Managerial Accounting 7th

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Task-Based Simulation Solutions

2020

Chapter 1. Managerial accounting

[Problem 1]

DM issue = 39 + 82 - 9 = 112

MOH = 6 + 25 + 8 + 17 + 3 + 5 = 64

CGM = 15 + 112 + 41 + 64 - 7 = 225

CGS = 43 + 225 - 19 = 249

Income Statement		CGM schedule	
Sales revenue	354	BWIP	15
COGS	249	DM	112
Gross profit	105	DL	41
S&A expenses	91	MOH	64
Operating income	14	EWIP	(7)
		CGM	225

[Problem 2]

1. 105 + 365 - 385 = 85
2. 450 - 265 = 185
3. 1610 - 385 - 450 = 775
4. 230 + 1610 - 1660 = 180
5. 130 + 1660 = 1790
6. 130 + 1660 - 1770 = 20

[Problem 3]

Chapter 2. Job order costing

[Problem 1]

[Problem 2]

Instruction (1) (a) $50 (b) $47

Instruction (2) (a) AA : $188,926 AB : $221,720 (b) AA : $186,166 AB : $218,600

[Problem 3]

Instruction (1)

Instruction (2) $52 millions

Instruction (3) $Actual MOH = 94. Applied MOH = 93, Under applied = 1, CGS = 295

[Problem 4]

Instruction (1) $65

Instruction (2) $55

Instruction (3) (1) $14,400 (2) $19,200

[Problem 5]

Instruction (1)

Rate-MD = $9,065,000 ÷ 185,000 = 49 　　Rate-FD = $8,181,000 ÷ $4,050,000= 2.02

Applied MOH-Job 431 = 140 x 49 + 1,250 x 2.02 = $9,385

Job 431 = $13,000 + 5,000 + 900 + 1,250 + 9,385= $29,535 　　UC = 29,535 ÷ 300 = $98.45

Instruction (2)

Applied MD = 200,000 x 49 = $9,800,000 ➠ 9,900,000 - 9,800,000 = 100,000 (U)

Applied FD = 4,100,000 x 2.02 = 8,282,000 ➠ 8,200,000 - 8,282,000 = (-) 82,000 (O)

Under applied as a whole = 100,000 - 82,000 = +18,000 (U)

[Problem 6]

Instruction (1) Predetermined OH rate = 70,000 ÷ 2,000 = $35

Instruction (2)

<a> Applied MOH = $35 × 1,900 = $66,500 　<b> Applied MOH = $35 × 2,000 = $70,000

<c> Applied MOH = $35 × 2,100 = $73,500 　<d> Applied MOH = $35 × 2,000 = $70,000

Instruction (3)

<a> 66,500 - 70,000 = −3,500 (under-applied) 　<b> 70,000 - 65,000 = +5,000 (over-applied)

<c> 73,500 - 70,000 = +3,500 (over-applied) 　<d> 70,000 - 75,000 = −5,000 (under-applied)

[Problem 7]

2,500 = Over-applied x 1/8 → Over-applied = 20,000

Applied MOH = 20,000 + 180,000 = 200,000 = 1,250 시간 x OH rate → OH rate = 160

[Problem 8]

Instruction (1)

GOV = 8,756,000 + 600,000 x 40/75 + 2,400,000 x 30/90 = $9,876,000

COR = 12,452,000 + 600,000 x 35/75 + 2,400,000 x 60/90 = $14,332,000

Instruction (2)

GOV = 8,756,000 + 600,000 x 40% + (2,400,000 + 600,000 x 25%) x 30/90 = $9,846,000

COR = 12,452,000 + 600,000 x 35% + (2,400,000 + 600,000 x 25%) x 60/90 = $14,362,000

Instruction (3)

GOV = 8,756,000 + (600,000 + 2,400,000 x 10%) x 40/75 + 2,400,000 x 30% = $9,924,000

COR = 12,452,000 + (600,000 + 2,400,000 x 10%) x 35/75 + 2,400,000 x 60% = $14,284,000

Instruction (4)

AS = 600,000 + IS x 0.10, IS = 2,400,000 + AS x 0.25, AS = 861,538 　　IS = 2,615,385

GOV = 8,756,000 + 861,538 x 40% + 2,615,385 x 30% = $9,885,230

COR = 12,452,000 + 861,538 x 35% + 2,615,385 x 60% = $14,322,770

Chapter 3. Process costing

[Problem 1]

NS =1400 x 15% =210 units ➠ ANS = 400 - 210 = 190 units

	Units	%	DM	Con
CGM	1400	100	1400	1400
Normal	210	100	210	210
Abnormal	190	100	190	190
EWIP	300	40	300	120
Total	2100		2100	1920
Total cost			$441,000	$163,200
Unit cost			$210	$85

<First Allocation>

CGM = 1400 x $210 + 1400 x $85 = $413,000

Normal spoilage = 210 x $210 + 210 x $85 = $61,950

Abnormal spoilage = 190 x $210 + 190 x $85 = $56,050

EWIP = 300 x $210 + 120 x $85 = $73,200

<Second Allocation>

CGM = 413,000 + 61,950 = $474,950 EWIP = $73,200

[Problem 2]

NS= 70,000 x 10% = 7,000 units ➠ ANS= 10,000 - 7,000 = 3,000 units

	Units	%	T-in	DM	Con
CGM	50,000	100	50,000	50,000	50,000
Normal	7,000	80	7,000	0	5,600
Abnormal	3,000	80	3,000	0	2,400
EWIP	20,000	95	20,000	20,000	19,000
Total	80,000		80,000	70,000	77,000
Total cost			$730,400	655,200	1,293,600
Unit cost			$9.13	9.36	16.8

<First Allocation>

CGM = 50,000 x (9.13 + 9.36 + 16.8) = $1,764,500

Normal spoilage = 7,000 x 9.13 + 5,600 x 16.8 = 157,990

Abnormal spoilage = 3,000 x 9.13 + 2,400 x 16.8 = 67,710

EWIP = 20,000 x 9.13 + 20,000 x 9.36 + 19,000 x 16.8 = 689,000

<Second Allocation>

CGM = $1,764,500 + 157,990 x 50,000/70,000 = $1,877,350

EWIP = 689,000 + 157,990 x 20,000/70,000 = $734,140

[Problem 3]

NS= 50,000 x 10% = 5,000 units ➠ ANS= 10,000 - 5,000 = 5,000 units

	Units	%	T-in	DM	Con
CGM	50,000	100	50,000	50,000	50,000
Normal	5,000	80	5,000	0	4,000
Abnormal	5,000	80	5,000	0	4,000
EWIP	20,000	50	20,000	0	10,000
Total	80,000		80,000	50,000	68,000
Total cost			$730,400	655,200	1,293,600
Unit cost			$9.13	13.104	19.024

<First Allocation>

CGM = 50,000 x (9.13 + 13.104 + 19.024) = $2,062,900

Normal spoilage = 5,000 x 9.13 + 4,000 x 19.024 = 121,746

Abnormal spoilage = 5,000 x 9.13 + 4,000 x 19.024 = 121,746

EWIP = 2,679,200 - (2,062,900 + 121,746 + 121,746) = 372,808

<Second Allocation>

CGM = $2,062,900 + 121,746 = $2,184,646 EWIP = $372,808

[Problem 4]

Instruction (1)

	Units	%	T-in	DM	Con
CGM	10,500	100	10,500	10,500	10,500
EWIP	2,000	50	2,000	0	1,000
Total	12,500		12,500	10,500	11,500
Total cost	$800,525		$500,000	110,775	189,750
Unit cost			$40	10.55	16.5

CGM = 10,500 x (40 + 10.55 + 16.5) = $704,025

EWIP = 2,000 x 40 + 1,000 x 16.5 = $96,500

Instruction (2)

	Units	%	T-in	DM	Con
CGM	10,500	100	8,000	10,500	9,875
EWIP	2,000	50	2,000	0	1,000
Total	12,500		10,000	10,500	10,875
Total cost	$639,025		$376,000	110,775	152,250
Unit cost			$37.6	10.55	14

CGM = 8,000 x 37.6 + 10,500 x 10.55 + 9,875 x 14 + 115,680 + 37,500 = $703,005

EWIP = 2,000 x 37.6 + 1,000 x 14 = $89,200

[Problem 5]

	Units	%	T-in	DM	Con
CGM	125,000	100	125,000	125,000	125,000
Normal	17,500	80	17,500	0	14,000
Abnormal	7,500	80	7,500	0	6,000
EWIP	50,000	95	50,000	50,000	47,500
Total	200,000		200,000	175,000	192,500
Total cost			$1,826,000	1,638,000	3,234,000
Unit cost			$9.13	9.36	16.8

<First Allocation>

CGM = 125,000 x (9.13 + 9.36 + 16.8) = $4,411,250

Normal spoilage = 17,500 x 9.13 + 14,000 x 16.8 = 394,975

Abnormal spoilage = 7,500 x 9.13 + 6,000 x 16.8 = 169,275

EWIP = 50,000 x 9.13 + 50,000 x 9.36 + 47,500 x 16.8 = 1,722,500

<Second Allocation>

CGM = 4,411,250 + 394,975 x 125,000/175,000 = $4,693,375

EWIP = 1,722,500 + 394,975 x 50,000/175,000 = $1,835,350

[Problem 6]

BWIP DM EUP = 78,000 − 66,000 = 12,000

BWIP Conversion EUP = 54,400 − 52,000 = 2,400

12,000 × % = 2,400 → % = 20%

[Problem 7]

FIFO DM EUP = 30,500 − 1,000 + 500 = 30,000

FIFO Conversion EUP = 30,500 − 1,000 × 0.4 + 500 × 0.8 = 30,500

DM cost per EUP = 240,000 ÷ 30,000 = @8

Conversion cost per EUP = 305,000 ÷ 30,500 = @10

CGM = 21,000 + 29,500 × @8 + 30,100 × @10 = 558,000

[Problem 8]

FIFO DM EUP = 9,500 − 600 − 400 + 200 + 300 = 9,000

FIFO Conversion EUP = 9,500 − 600 × 1/3 − 400 × 1/2 + 200 × 0.4 + 300 × 0.7 = 9,390

DM cost per EUP = 135,000 ÷ 9,000 = @15

Conversion cost per EUP = 281,700 ÷ 9,390 = @30

EWIP = 500 × @15 + 290 × @30 = 16,200

Chapter 4. ABC

[Problem 1] In class

[Problem 2]

Instruction (1) In class

Instruction (2)

HT = $820,000 ÷ 40,000H = $20.50   ST = $370,000 ÷ 30,000H = $12.33

[Problem 3]

Instruction (1)

Indirect costs = $190,000 + 90,000 + 50,000 + 120,000 + 16,000 = $466,000

Interior unit cost = $60 + $32 x 1.50H + $466,000 x 5,500/10,000 ÷ 3200 units = $188.1

Exterior unit cost = $90 + $32 x 2.25H + $466,000 x 4,500/10,000 ÷ 1800 units = $278.5

Instruction (2)

Interior unit cost = $60 + $32 x 1.50H +{$190,000 x 40/125 + $90,000 x 72/240 + $50,000x 45/200 + $120,000 x 5,500/10,000 + $16,000 x 250/400} ÷ 3200 units = $162.7

Exterior unit cost = $90 + $32 x 2.25H + {$190,000 x 85/125 + $90,000 x 168/240 + $50,000 x155/200 + $120,000 x 4,500/10,000 + $16,000 x150/400}÷ 1800 units = $323.6

[Problem 4]

1-D, 2-E, 3-C, 4-B, 5-A

[Problem 5]

기계가동 = 84,000 ÷ 5,000시간 = @16.8 (기계시간당)

엔지니어링 = 60,000 ÷ 1,200시간 = @50 (작업시간당)

품질검사 = 41,000 ÷ 25회 = @1,640 (품질검사횟수당)

제품A의 applied MOH = 2,000시간 × 16.8 + 500시간 × 50 + 10회 × 1,640 = 75,000

[Problem 6]

전통 applied MOH = 8시간 × 150,000 ÷ 50대 = 24,000

활동 applied MOH = (1,000개 × 1,000 + 8시간 × 40,000 + 15분 × 10,000) ÷ 50대 = 29,400

Chapter 5. Joint costing

[Problem 1]

Instruction (1)

NRV(X) = 200tons x $1,200 = $240,000
NRV(Y) = 600tons x $900 = $540,000
NRV(Z) = 700tons x $600 - 200,000= $220,000

JC(X) = $580,000 x 240/1,000 = $139,200
Inventory(X) = 139,200 x 132/200 = $91,872   CGS (X) = 139,200 x 68/200 = $47,328

JC (Y) = $580,000 x 540/1,000 = $313,200
Inventory(Y) = 313,200 x 120/600 = $62,640   CGS (Y) = 313,200 x 480/600 = $250,560

JC(Z) = $580,000 x 220/1,000 = $127,600
Inventory(Z) = 327,600 x 28/700 = $13,104   CGS (Z) = 327,600 x 672/700 = $314,496

Instruction (2)

Sales(X)=240,000, Sales(Y)=540,000, Sales (Z)= 420,000,
Sales (X+Y+Z) = $1,200,000, COGS (X+Y+Z) = 580,000 + 200,000 = $780,000
CGS percentage = 780/1,200 = 0.65

JC(X) = 240,000 x 0.65 =$156,000
Inventory(X) = 156,000 x 132/200 = $102,960   CGS (X) = 156,000 x 68/200 = $53,040

JC(Y) = $540,000 x 0.65 = $351,000
Inventory(Y) = 351,000 x 120/600 = $70,200   CGS (Y) = 351,000 x 480/600 = $280,800

JC(Z) = $420,000 x 0.65- 200,000 = $73,000
Inventory(Z) = 273,000 x 28/700 = $10,920   CGS (Z) = 273,000 x 672/700 = $262,080

Instruction (3)

Same as Instruction (1)

Instruction (4)

Units (X+Y+Z) = 200 + 600+ 700 = 1500tons

JC(X) = $580,000 x 200/1500 = $77,333

Inventory(X) = 77,333 x 132/200 = $51,040   CGS (X) = 77,333 x 68/200 = $26,293

JC(Y) = $580,000 x 600/1500 = $232,000

Inventory(Y) = 232,000 x 120/600 = $46,400   CGS (Y) = 232,000 x 480/600 = $185,600

JC(Z) = $580,000 x 700/1500 = $270,667

Inventory(Z) = 470,667 x 28/700 = $18,827   CGS (Z) = 470,667 x 672/700 = $451,840

[Problem 2]

Instruction (1)

① Under the production method

NRV(by product) = 8,500 x $10 = $85,000

JC(by product) = $85,000

JC(Potato chips) = $500,000 - $85,000 = $415,000

Sales(Potato chips) = 42,640 x $16 = $682,240

CGS(Potato chips) = $415,000 x 42,640/52,000 = $340,300

GM = 682,240 - 340,300 = $341,940

② Under the sales method

JC(by product) = 0

JC(Potato chips) = $500,000 - 0 = $500,000

Sales(Potato chips) = 42,640 x $16 = $682,240

CGS(Potato chips) = $500,000 x 42,640/52,000 = $410,000

(-) CGS(by product) = 6,500 x $10 = $65,000

GM = 682,240 - (410,000 - 65,000) = $337,240

Instruction (2)

① Under the production method

Inventory(Potato chips) = $415,000 x 9,360/52,000 = $74,700

Inventory(by product) = $85,000 x 2,000/8,500 = $20,000

② Under the sales method

Inventory(Potato chips) = $500,000 x 9,360/52,000 = $90,000

Inventory(by product) = $0 x 2,000/8,500 = $0

[Problem 3]

Instruction (1)

NRV(A) = 12,000 pounds x \$12 - \$27,000 = \$117,000

NRV(B) = 65,000 pounds x \$3 = \$195,000

NRV(C) = 16,000 pounds x \$6 - \$12,000 = \$84,000

JC(by product) = \$84,000 ➠ JC(A+B) = 180,000 - 84,000 = \$96,000

NRV(A+B) = 117,000 + 195,000 = \$312,000

JC(A) = \$96,000 x \$117,000 / \$312,000 = \$36,000

JC(B) = \$96,000 x \$195,000 / \$312,000 = \$60,000

Unit cost(A) = (\$36,000 + \$27,000) ÷ 12,000 pounds = \$5.25

Unit cost(B) = \$60,000 ÷ 65,000 pounds = \$0.92

Unit cost(C) = (\$84,000 + \$12,000) ÷ 16,000 pounds = \$6

Instruction (2)

NRV(A+B+C) = 117,000 + 195,000 + \$84,000 = \$396,000

JC(A) = \$180,000 x \$117,000 / \$396,000 = \$53,182

JC(B) = \$180,000 x \$195,000 / \$396,000 = \$88,636

JC(C) = \$180,000 x \$84,000 / \$396,000 = \$38,182

Unit cost(A) = (\$53,182 + \$27,000) ÷ 12,000 pounds = \$6.68

Unit cost(B) = \$88,636 ÷ 65,000 pounds = \$1.36

Unit cost(C) = (\$38,182 + \$12,000) ÷ 16,000 pounds = \$3.14

[Problem 4]

JC(B)= 360,000× 280,000/800,000 = 126,000   JC(C) =360,000 − 180,000 − 126,000 = 54,000

GP(C)= 400개 × 500 − 54,000 − 14,000 = 132,000

[Problem 5]

JC(Y)= 80,000 x 3/6 = 40,000

JC(B)= 150,000 − 80,000 − 40,000 = 30,000

Chapter 6

[Problem 1]

Instruction (1)

Identify customer needs ➠ Design of products and processes

Perform market research on competing brands ➠ Marketing

Design a prototype of the Galaxy smartphone ➠ Design of products and processes

Market the new design to cell phone companies ➠ Marketing

Manufacture the Galaxy smartphone ➠ Production

Process orders from cell phone companies ➠ Distribution

Package the Galaxy smartphones ➠ Distribution

Deliver the Galaxy smartphones to the cell phone companies ➠ Distribution

Provide online assistance to cell phone users for use of the Galaxy smartphone ➠ CS

Make design changes to the smartphone based on customer feedback ➠ CS

Instruction (2)

Identify customer needs

➠ Number of surveys returned and processed from competing smartphone users

Perform market research on competing brands

➠ Hours spent researching competing market brands

Design a prototype of the Galaxy smartphone

➠ Engineering hours spent on initial product design

Market the new design to cell phone companies

➠ Number of cell phone companies purchasing the Galaxy smartphone

Manufacture the Galaxy smartphone

➠ Machine hours required to run the production equipment

Process orders from cell phone companies

➠ Number of smartphone orders processed

Package the Galaxy smartphones

➠ Number of smartphones shipped by Galaxy

Deliver the Galaxy smartphones to the cell phone companies

➠ Number of deliveries made to cell phone companies

Provide online assistance to cell phone users for use of the Galaxy smartphone

➠ Customer-service hours

Make design changes to the smartphone based on customer feedback

➠ Number of design changes

Chapter 7

[Problem 1]

Instruction (1)

$UVC = 1{,}500 + 125 \times 5 + 700 = \underline{\$2{,}825}$

$TFC = (1{,}200{,}000+1{,}800{,}000)/12 + 74{,}500 = \underline{\$324{,}500}$

Instruction (2)

$UC = 2{,}825 + (250{,}000+50{,}000)/100 = \underline{\$5{,}825}$

$UC = 2{,}825 + (250{,}000+200{,}000)/225 = \underline{\$4{,}825}$

[Problem 2]

Instruction (1)

$UVC = (280{,}000 - 190{,}000) / (140{,}000 - 95{,}000) = 2$

$190{,}000 = 95{,}000 \times 2 + TFC \Rightarrow TFC = 0$ $\underline{TC = \$2 \times \text{Machine hours} + 0}$

Instruction (2)

$TC = \$2 \times 100{,}000 + 0 = \underline{\$200{,}000}$

Chapter 8

[Problem 1]

(Instruction 1)

UCM = 35 - 18.50 = 16.50

NI = (22,000 x 16.50 - 214,500) x (1- 0.4) = $89,100

(Instruction 2)

BEPQ = $214,500 ÷ 16.50 = 13,000 units

(Instruction 3)

NI = (25,000 x 16.50 - 214,500 - 16,500) x (1- 0.4) = $108,900

(Instruction 4)

BEPQ = (214,500 + 16,500) ÷ 16.50 = 14,000 units

BEPS = 14,000 x $35 = $490,000

(Instruction 5)

NI = (Q x 16.50 - 214,500 - 16,500) x (1- 0.4) = $89,100 → Q = 23,000

revenue = 23,000 x $35 = $805,000

(Instruction 6)

NI = (25,000 x 16.50 - 214,500 - A) x (1- 0.4) = $108,450 → A = $17,259

[Problem 2]

Instruction (1)

UCM = 30 x 0.95 - 21 = 7.5 → BEPQ = 1,500,000/7.5 = 200,000

Instruction (2)

(1) TIPQ = (1,500,000+450,000) / 7.5 = 260,000

(2) TIPQ = (1,500,000+450,000÷0.75) / 7.5 = 280,000

Instruction (3)

(1) UCM = 7.5 x 1.1 = 8.25 → TIPQ = (1,500,000+450,000÷0.75)/8.25= 254,545

(2) UCM = 32.50 x 0.95-21= 9.875 → TIPQ = 2,100,000/9.875= 212,658

(3) UCM = 30 x 0.95 - 23 = 5.5

→ TIPQ = (1,200,000 x 0.4 + 300,000 +450,000÷0.75)/5.5= 250,909

[Problem 3]

Instruction (1)

WACM = (5 x 24 + 4 x 96 + 3 x 48) / 168 = $3.86

BEPQ = 405,000 / 3.86 = 104,922 units

Instruction (2)

CM = 5 x 24,000 + 4 x 96,000 + 3 x 48,000 = $648,000

OI = 648,000 – 405,000 = $243,000

Instruction (3)

CM = 5 x 24,000 + 4 x 48,000 + 3 x 96,000 = $600,000

OI = 600,000 – 405,000 = $195,000

WACM = (5 x 24 + 4 x 48 + 3 x 96) / 168 = $3.57

BEPQ = 405,000 / 3.57 = 113,445 units

Instruction (3)

requirement 1

[Problem 4]

Instruction (1)

UCM = 206 – 24 = 182 BEPQ = 327,600 / 182 = 1,800units

Q(S) = $618,000/206 = 3,000 units M/S(Q) = 3,000 – 1800 =1,200 units

Instruction (2)

(1) UCM = 224 – 24 = 200 BEPQ = 327,600 / 200 = 1,638units

M/S(%) = (3,000 – 1,638)/3,000 = 45.4%

(2) Q(S) = 3,000 x 1.15 = 3,450units

M/S(%) = (3,450 – 1,800)/3,450 = 47.8%

(3) BEPQ = (327,600 x 1.05)/(182+2) = 1,869

M/S(%) = (3,000 – 1,869)/3,000 = 37.7%

[Problem 5]

Instruction (1)

TFC = 800 + 2 x 160 x 10 + 40,000 x 0.5 x 1.2/12 =6,000

UCM = 20 – 5 = 15 → BEPQ = 6,000/15 = 400

Instruction (2)

TIPQ = (6,000+4,500) / 15 = 700

Instruction (3)

TFC = 800 + 40,000 x 0.5 x 1.2/12 = 2,800

UCM = 20 x 0.85 – 5 = 12 → TIPQ = (2,800+4,500) / 12 = 608.33

Instruction (4)

TFC = 2 x 160 x 10 + 40,000 x 0.5 x 1.2/12 = 5,200

UCM = 20 x 0.92 - 5 = 13.4

15Q + 6,000 = 13.4Q + 5,200 → Q = 500

[Problem 6]

Instruction (1)

(a) UCM = 1,000 - 400 = 600 → BEPQ = 17,400/600 = 29 units

(b) BEPQ = 0 units

Instruction (2)

600Q - 17,400 = 400Q → Q=87 units

Instruction (3)

(a) DOL = (87 x 600)/(87 x 600-17,400) = 1.5

(b) DOL = 1

[Problem 7]

WACM = 50 × 0.3 + 30 × 0.7 = 36 BEPQ = 21,600 ÷ 36 = 600개

제품 A의 판매수량 = 600개 × 0.3 =180개

[Problem 8]

1월 매출액 = (60,000 / 0.6 + 500,000) ÷ 0.4 = 1,500,000

2월 매출액 = (72,000 / 0.6 + 600,000) ÷ 0.4 = 1,800,000

매출차이 = 1,800,000 - 1,500,000 = 300,000

[Problem 9]

BEPQ = 120,000,000 ÷ (50,000 - 10,000) = 3,000개

객실임대율 = 3,000개 ÷ (365일 × 100개) = 8.21%

[Problem 10]

OI = (21,000 - 11,000) × 40,000개 - 280,000,000 = 120,000,000

120,000,000 = (P - 11,400) × 40,000개 - 300,000,000 → P = 21,900

Chapter 9

[Problem 1]

Instruction (1)

(a) OI(Jan) = 1,825 x 1300 – 610,000 = $1,762,500

OI(Feb) = 1,825 x 1400 – 610,000 = $1,945,000

OI(Mar) = 1,825 x 1425 – 610,000 = $1,990,625

(b) FOH UC = 490,000 / 1400 = $350

Unit cost = 950 + 350 + 725 = 2,025

OI(Jan) = 1,475 x 1300 – 120,000 = $1,797,500

OI(Feb) = 1,475 x 1400 – 120,000 = $1,945,000

OI(Mar) = 1,475 x 1425 – 120,000 = $1,981,875

Instruction (2)

Difference(Jan) = (100units – 0) x 350 = $35,000

Difference(Feb) = (100units –100 units) x 350 = $0

Difference(Mar) = (75units –100 units) x 350 = -$8,750

[Problem 2]

Instruction (1)

(a) OI(Jan) = 1,825 x 1300 – 610,000 = $1,762,500

OI(Feb) = 1,825 x 1375 – 610,000 = $1,899,375

OI(Mar) = 1,825 x 1455 – 610,000 = $2,045,375

(b) FOH UC = 490,000 / 1400 = $350

Unit cost = 950 + 350 + 725 = 2,025

OI(Jan) = 1,475 x 1300 – 120,000 = $1,797,500

OI(Feb) = 1,475 x 1375 – 120,000 – 25 x 350 = $1,899,375

OI(Mar) = 1,475 x 1455 – 120,000 + 30 x 350 = $2,036,625

Instruction (2)

Difference(Jan) = (100units – 0) x 350 = $35,000

Difference(Feb) = (100units –100 units) x 350 = $0

Difference(Mar) = (75units –100 units) x 350 = -$8,750

[Problem 3]

(Instruction 1)

UCM = 750 - 325 - 15 = 410

TFC = 280,000 + 112,000 = 392,000

Operating Income under VC = 995 x 410 - 392,000 = $15,950

(Instruction 2)

Inventory unit cost = 325 + 280,000/1,000 = $605

OI under AC = 995 x (750 - 605 - 15) -112,000 - 100 x 280 = -$10,650

(Instruction 3)

Difference = (900units -995 units) x 280 = -$26,600

OI (AC) - OI(VC) = -10,650 - 15,950 = -26,600

[Problem 4]

20X1 FOH unit cost = 10 × 50% = @5

20X2 FOH unit cost = 20X2년 단위당 FOH = 12 × 60% = @7.2

OI(AC) - OI(VC) = 1,400개 × 7.2 - 2,000개 × 5 = +840 (전부원가가 더 크다)

[Problem 5]

FOH unit cost = 3,000,000 ÷ 20,000개 = @150

OI(AC) = 6,000,000 + 1,000개 × 150 - 2,000개 × 150 = 5,850,000

Chapter 10

[Problem 1]

(1) 915,000 x $4,050 = $3,705,750,000

(2) 915,000 + 70,000 – 115,000 = 870,000 units

(3) 870,000 x 2 + 72,000 – 55,000 = 1,757,000 wheels

1,757,000 x $180 = $316,260,000

[Problem 2]

Instruction (1)

Thingone = 62,000 x $172 = $10,664,000

Thingtwo = 46,000 x $264 = $12,144,000

Instruction (2)

Thingone =62,000 + 26,000 – 21,000 = 67,000 units

Thingtwo = 46,000 + 14,000 –13,000 = 47,000 units

Instruction (3)

DM(A) = 67,000 x 5 + 47,000 x 6 + 40,000 – 37,000 = 620,000 lb.

DM(B) = 67,000 x 3 + 47,000 x 4 + 35,000 – 32,000 = 392,000 lb.

Instruction (4)

DM(A)=620,000 lb. x $11 = $6,820,000 DM(B)=392,000 lb. x $6 = $2,352,000

Instruction (5)

67,000 x 3 x $11 + 47,000 x 4 x $14 = $4,843,000

Instruction (6)

(67,000 x 3 + 47,000 x 4) x $19 = $7,391,000

Instruction (7)

Thingone = 26,000 x (5 x $11 + 3 x $6 + 3 x $30) = $4,238,000

Thingtwo = 14,000 x (6 x $11 + 4 x $6 + 4 x $33) = $3,108,000

Instruction (8)

Thingone = 62,000 x (5 x $11 + 3 x $6 + 3 x $30) = $10,106,000

Thingtwo = 46,000 x (6 x $11 + 4 x $6 + 4 x $33) = $10,212,000

Instruction (9)

GP(Thingone) = 10,664,000 – 10,106,000 = $558,000

GP(Thingtwo) = $12,144,000 –$10,212,000 = $1,932,000

[Problem 3]

Instruction (1)

Income Statement (4/1-4/30)

(1) Sales = $625,000

(2) COGS = 625,000 x 40% = $250,000

(3) GP = (2) - (1) = $375,000

(4) S&A-VC =625,000 x 10% = $62,500

(5) S&A-FC = 2,640,000 ÷ 12 = $220,000

(6) Operating Income = (3) - (4) - (5) = $92,500

Instruction (2)

Balance Sheet (4/30)

(1) A/R =700,000 x 80% x 25% + 625,000 x 80% x 65% =$465,000

(2) Inventory = 720,000 x 40% x 30% =$86,400

(3) Prepaid expense =180,000 x 2/12 + 240,000 x 2/12= $70,000

(4) A/P = 625,000 x 40% x 70% + 720,000 x 40% x 30% =$261,400

(5) Accrued liability = 625,000 x 10% = $62,500

Instruction (3)

Cash Flow Statement (4/1-4/30)

(1) Cash inflow from customers

= 650,000 x 80% x 25% + 700,000 x 80% x 40%

+ 625,000 x (20% + 80% x 30%) = $629,000

(2) Cash outflow to suppliers

=700,000 x 40% x 70% + 625,000 x 40% x 30% = $271,000

(3) Cash outflow-S&A-VC =700,000 x 10% =$70,000

(4) Cash outflow-S&A-FC

=180,000 x 3/12 + 240,000 x 6/12 + (720,000+1,080,000) x 1/12 = $315,000

(5) Cash flow from operation = (1) - (2) - (3) - (4) = ($27,000)

[Problem 4]

(Instruction 1)

Cat : 530 x 205 = $108,650

Dog : 225 x 310 = $69,750

Total Revenue = 108,650 + 69,750 = $178,400

(Instruction 2)

Cat : 530 + 30 - 10 = 550 units

Dog : 225 + 10 - 25 = 210 units

Total Production Units = 550 + 210 = 760 units

(Instruction 3)

Plastic : 550 x 4 pounds + 210 x 6 pounds = 3,460 pounds

Metal : 550 x 0.5 pounds + 210 x 1 pound = 485 pounds

Plastic Usage = $1,102 + (3460-290) x $5 = $16,952

Plastic Purchase = (3460 + 410 -290) x $5 = $17,900

Metal Usage = $217 + (485-70) x $4 = $1,877

Metal Purchase = (485 + 65 -70) x $4 = $1,920

(Instruction 4)

DL hours : 550 x 3H + 210 x 5H = 2,700 hours

DL cost = 2700H x $10 = $27,000

(Instruction 5)

Number of batch : Cat = $\frac{550}{25}$ = 22 Dog = $\frac{210}{9} = \frac{70}{3}$ = 24

MOH for Setup = (22 x 1.50H + 24 x 1.75H) x $105 = $7,875

MOH for Processing = (550 x 11H + 210 x 19H) x $10 = $100,400

MOH for Inspection = (22 x 0.50H + 24 x 0.7H) x $15 = $417

(Instruction 6)

Unit cost of ending FG

Plastic Usage cost per unit = $16,952 ÷ 3460 = 4.899

Metal Usage cost per unit = $1,877 ÷ 485 = 3.87

CGM for Cat = $4.899 x 2200 pounds + $3.87 x 275 pounds + 550 x 3H x $10
+ 22 x 1.5H x $105 + 550 x 11H x $10 + 22 x 0.5H x 15 = $92,472

CGM for Dog = $4.899 x 1260 pounds + $3.87 x 210 pounds + 210 x 5H x $10
+ 24 x 1.75H x $105 + 210 x 19H x $10 + 24 x 0.7H x 15 = $62,047

Unit cost of ending FG

Cat = 92,472 ÷ 550 = $168.13

Dog = 62,047 ÷ 210 = $295.46

(Instruction 7)

CGS for Cat = $1,000 + (530 - 10) x 168.13 = $88,428

CGS for Dog = $4,650 + (225 - 25) x 295.46 = $63,742

(Instruction 8)

Non-manufacturing costs = 178,400 x 0.01 + 16,000 + 16,000 x 1.05 = $50,640

(Instruction 9)

(1) Sales = $178,400

(2) CGS = 88,428 + 63,742 = 152,170

(3) GP = (1) - (2) = $26,230

(4) S&A = 50,640

(5) Operating Income = (3) - (4) = <u>(-)24,410</u>

[Problem 5]

Instruction (1)

$13,573.5

Instruction (2)

Ordering = (14 + 24 + 14) x $45 = $2,340

Delivery = (12 + 62 + 19) x $41 = $3,813

Stocking = (16 + 172 + 94) x $10.50 = $2,961

Support = (4,600+ 34,200+ 10,750) x $0.09 = $4,459.5

Instruction (3)

soft drinks = (14 x $45) + (12 x $41) + (16 x $10.50) + (4600 x 0.09) = $1,704

snacks = (24 x $45) + (62 x $41) + (172 x $10.50) + (34200 x 0.09) = $8,506

packaged= (14 x $45) + (19 x $41) + (94 x $10.50) + (10750 x 0.09) = $3,363.5

Instruction (4)

fresh snacks

Chapter 11

[Problem 1]

(Instruction 1)

500,000 x (P - 4) - 2,500,000 = 180,000 → P = $9.36

(a) Sales = 9.36 x 500,000 = $4,680,000

(b) Selling price = $9.36

(c) ROI = 180,000 / 2,250,000 = 8%

(d) Unit cost = $4 + $2.500,000/500,000 = $9

Markup = ($9.36 - $9) / $9 = 4%

(Instruction 2)

Unit cost = $4 - $0.30 + $2,275,000/500,000 = $8,25

P = $8.25 x 1.04 = $8.58

(Instruction 3)

Unit cost = $4 - $0.30 + $2,275,000/(500,000 x 0.95) = $8,49

P = $8.49 x 1.04 = $8.83

Operating Income = (8.83 - 3.70) x 500,000 x 0.95 - 2,275,000 = $161,750

[Problem 2]

Instruction (1)

15,000,000 x 10% = $1,500,000

Instruction (2)

Unit cost = 5 + $900,000/300,000 = $8

$1,500,000 = (P − $5) x 300,000 − $900,000 → P = $13

Mark-up = (13-8)/8 = 62.5%

Instruction (3)

OI = ($15-$5) x 300,000 x 0.96 - $900,000 = $1,980,000

ROI = 1,980000/15,000,000 = 13.2%

[Problem 3]

Instruction (1)

\$65 + (\$100 - \$8 - \$65) = \$92

Instruction (2)

\$100 + \$7 = \$107

Instruction (3)

(1) \$65 + (\$100 - \$8 - \$65) x 0.7 = \$83.9 (2) 20,000 screens

[Problem 4]

최소대체가격 = 1,800 + 150,000 ÷ 1,000개 = 1,950

최대대체가격 = 2,000

[Problem 5]

Instruction (1)

(a) OI(US) = 0

OI(G) = (575 – 400 x 1.15) x 100,000 x (1-0.4) = \$6,900,000

(b) OIUS = (475 – 400) x 100,000 x (1-0.35) = \$4,875,000

OI(G) = (575 – 475 x 1.15) x 100,000 x (1-0.4) = \$1,725,000

Instruction (2)

(P-400) x 0.35 + (575 – P x 1.15) x 0.4 + P x 0.15 = 0.04P+ 90 ➠ \$400

Chapter 12

[Problem 1]

Incremental revenue = 190 + 10 =200 Incremental cost = 260

Incremental profit = -$60 ➠ reject

[Problem 2]

Incremental revenue = 5,000 x $6.25 = $31,250

Incremental cost = 5,000 x $5 = $25,000 Incremental profit = +$6,250

[Problem 3]

Instruction (1)

Incremental revenue = 10,000 x $23 = $230,000

Incremental cost = 10,000 x $20 = $200,000 Incremental profit = +$30,000

Instruction (2)

(1) Incremental revenue = 10,000 x $23 = $230,000

Incremental cost = 10,000 x ($20 + $13) = $330,000

Incremental profit = -$100,000

(2) $33

(3) in class

[Problem 4]

Incremental revenue = 30,000 x $43 + RC

Incremental cost = 30,000 x $47

$30,000 = 30,000 x (43-47) + RC ➠ RC = $150,000

[Problem 5]

Instruction (1)

Cola = $5, Lemonade = $4.50, Punch = $6.80, Juice = $9.20

Instruction (2)

Cola = 7 x $5 = $35, Lemonade = 12 x $4.50 = $54

Punch = 24 x $6.80 = $163.2, Juice = 6 x $9.20 = $55.2

[Problem 6]

Instruction (1) OI = 70,000 − 40,000 + 44,000 = $74,000

Instruction (2) OI = 70,000 − 25,000 + (15,000 − 4,000) = $56,000

[Problem 7]

Instruction (1)

(1) a partially automated B2B

300,000 ➠ Cost = 300,000 x 35 + 5,000,000 = $15,500,000

400,000 ➠ Cost = 400,000 x 35 + 5,000,000 = $19,000,000

500,000 ➠ Cost = 500,000 x 35 + 5,000,000 = $22,500,000

600,000 ➠ Cost = 600,000 x 35 + 5,000,000 = $26,000,000

700,000 ➠ Cost = 700,000 x 35 + 5,000,000 = $29,500,000

(2) a fully automated B2B

300,000 ➠ Cost = 300,000 x 20 + 11,000,000 = $17,000,000

400,000 ➠ Cost = 400,000 x 20 + 11,000,000 = $19,000,000

500,000 ➠ Cost = 500,000 x 20 + 11,000,000 = $21,000,000

600,000 ➠ Cost = 600,000 x 20 + 11,000,000 = $23,000,000

700,000 ➠ Cost = 700,000 x 20 + 11,000,000 = $25,000,000

Instruction (2)

Expected orders = 485,000

a partially automated B2B : Cost = 485,000 x 35 + 5,000,000 = $21,975,000

a fully automated B2B : Cost = 485,000 x 20 + 11,000,000 = $20,700,000

[Problem 8]

Instruction (1)

Excess capacity = 8000 시간 × 25% × 2개 = 4,000개

단위당 변동원가 = 200 + 300 + 240 × 0.5 = 620

기회비용 = (5,000개 - 4,000개) × (1,000 - 620) = 380,000

Instruction (2)

증분수익 = 5,000개 × 700 = 3,500,000

증분비용 = 5,000개 × 620 + 380,000 = 3,480,000 ➠ 증분이익 = 20,000

Chapter 13

[Problem 1]

Instruction (1)

WACM = $15,525/2,300 = $6.75

Budgeted sales-mix percentage of Plan=w

$6.75 = w x $5 + (1-w) x $12 ➠ w=75%

Total actual quantity = 2,300 + $2,700/6.75 = 2.700

Sales quantity variance of Plain = (2700-2300) x 75% x $5 = +1,500

Sales quantity variance of Chic = (2700-2300) x 25% x $12 = +1,200

Instruction (2)

Sales mix variance of Plain = (60%-75%) x 2700 x $5 = -2,025

Sales mix variance of Chic= (40%-25%) x 2700 x $12 = +4,860

Total sales mix variance = -2,025 + 4,860 = +2,835

Instruction (3)

Sales volume variance of Plain = -2,025 + 1,500 = -525

Sales volume variance of Chic = 4,860 + 1,200 = 6,060

Total sales volume variance = -525 + 6,060 = +5,535

[Problem 2]

Instruction (1)

Static budget OI = 15,000 x (20-8) -145,000 = $35,000

Actual OI = 12,000 x (21-7) -150,000 = $18,000

Static-Budget Variance = 18,000 – 35,000 = -17,000(U)

Instruction (2)

Flexible budget OI = 12,000 x (20-8) -145,000 = -1,000

Flexible-Budget Variance = 18,000 – (-1,000) = +19,000(F)

[Problem 3]

Instruction (1)

static-budget variance in units = 350,000 – 335,000 = 15,000 units(F)

static-budget variance in revenues = 2,012,500 – 1,976,500 = +36,000(F)

static-budget variance in variable manufacturing costs

= 1,137,500 – 1,038,500 = +99,000(U)

static-budget variance in contribution margin

= 875,000 – 938,000 = -63,000(U)

static-budget variance percentage relative to its static-budget amount

unit = 15,000/335,000 = 4.48%

revenues = 35,500/1,976,500 = 1.80%

variable manufacturing costs = 99,000/1,038,500 = 9.53%

contribution margin = 63,000/938,000 = 6.72%

Instruction (2)

(1) units

flexible-budget variance = 350,000 – 350,000 = 0

sales-volume variance = 15,000 – 0 = 15,000(F)

(2) revenues

flexible-budget variance = 350,000 x (5.75- 5.9) = -52,500(U)

sales-volume variance = 36,000 - (-52,500) = 88,500(F)

(3) variable manufacturing costs

flexible-budget variance = 350,000 x (3.25- 3.1) = +52,500(U)

sales-volume variance = 99,000 – 52,500 = 46,500(U)

(4) contribution margin

flexible-budget variance = 350,000 x (2.5- 2.8) = -105,000(U)

sales-volume variance = -63,000-(-105,000) = 42,000(F)

Instruction (3)

selling-price variance = 350,000 x (5.75- 5.9) = -52,500(U)

Chapter 14

[Problem 1]

Instruction (1)

DM price variance = (5.10-5) x 3700 = $370(U)

DM efficiency variance = 5 x (3700 – 4000) = $1500(F)

DL price variance = (9.80-10) x 900 = $180(F)

DL efficiency variance = 10 x (900–1000) = $1000(F)

Instruction (2)

DM price variance = (5.10-5) x 6000 = $600(U)

DM efficiency variance = 5 x (3700 – 4000) = $1500(F)

[Problem 2]

DL price variance = $940,000 - $9 x 94,000 = $94,000(U)

DL efficiency variance = $9 x (94,000–88,000) = $54,000(U)

VOH spending variance = $740,000 – 94,000 x $8 = $12,000(F)

VOH efficiency variance = $8 x (94,000–88,000) = $48,000(U)

FOH spending variance = $540,000 – $500,000 = $40,000(U)

FOH volume variance =$5 x (100,000–88,000) = $60,000(U)

[Problem 3]

Instruction (1)

VOH spending variance = $680,400 – 50,400 x $10 = $180,000(U)

VOH efficiency variance = $10 x (50,400– 56,000) = $56,000(F)

VOH budget variance = +180,000 – 56,000 = $124,000(U)

Instruction (2)

FOH spending variance = $282,000 – 64,000 x $4 = $26,000(U)

FOH volume variance = $4 x (64,000– 56,000) = $32,000(F)

[Problem 4]

VOH spending variance = $618,840 – 76,400 x $8 = $7,640(U)

VOH efficiency variance = $8 x (76,400– 78,600) = $17,600(F)

FOH spending variance = \$145,790 – \$144,000 = \$1,790(U)

FOH volume variance = \$2 x (72,000– 78,600) = \$13,200(F)

[Problem 5]

DM price variance = (\$3.80-\$4) x 40,300 = \$8,060(F)

DM efficiency variance = \$4 x (37,300 – 38,000) = \$2,800(F)

DL price variance = (\$16.25-\$16) x 31,400 = \$7,850(U)

DL efficiency variance = \$16 x (31,400-30,400) = \$16,000(U)

MOH spending variance = \$650,000 – 31,400 x \$8 – 37,000 x \$9 = \$65,800(U)

VOH efficiency variance = \$8 x (31,400-30,400) = \$8,000(U)

FOH volume variance = \$9 x (37,000– 30,400) = \$59,400(U)

Chapter 15

[Problem 1]

Instruction (1)

OI = ($720-$500) x 150,000 - $30,000,000 = $3,000,000

ROI = 3,000,000/48,000,000 = 6.25%

Instruction (2)

OI = 48,000,000 x 25% = $12,000,000

$12,000,000 = (P-$500) x 150,000 - $30,000,000 ⇒ P = $780

[Problem 2]

(Company A)

Income as a percentage of revenues = 150,000/500,000 = 30%

Investment turnover = 500,000/250,000 = 2

ROI = 30% x 2 = 60%

(Company B)

Investment = 60,000/0.06 = 1,000,000

Income as a percentage of revenues = 60,000/200,000 = 30%

Investment turnover = 200,000/1,000,0000 = 0.2

(Company C)

Revenues = 1,000,000 x 2 = $2,000,000

Operating income = 2,000,000 x 3% = $60,000

ROI = 3% x 2 = 6%

[Problem 3]

WACC = 10% x (1-0.4) x 1/2 + 14% x 1/2 = 10%

EVA(남부) = 250,000 x (1-0.4) - (1,500,000 x 10%) = 0

EVA(중부) = 2,000,000 x (1-0.4) - (7,000,000 x 10%) = $500,000

[Problem 4]

Instruction (1)

ROI for New Car = 2,475,000/33,000,000 = 7.5%

ROI for Performance Part= 2,565,000/28,500,000 = 9%

Instruction (2)

RI for New Car = 2,475,000 – (26,400,000 x 12%) = (-)$693,000

RI for Performance Part= 2,565,000 – (20,100,000 x 12%) = $153,000

Instruction (3)

WACC = 10% x (1-0.4) x 18/30 + 15% x 12/30 = 9.6%

EVA for New Car = 2,475,000 x (1-0.4) – (26,400,000 x 9.6%) = (-)$1,049,400

EVA for Performance Part

= 2,565,000 x (1-0.4) – (20,100,000 x 9.6%) = (-)$390,600

[Problem 4]

Instruction (1)

NI = (200,000 – 600,000 x 6.25%) x (1-0.2) = $130,000

Instruction (2)

ROI = 200,000/1,250,000 = 16%

Instruction (3)

RI = 200,000 – 1,250,000 x 10% = $75,00

Instruction (4)

WACC = 6.25% x (1-0.2) x 6/14 + 12% x 8/14 = 9%

EVA = 200,000 x (1-0.2) – (1,000,000 x 9%) = $70,000

Chapter 16

[Problem 1]

Instruction (1)

appraisal cost = 200,000 x $5 = $1,000,000

internal failure cost = 200,000 x 5% x $1 = $10,000

Instruction (2)

out-of-pocket external failure cost = 200,000 x 1% x $9 = $18,000

Instruction (3)

opportunity cost associated with the external failures

= 200,000 x 1% x $100 = $200,000

Instruction (4)

total costs of quality = 1,000,000 +10,000 + 18,000 + 200,000 = $1,228,000

Instruction (5)

appraisal cost = 200,000 x $3 = $600,000

internal failure cost = 200,000 x 3.5% x $1 = $7,000

external failure cost = 200,000 x 2.5% x $109 = $545,000

total costs of quality = 600,000 +7,000 + 545,000 = $1,152,000

[Problem 2]

Instruction (1)

Incremental revenues = 315,000 x 60% + 787,500 x 70% = 740,250

Incremental costs = 150,000 + 137,500 = 287,500

Incremental profits = +452,750

Instruction (2)

<before the change in the production process>

(1) as a percentage of total quality costs

total quality costs = 210,000 + 100,000 + 441,000 + 1,102,500 = 1,853,500

prevention costs = 210,000 /1,853,500 = 11.3%

appraisal costs = 100,000 /1,853,500 = 5.4%

internal failure costs = 441,000 /1,853,500 = 23.8%

external failure costs = 1,102,500 /1,853,500 = 59.5%

(2) as a percentage of sales

prevention costs = 210,000 /10,500,000 = 2%

appraisal costs = 100,000 /10,500,000 = 1%

internal failure costs = 441,000 /10,500,000 = 4.2%

external failure costs = 1,102,500 /10,500,0000 = 10.5%

<after the change in the production process>

(1) as a percentage of total quality costs

total quality costs = 497,500 + 100,000 + 441,000 + 362,250 = 1,400,750

prevention costs = 497,500 /1,400,750 = 35.5%

appraisal costs = 100,000 /1,400,750= 7.1%

internal failure costs = 441,000 /1,400,750 = 31.5%

external failure costs = 362,250 /1,400,750 = 25.9%

(2) as a percentage of sales

prevention costs = 497,500 /10,500,000 = 4.7%

appraisal costs = 100,000 /10,500,000 = 1%

internal failure costs = 441,000 /10,500,000 = 4.2%

external failure costs = 362,250 /10,500,0000 = 3.5%

[Problem 3]

prevention costs = 10 + 40 +70 + 90 = 210

appraisal costs = 60

internal failure costs = 20

external failure costs = 30 +50 +80 = 160