Spring's management concluded that unit sales would have been the same if the product had been marketed at the original price of $130 each. Management has predicted that next year's sales of the W899 would be either 85,000 units at $100 each or 60,000 units at $130 each. Spring has decided to raise the price of the disk drive to $130 effective immediately.
Having supported the higher price from the beginning, Sharon Haley, Spring's marketing director, believes that the opportunity cost of selling the W899 for $100 should be reflected in the company's internal records and reports. In support of her recommendation, Haley explained that the company has booked these types of costs on other occasions when purchase discounts not taken for early payment have been recorded.

Required:
a. Define *opportunity cost* and explain why opportunity costs are not usually recorded.
b. What is the current year's opportunity cost?
c. Explain the impact of Spring Company's selection of the $130 selling price for the W899 on next year's operating income. Support your answer with appropriate calculations.

Feedback:
a. Opportunity cost is defined as the profit that could have been realized if a particular action was not chosen.
Opportunity costs occur because a firm is faced with alternative uses of resources.
Opportunity costs are not ordinarily incorporated in formal accounting systems because

- they do not involve cash receipts or outlays (absence of a transaction).
- the next best opportunity is often difficult to determine.
- these types of costs often are not readily measurable.

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b. Opportunity cost in the current year = Units sold × Opportunity cost per unit

$$\text{Units sold} = \frac{\text{Revenue}}{\text{Unit sale price}}$$

$$= \frac{\$5{,}000{,}000}{\$100}$$

Revenue per unit = 50,000 units sold

Variable cost per unit = 50,000 × ($130 − 100)

Contribution margin per unit = $1,500,000 opportunity cost in the current year

c. The selection of the $130 selling price for the W899 will increase Spring's next year operating income by $1,050,000. This is equal to the increase in total contribution shown in the analysis of projected sales of the W899 presented below.

	$100 Selling Price	$130 Selling Price
Revenue per unit	$ 100	$ 130
Variable cost per unit	70	70
Contribution margin per unit	$ 30	$ 60

Total contribution:

At $130 selling price 60,000 units × $60	= $3,600,000
At $100 selling price 85,000 units × $30	= 2,550,000
Net gain in total contribution	= $1,050,000

AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example
Topic: Limitations of Cost-Volume-Profit Analysis

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26. Make/Buy and the Opportunity Cost of Freed Capacity

Zelean Manufacturing uses 10 units of part KJ37 each month in the production of radar equipment. The cost to manufacture one unit of KJ37 is presented in the accompanying table.

Direct materials	$ 1,000
Materials handling (20% of direct material cost)	200
Direct labor	8,000
Manufacturing overhead	12,000
Total manufacturing cost	$21,200

Materials handling represents the direct variable costs of the receiving department and is applied to direct materials and purchased components on the basis of their cost. This is a separate charge in addition to manufacturing overhead. Zelean's annual manufacturing overhead budget is one-third variable and two-third fixed. Scott Supply, one of Zelean's reliable vendors, has offered to supply part KJ37 at a unit price of $15,000. The fixed cost of producing KJ37 is the cost of a special piece of testing equipment that ensures the quality of each part manufactured. This testing equipment is under a long-term, noncancelable lease. If Zelean were to purchase part KJ37, materials handling costs would not be incurred.

Required:
a. If Zelean purchases the KJ37 units from Scott, the capacity Zelean was using to manufacture these parts would be idle. Should Zelean purchase the parts from Scott? Make explicit any key assumptions.
b. Assume Zelean Manufacturing is able to rent all idle capacity for $25,000 per month. Should Zelean purchase from Scott Supply? Make explicit any key assumptions.
c. Assume that Zelean Manufacturing does not wish to commit to a rental agreement but could use idle capacity to manufacture another product that would contribute $52,000 per month. Should Zelean manufacture KJ37? Make explicit any key assumptions.

Feedback:
a. Cost of outside purchase:

Payment to Scott	$15,000
Continuing cost of idle capacity (12,000 × 2/3)	8,000
	$23,000
Cost if continue to make:	21,200
Incremental cost of purchase	$ 1,800

Explicit assumption: the two-thirds of the fixed manufacturing overhead ($8,000) is not a sunk cost and will still be incurred if the facility is idle.

b. Cost of outside purchase:

Payment to Scott	$15,000
Continuing cost of capacity	8,000
Lease receipts ($25,000 ÷ 10 units)	(2,500)
Net cash outlay of purchase	20,500
Cost if continue to make	21,200
Incremental cost of making	$ 700

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Explicit assumption: the two-thirds of the fixed manufacturing overhead ($8,000) is not a sunk cost and will still be incurred if the facility is idle.

c. Cost of outside purchase:

Payment to Scott	$ 15,000
Continuing cost of capacity	8,000
Contribution from new product ($52,000 ÷ 10 units)	(5,200)
Net cash outlay of purchase	$ 17,800
Cost if continue to make	21,200
Incremental cost of manufacturing	$ 3,400

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Measurement
Blooms: Apply
Difficulty: 3 Hard
Topic: Characteristics of Opportunity Costs
Topic: Examples of Decisions Based on Opportunity Costs
Topic: Opportunity Costs

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27. "Price gouging" or increased opportunity cost?

After the Iraqi invasion of Kuwait in August 1990, the world price of crude oil doubled to more than $30 per barrel in anticipation of reduced supply. Immediately, the oil companies raised the retail price on refined oil products even though these products were produced from oil purchased at the earlier, lower prices. The media charged the oil companies with profiteering and price gouging, and politicians promised immediate investigations.

Required:
Critically evaluate the charge that the oil companies profited from the Iraqi invasion. What advice would you offer the oil companies?

Feedback:
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.

AACSB: Analytical Thinking
AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
Accessibility: Screen Reader Compatible
AICPA: BB Global
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Analyze
Difficulty: 3 Hard
Topic: Characteristics of Opportunity Costs
Topic: Examples of Decisions Based on Opportunity Costs
Topic: Opportunity Costs

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28. Break-even analysis with multiple products

You are a new consultant with the Boston Group and have been sent to advise the executives of Penury Company. The company recently acquired product line L from an out-of-state concern and now plans to produce it, along with its old standby K, under one roof in a newly renovated facility. Management is quite proud of the acquisition, contending that the larger size and related cost savings will make the company far more profitable. The planned results of a month's operations, based on management's best estimates of the maximum product demanded at today's selling prices are:

	Line K		Line L		
	Amount	Per Unit	Amount	Per Unit	Total
Sales revenue	$120,000	$ 1.20	$80,000	$0.80	$200,000
Variable expense	60,000	0.60	60,000	0.60	120,000
Contribution margin	$ 60,000	$ 0.60	$20,000	0.20	80,000
Fixed expense					50,000
Net income					$ 30,000

Required:

a. Based on historical operations, K alone incurred fixed expenses of $40,000, and L alone incurred fixed expenses of $20,000. Find the break-even point in sales dollars and units for each product separately.
b. Give reasons why the fixed costs for the two products combined are expected to be less than the sum of the fixed costs of each product line operating as a separate business.
c. Assuming that for each unit of K sold, one unit of L is sold, find the break-even point in sales dollars and units for each product.
d. Assuming the sales mix is 1:3 (that is, for each unit of K sold, 3 units of L are sold), what is the breakeven in sales dollars and units for each product. Assume fixed costs remain the same.
e. Why does Penury have to sell more units and greater sales dollars of the two products when the sales mix is 1:3 rather when it is 1:1?

Feedback:

a. Break-even when products have separate fixed costs:

	Line K	Line L
Fixed costs	$ 40,000	$ 20,000
Divided by contribution margin	$ 0.60	$ 0.20
Break-even in units	66,667 units	100,000 units
Times sales price	$ 1.20	$ 0.80
Break-even 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.

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

At break-even 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 units

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

d. Break-even when the sales mix is 1:3

At break-even, total contribution margin is equal to fixed cost.

Let Q = number of K units sold at break-even

Then, 3Q = number of L units sold at break-even

$0.60 Q + $0.20 3Q = $50,000

1.20 Q = $50,000

Q = 41,667 units

3Q = 125,000 units

Product	Break-even Units	Price	Break even Sales
K	41,667	$1.20	$ 50,000
L	125,000	$0.80	$ 100,000

e. Penury has to sell more units and greater sales dollars of products K and L when the sales mix is 1:3 compared to when it 1:1 because Penury is selling more units of L which has a lower contribution margin per unit ($0.20/unit) than K ($0.60/unit)

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Multiple Products

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29. Average versus Variable Cost

Measer Enterprises produces energy-efficient light bulbs and operates in a highly competitive market in which the bulbs are sold for $4.50 each. Because of the nature of the production technology, the firm can produce only between 10,000 and 13,000 units per month, in fixed increments of 1,000 units. Measer has the following cost structure:

Production and Cost Data

	Units Produced			
	10,000	11,000	12,000	13,000
Factory cost, variable	$37,000	$40,800	$44,600	$48,400
Factory cost, fixed	9,000	9,000	9,000	9,000
Selling cost, variable	6,000	6,600	7,400	8,200
Administration, fixed	6,000	6,000	6,000	6,000
Total	$58,000	$62,400	$67,000	$71,600
Average unit cost	$ 5.80	$ 5.67	$ 5.58	$ 5.51

Required:

At what output level should the firm operate?

Feedback:

"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.

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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	$ 0.20	$ 0.19	$ 0.17	$ 0.15
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.

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Copier Example
Topic: Fixed, Marginal, and Average Costs
Topic: Linear Approximations

30. Break-even Analysis

The MedView brochure said, "Only 45 scans per month to cover the monthly equipment rental of $18,000." The footnote at the bottom of the brochure read: *"Assumes a reimbursable fee of $475 per scan."
The MedView brochure refers to a new radiology imaging system that MedView rents for $18,000 per month. A "scan" refers to one imaging session that is billed at $475 per scan. Each scan involves giving the patient a chemical injection and requires exposing and developing an X-ray negative.

Required:
a. What variable cost per scan is MedView assuming in calculating the 45-scans-per-month amount?
b. Is the MedView brochure really telling the whole financial picture? What is it omitting?

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

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

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

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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.

AACSB: Analytical Thinking
AACSB: Communication
AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
AICPA: FN Risk Analysis
Blooms: Analyze
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Fixed, Marginal, and Average Costs

31. Break-even Analysis

Exotic Roses, owned by Margarita Rameriz, provides a variety of rare rose bushes to local nurseries that sell Rameriz's roses to the end consumer (landscapers and retail customers). Rameriz grows the roses from cuttings that she has specifically cultivated for their unusual characteristics (color, size, heartiness, and resistance to disease). Margarita's roses are in great demand as evidenced by the wholesale price she charges nurseries, $15 per potted plant. Exotic Roses has the following cost structure (variable costs are per potted plant):

	Fixed Costs per Year	Variable Costs
Plant materials		$ 0.50
Pot		0.30
Labor	$ 8,000	0.70
Utilities	9,000	
Rent	7,500	
Other costs	2,500	

Required:

a. How many potted rose plants must Exotic Roses sell each year to break even?
b. If Rameriz wants to make profits of $10,000 before taxes per year, how many potted rose plants must be sold?
c. If Rameriz wants to make profits of $10,000 after taxes per year, how many potted rose plants must be sold assuming a 35 percent income tax rate?

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Feedback:
a. Fixed costs total $27,000 per year and variable costs are $1.50 per plant. The break-even 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

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits

32. Break-even Analysis

You are evaluating ways to expand an optometry practice and its earnings capacity. Optometrists perform eye exams, prescribe corrective lenses (eyeglasses and contact lenses), and sell corrective lenses. One way to expand the practice is to hire an additional optometrist. The annual cost of the optometrist, including salary, benefits, and payroll taxes, is $63,000. You estimate that this individual can conduct two exams per hour at an average price to the patient of $45 per exam. The new optometrist will work 40-hour weeks for 48 weeks per year. However, because of scheduling conflicts, patient no-shows, training, and other downtime, the new optometrist will not be able to conduct, bill, and collect 100 percent of his or her available examination time.
From past experience, you know that each eye exam drives additional product sales. Each exam will lead to either an eyeglass sale with a net profit (revenue less cost of sales) of $90 (not including the exam fee) or a contact lens sale with net profits of $65 (not including the exam fee). On average, 60 percent of the exams lead to eyeglass sales, 20 percent lead to contact lens sales, and 20 percent of the exams lead to no further sales.
Besides the salary of the optometrist, additional costs to support the new optometrist include:

Office occupancy costs	$ 1,200/year
Leased equipment	$ 330/year
Office staff	$23,000/year

Required:
In terms of the percentage of available time, what is the minimum level of examinations the new optometrist must perform to recover all the incremental costs of being hired?

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Feedback:
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 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

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

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

$$= 781.5 \text{ exams}$$

$$\text{Break even volume as a fraction of capacity} = \frac{781.5 \text{ exams}}{2 \times 40 \times 48}$$

$$= 20.3\%$$

AACSB: Knowledge Application
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Copier Example

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33. Break-even Analysis

Xtra Corporation produces and sells two models of espresso machines, Standard and Deluxe. The company records show the following monthly data relating to these two products:

	Standard	Deluxe
Selling price per unit	$ 150	$ 165
Variable production costs	$ 113	$ 128
Variable selling expense per unit	$ 23	$ 11
Expected monthly sales in units	600	1,200

The company's total monthly fixed cost is $15,000. Tax rate = 35%.

Required:
a. What is the break-even in sales dollars?
b. How much (in sales dollars) should Xtra Corporation sell to achieve an after-tax profit of $45,000?
c. If the expected monthly sales in units were divided equally between the two models (900 Standard and 900 Deluxe), would the break-even level of sales be higher, lower or the same as before (in part a)? Why?
d. The Marketing department is of the opinion that the optimal sales mix for the company is 3: 1; that is, the company sells 3 standard units for every deluxe. If so, how many units of Standard and Deluxe should Xtra sell to achieve breakeven?
e. The Marketing department is of the opinion that the optimal sales mix for the company is 3: 1; that is, the company sells 3 standard units for every deluxe. If so, how many units of Standard and Deluxe should Xtra sell to achieve an after-tax profit of $45,000

Feedback:

a.

	Standard	Deluxe	Total
Selling price per unit	$ 150	$ 165	
Units	600	1,200	
Sales in dollars	$ 90,000	$ 198,000	$ 288,000
Total variable costs	81,600	166,800	248,400
Contribution margin	8,400	31,200	39,600
Total fixed costs			15,000
Net Income			24,600

$$\text{Overall CM ratio for Xtra Corp} = \frac{\text{Total Contribution Margin}}{\text{Total Sales}}$$

$$= \frac{39,600}{288,000} = 0.1375$$

$$\text{Breakeven point in sales dollars} = \frac{\text{Fixed expenses}}{\text{Overall CM ratio}}$$

$$= \frac{15,000}{0.1375} = 109,091$$

Breakeven in sales dollars = $109,091

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b.

After-tax profit = $45,000

$$\text{Before-tax profit} = \frac{45{,}000}{1 - 0.35} = \$69{,}231$$

Sales dollars to achieve an after-tax profit of $45,000 (or a before-tax profit of $69,231

$$= \frac{15{,}000 + 69{,}231}{0.1375} = \$612{,}589$$

c.

	Standard	Deluxe
Selling price per unit	$ 150	$ 165
Contribution margin per Unit	14	26
CM ratio	0.0933	0.1576

Deluxe has a higher contribution margin per unit and a higher contribution margin ratio, so if the quantity sold of Deluxe is reduced, the breakeven quantity and breakeven sales dollars will be higher,

d.

Let X = number of units of Deluxe sold at breakeven
Then, 3X = the number of units of Standard sold at breakeven

$X \times 26 + 3X + 14 = 15{,}000$

$68 \times X = 15{,}000$

X = 220.5 = 221 = Breakeven units for Deluxe
3X = 662 = Breakeven units of Standard

e.

Let Y = number of units of Deluxe sold to achieve a profit of $45,000 after tax
Then, 3Y = the number of units of Standard sold to achieve a profit of $45,000 after tax

$Y \times 26 + 3Y \times 14 = 15{,}000 + 69{,}231$
$68Y = 84{,}231$

Y = 1,239 = number of units of Deluxe sold to achieve a profit of $45,000 after tax
Then, 3Y = 3,716 the number of units of Standard sold to achieve a profit of $45,000 after tax

AACSB: Analytical Thinking
Accessibility: Keyboard Navigation
AICPA: BB Industry
AICPA: FN Decision Making
Blooms: Apply
Difficulty: 3 Hard
Topic: Calculating Break-Even and Target Profits
Topic: Multiple Products

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Chapter 02 Test Bank – Static Summary

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