Vol. 1, Chapter 10 – Cost-Volume-Profit Analysis

Problem 1: Solution

1. Selling price - Variable cost per unit = Contribution margin
   $12.00 - $8.00 = $4.00

   Contribution margin / Selling price = Contribution margin ratio
   $4.00 / $12.00 = .333

2. Selling price - Variable cost per unit = Contribution margin
   $11.00 - $7.75 = $3.25

   Contribution margin / Selling price = Contribution margin ratio
   $3.25 / $11.00 = .295

3. Total fixed cost / (Selling price - Variable cost per unit) = Units sold
   $200.00 / ($11.00 - $7.75) = 62 lunch covers

Problem 2: Solution

1. Total fixed cost / (Selling price - Variable cost per unit) = Units sold at breakeven
   $100,000 / ($80 - $15) = 1,539 rooms

2. Rooms sold to break even / Rooms sold per day = Day breakeven occurs
   1,539 / 60 = 25.65 or the 26th day

3. Annual fixed costs increase / 12 months = Monthly fixed costs increase
   $72,000 / 12 = $6,000

   Total fixed costs / (Selling price - Variable cost per unit) = Units sold at breakeven
   $106,000 / ($80 - $12) = 1,559 rooms

   Units sold at breakeven × Selling price = Breakeven revenues
   1,559 × $80 = $124,720

Problem 3: Solution

Transportation costs are fixed only on a daily basis. Treat this as a variable cost at $.02 per glass.

1. Cost per drink + Other variable costs = Total variable cost per unit
   $.20 + $.05 + $.02 = $.27

   Selling price - Variable cost per unit = Contribution margin

   $.75 - $.27 = $.48

2. Total fixed cost / (Selling price - Variable cost per unit) = Units sold at breakeven
   $750 / ($.75 - $.27) = 1,563 lemonades

3. Lemonades sold to break even / Lemonades sold per day = Day breakeven occurs
   1,563 / 75 = 20.84 or the 21st day or Monday, June 29.

Problem 4: Solution

1.

Mixed Costs	Low Month 60% Occ.	High Month 80% Occ.	Variable Costs per 1% Occ.	Variable Costs Per Room	Fixed Costs
Repairs	$3,000	$3,500	$25	$0.83	$1,500
Utilities	$4,000	$5,000	$50	$1.67	$1,000

   Variable cost per room:
   $20 + $.83 + $1.67 = $22.50

2. Monthly fixed costs:
   $100,000 + $1,500 + $1,000 = $102,500

3. Day breakeven occurs = Rooms sold to break even / Rooms sold per day
   25 = X / 75
   X = 1,875 rooms sold to break even

   (Total fixed costs / Units sold) + Variable cost per unit = Selling price at breakeven
   ($102,500 / 1,875) + $22.50 = $77.17

Problem 5: Solution

1. Fixed costs = (1-VC%) × Sales
   550,000 = .8 × Sales
   Sales = 687,500

2. Required return = investment × ROI
   = 1,500,000 × .2
   = 300,000

Problem 6: Solutions

1. a. Breakeven Point

CMRw = ((60/100) × ((60 - 12)/60)) + ((40/100) × ((40 - 20)/40))

CMRw = 0.68

R = $410,000/.68 Breakeven Point = $602,941.18

b. NI

Variable Expense % Rooms = $120,000/$600,000 = 0.2

Variable Expense % Coffee Shop = $200,000/$400,000 = 0.5

		Calculations	
Rooms Sales	$720,000	.6(1,200,000)	
Coffee Shop Sales	480,000	.4(1,200,000)	
Variable Expense Rooms	144,000	.2(720,000)	
Variable Expense C.S.	240,000	.5(480,000)	
Total Contrib. Margin	816,000		
Fixed Costs:			
Rooms	50,000		
Coffee Shop	60,000		
Overhead	300,000		
Pre-tax earnings	406,000		
Taxes	81,200		.2(406,000)
Net Income	$324,800		

c.

Net Income	$200,000
Fixed Costs:	
Rooms	50,000
Coffee Shop	60,000
Overhead	300,000
	$610,000

$$\frac{\text{NI + Fixed costs}}{\text{CMRw}} = \text{annual revenue}$$

610,000/0.68 = $ 897,058.82

Problem 6: Solutions (continued)

2. a. Breakeven Point

CMRw = ((75/100)×(.8) + ((25/100 × (.5))

CMRw = .725

R = $410,000/0.725 Breakeven Point = $565,517.24

b. Net Income

		Calculations
Total Revenue	$1,200,000	
Fixed Costs:		
Rooms	50,000	
Coffee Shop	60,000	
Overhead	300,000	
Variable Costs:		
Rooms	180,000	.2(.75×1,200,000)
Coffee Shop	150,000	.5(.25×1,200,000)
Pre-tax earnings	460,000	
Taxes	92,000	.2(460,000)
Net Income	$368,000	

c.

Net Income	$200,000
Fixed Costs:	
Rooms	50,000
Coffee Shop	60,000
Overhead	300,000
	$610,000

(NI + Fixed costs)/CMRw = annual revenue

$610,000/0.725 = $841,379.31

Problem 7: Solution

1. Revenue at breakeven point:

$$B = \frac{F}{CM} = \frac{20{,}000}{20} = 1{,}000 \text{ rooms}$$

Revenue = rooms sold × selling price = 1,000 × $30 = $30,000

2. Margin of safety:

Stated revenues	$450,000
Breakeven ($30,000 × 12)	360,000
Margin of safety—revenue	$ 90,000

Margin of safety—rooms: $90,000/30 = 3,000 rooms

3. Rooms sold when pretax profit is $100,000

$$x = \frac{F + I_b}{CM} = \frac{\$240{,}000 + \$100{,}000}{\$20} = 17{,}000$$

4. Paid occupancy percentage:

$$\frac{\text{rooms sold}}{\text{rooms available}} = \frac{17{,}000}{50 \times 365} = 93.15\%$$

Problem 8: Solution

Part 1	Revenue	Var. Cost	Dept. Income
Rooms	$2,500,000	$ 750,000	$1,750,000
Coffee Shop	750,000	300,000	450,000
Restaurant	1,200,000	750,000	450,000
	$4,450,000	$1,800,000	$2,650,000

$$CMR_w = \frac{\text{Total Dept. Income}}{\text{Total Sales}} = \frac{2{,}650{,}000}{4{,}450{,}000} = 59.55\%$$

Part 2

$$(I_n + F)/CMR_w = \text{Sales}$$

$$\frac{\$500{,}000 + \$1{,}000{,}000}{.5955} = \$2{,}518{,}891.69$$

Part 3

$$I_b = I_n/(1 - t)$$

$$= \frac{\$500{,}000}{1 - .3} = \$714{,}285.71$$

$$(I_b + F)/CMR_w = \text{Sales}$$

$$\frac{\$1{,}000{,}000 + \$714{,}285.71}{.5955} = \$2{,}878{,}733.35$$

Problem 9: Solution

Required annual profit = ROI(investment)
= .18($1,500,000)
= $270,000

Pretax income (I_b) = $I_n/(1 - t)$

= $270,000/0.7

= $385,714.29

CMR_w = .8(.76) + .2(.55)
= .608 + .110
= .718

Revenue = $(F + I_b)/CMR_w$ = $\frac{\$240,000 + \$385,714.29}{.718}$ = $871,468.37

Problem 10: Solution

1. Total Revenues - Total Variable Costs = Contribution Margin
$2,000,000- $700,000 = $1,300,000

Contribution Margin Percentage

$\frac{\$1,300,000}{\$2,000,000}$ = 0.65

Breakeven Point

$\frac{\$1,000,000}{.065}$ = $1,538,462

2. $\frac{\$520,000}{0.45}$ = $1,155,556

Problem 11: Solution

1) CMR	($60 – $20)/$60	=	0.6667
2) Breakeven Point	$20,000/0.6667	=	$29,998.50
	$29,998.50/$60	=	500 rooms
3) Total Revenue			
Net Income			$10,000.00
Pretax Income	$10,000 / (1 - .2)	=	$12,500.00
Total Revenue	($12,500 + $20,000) / 0.6667	=	$48,747.56
4) June breakeven point			
Total Revenue			$48,747.56
Rooms sold per day	($48,747.56/60)/30	=	27.08
Daily Revenue	$27.08 × 60	=	$1,624.80
Breakeven point			$29,998.50
Days to break even	$29,998.50 / $1,624.80	=	18.4629

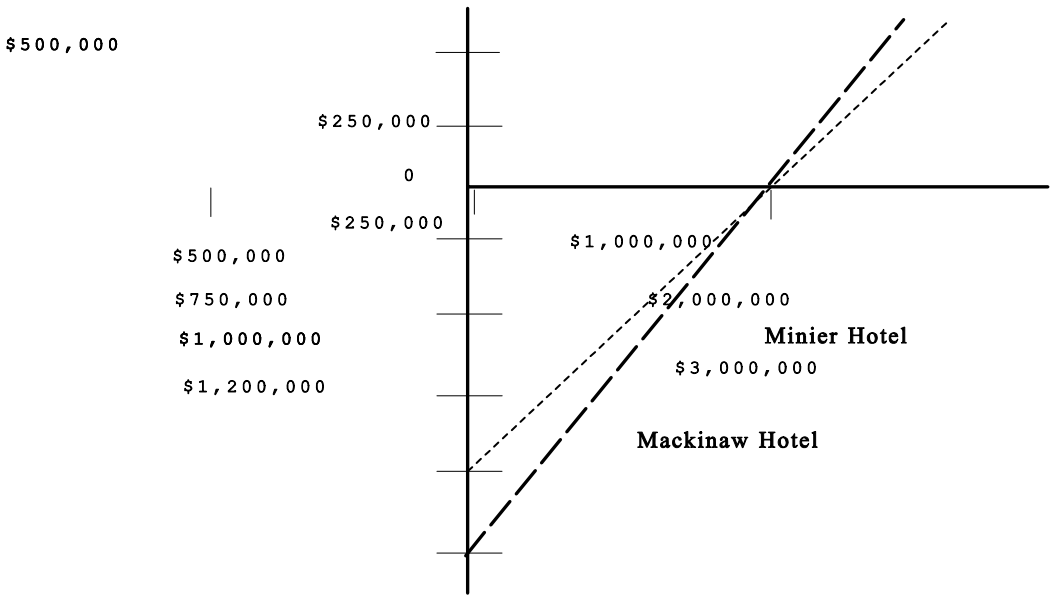
The Meyer Motel will break even on: June 19th

5) Increase in ADR			
Revised variable costs	$20 × 1.5	=	$30
To maintain the CM of $40, ADR must increase by:			$10

Problem 12: Solution

1. | | Mackinaw Hotel | Minier Hotel |
|---|---|---|
| $B = \frac{F}{CMR_w}$ | $\frac{\$1,200,000}{.6} = \$2,000,000$ | $\frac{\$1,000,000}{.5} = \$2,000,000$ |

2. Profit-volume graph:



3. The Mackinaw Hotel is riskier because it has a higher level of fixed costs and a lower variable cost percentage than the Minier Hotel. With zero sales, the Mackinaw Hotel would lose $1,200,000 (its fixed costs). With zero sales, the Minier Hotel would lose only $1,000,000.

Problem 13: Solution

1. Level of sales under each lease option

Var.: X = .3X + .2X + .1X + .06X + $100,000
X = $294,117.65

Mixed: X = .3X + .2X + .1X + .02X + 12($1,500) + $100,000
X = $ 310,526

Fixed: X = .3X + .2X + .1X + 12(2,500) + $100,000
X = $325,000

2. Net Income

Var.: $700,000 – (.66($700,000) + $100,000)
NI = $138,000

Mixed: $700,000 – (.62($700,000) + 12($1,500) + $100,000)
NI = $148,000

Fixed: $700,000 – (.6($700,000) + 12($2,500) + $100,000)
NI = $150,000

3. Recommendation

Var.: $400,000 – (.66($400,000) + $100,000)
NI = $36,000

Mixed: $400,000 – (.62($400,000) + 12($1,500) + $100,000)
NI = $34,000

Fixed: $400,000 – (.6($400,000) + 12($2,500) + $100,000)
NI = $30,000

The variable lease is the better option at the given level of sales.

Problem 14: Solution

1. Breakeven point:

$$B = \frac{F}{CMR_w} = \frac{\$1,000,000.00}{.65} = \$1,538,461.54$$

2. Revised breakeven point:

$$\text{Revised } CMR_w = .65 - .20 = .45$$

$$B = \frac{F}{CMR_w} = \frac{\$520,000}{.45} = \$1,155,555.56$$

3. Increase in sales required to cover an increase in variable costs:

$$\text{Revised revenue} = \frac{I_b + F}{CMR_w} = \frac{\$300,000 + \$1,000,000}{.585} = \$2,222,222.22$$

$$\text{Revised } CMR_w = .65 - .065 = .585$$

Original revenue	= $2,000,000.00
Increase in revenue	= $222,222.22
Percentage increase in sales	= 11%

4. Room sales when net income equals $300,000:

$$\text{Revenue} = \frac{I_b + F}{CMR_w} = \frac{\$400,000 + \$1,000,000}{.65} = \frac{\$1,400,000}{.65} = \$2,153,846.15$$

$$I_b = \frac{I_n}{1 - t} = \frac{\$300,000}{1 - .25} = \$400,000$$

$$\text{Room sales} = .75(\text{total sales}) = .75(\$2,153,846.15) = \$1,615,384.62$$

Problem 15: Solution

Part 1

$$\text{Revenue} = (I_b + F)/CMR_w$$

$$I_b = I_n/(1 - t) = \frac{\$40,000}{1 - .25} = \$53,333$$

$$CMR_w = \frac{\text{Contribution Margin}}{\text{Total Revenue}} = \frac{\$100,000}{\$140,000} = 71.43\%$$

$$\text{Revenue} = \frac{\$53,333 + \$80,000}{.7143} = \$186,662.47$$

Part 2

$$CF_b = \frac{CF_d + NECD - NCE}{1 - t} - NECD + NCE$$

$$= \frac{\$20,000 + \$5,000 - \$20,000}{1 - .25} - \$5,000 + \$20,000$$

$$= \frac{\$5,000}{.75} + \$15,000$$

$$= \$21,666.67$$

$$R = \frac{CF_b + F - NCE + NECD}{CMR_w}$$

$$= \frac{\$21,666.67 + \$80,000 - \$20,000 + \$5,000}{.7143}$$

$$= \$121,330.91$$

*depreciation
**reduction of mortgage:

mortgage payment	$15,000
less: interest exp.	10,000
	$ 5,000

Note: The cash flow calculation assumes income taxes are based on cash flows.

Problem 16: Solution

1. Contribution Margin Ratio	$\frac{5,000,000 - 1,000,000}{5,000,000} =$	0.8
2. Weighted Ave. CMR	$\frac{8,500,000 - 2,700,000}{8,500,000} =$	0.6824
3. Breakeven Point R = F / CMRw	$\frac{3,600,000}{0.6824} =$	$5,275,498.24
4. Room sales when NI= 1.5M		
$Ib = \frac{In}{(1 - t)}$	$\frac{1,500,000}{(1 - 6/22)} =$	$2,062,500
$R = \frac{(Ib + F)}{CMRw}$	$\frac{(3,600,000 + 2,062,500)}{0.6824} =$	$8,297,919.11
Room Sales = R × Room Sales / Total Sales	8,297,919.11 × 5,000,000 / 8,500,000	$4,881,128.89

Problem 17: Solution

Part 1
Food department's CMR: $50,000 ÷ $200,000 = 25%

Part 2
CMR_w: $401,000 ÷ $705,000 = 56.88%

Part 3
Breakeven point: $151,000 ÷ .5688= $265,471.17

Part 4
Increase in room sales to yield a $30,000 increase in net income:

$$\Delta I_b = \frac{\Delta I_n}{1 - .5} = \frac{\$30,000}{1 - .5} = \$60,000$$

CMR_{rooms} = $350,000 ÷ $500,000= .7

$$\text{Increased room sales} = \frac{\Delta I_b}{CMR_{rooms}} = \frac{\$60,000}{.7} = \$85,714.29$$

Problem 17: Solution (continued)

Part 5
Stable sales to cover increase in fixed costs of $500:

$$CMR_{stables} = \frac{\$1,000}{\$5,000} = .2$$

$$\text{Increase in stable sales} = \frac{\Delta F}{CMR_{stables}} = \frac{\$500}{.20} = \$2,500$$

Part 6
Total revenue to cover increase in fixed costs of $1,500:

$$\text{Increase in total sales} = \frac{\Delta F}{CMR_w} = \frac{\$1,500}{.5688} = \$2,637.13$$

Problem 18: Solution

1. $$\frac{(\$7,000,000 - \$2,850,000)}{7,000,000} = 0.5929$$

2. $$\frac{(\$200,000 + \$400,000 + \$100,000 + \$100,000 + \$2,800,000)}{0.5929} = \$6,071,850$$

3. $$\frac{(\$2,000,000 - \$1,000,000 + \$200,000 + \$100,000 + \$200,000 + \$400,000 + \$100,000 + \$100,000 + \$2,800,000)}{0.5929} = \$8,264,463$$

4. $$CMR = \frac{(\$300,000 - \$150,000)}{\$300,000} = .5 + .1^* = .6$$

*Management Fee

$$\frac{(\$2,000 + \$4,000 + \$3,143^{**})}{0.4} = \$22,858$$

**$2,000/(1 - .3636) = $3,143

5.

			CM	Weight	CMR
Rooms	$\frac{(\$4,000,000 - \$800,000)}{\$4,000,000}$	=	0.8000	50%	0.4
Food	$\frac{(\$2,400,000 - \$1,000,000)}{\$2,400,000}$	=	0.5833	35%	0.2042
Other	$\frac{(\$300,000 - \$200,000)}{\$300,000}$	=	0.3333	5%	0.0167
Gift Shop	$\frac{(\$300,000 - \$150,000)}{\$300,000}$	=	0.5000	10%	0.05

CMR	0.6709
Management Fee	-0.1
CMR =	0.5709

Problem 19: Solution

1. Expected net income during June. Expected number of room sales: 100 × .8 × 30 = 2,400

Sales	2,400 × $35	$84,000
Variable costs	2,400 × $9	21,600
Monthly fixed costs		21,500
Pre-tax income		40,900
Income taxes		12,270
Net income		$28,630

2. Breakeven point in rooms sold in June

$21,500/$26 = 826.9 rooms, on June 11

3. Net income expected to be earned during November. Expected number of room sales: 100 × .7 × 30 = 2,100

Sales	2,100 × $35	$73,500
Variable costs	2,100 × $10	21,000
Fixed costs		19,500
Pre-tax income		33,000
Income taxes		9,900
Net income		$23,100

4. Breakeven point during November:

$19,500/$25 = 780 rooms, on November 12

Problem 20: Solution

1. $\frac{(\$5,000,000 - \$1,000,000)}{\$5,000,000} = 0.8$

2. $\frac{(\$8,500,000 - \$2,700,000)}{\$8,500,000} = 0.6824$

3. $\frac{(\$1,000,000 + \$500,000 + \$100,000 + \$2,000,000)}{0.6824} = \$5,275,498$

4. Desired pretax income: $\frac{\$1,500,000}{1 - .2728} = \$2,062,706$

Total revenue: $\frac{(\$2,062,706 + \$3,600,000)}{0.6824} = \$8,298,221$

Room sales: $\frac{\$5,000,000}{\$8,500,000} \times 8,298,221 = \$4,881,307$