The following information is for the next three Questions: Delphi has developed a new project that will be marketed for the first time in the next fiscal year. Although the Marketing Department estimates that 35,000 units could be sold at $36 per unit, Delphi's management has only allocated enough manufacturing capacity to manufacture 25,000 units of the new product annually. The fixed costs that are associated with the new product are budgeted at $450,000 for the year, which includes $60,000 of depreciation on new manufacturing equipment. Data for each unit of product is below and Delphi is subject to a 40% tax rate.

	Variable Costs
Direct material	$ 7.00
Direct labor	3.50
Manufacturing overhead	4.00
Total variable manufacturing cost	14.50
Selling expenses	1.50
Total variable costs	$16.00

Question 22: The number of units of the new product that Delphi must sell in order to break even during the next fiscal year is:

a) 20,930

b) 18,140

c) 22,500

d) 25,500

Question 23: The maximum after-tax profit that can be earned by Delphi Company from sales of the new product during the next fiscal year is:

a) $30,000

b) $50,000

c) $110,000

d) $66,000

Question 24: Delphi Company's management has stipulated that it will not approve the continued manufacture of the new product after the next fiscal year unless the after-tax profit is at least $75,000 the first year. The unit selling price to achieve this target profit must be at least:

a) $37.00

b) $36.60

c) $34.60

d) $39.00

(CMA Adapted)

Question 25: A company has sales of $500,000, variable costs of $300,000, and pre-tax profit of $150,000. If the company increased the sales price per unit by 10%, reduced fixed costs by 20%, and left variable cost per unit unchanged, what would be the new breakeven point in sales dollars?

a) $88,000

b) $100,000

c) $110,000

d) $125,000

(CIA Adapted)

Using Breakeven Analysis in Decision-Making

Breakeven analysis can also be used in decision-making. Two decisions it may be used in are:

1) Determining if the company should increase fixed marketing costs, or

2) Determining if reducing the sales price will increase profits.

Increasing Fixed Marketing Costs in Order to Increase Sales

When the company needs to decide whether to assume additional fixed costs, the decision is whether the contribution generated by the additional costs is greater than the additional cost.

Suppose our company, with $4,600 in fixed costs, a required pre-tax operating income of $5,000, and contribution margin of $1.80 ($4.00– $2.20) is presently selling only 5,000 units, which is less than is required to meet its profit requirement. (Recall that the required number of units to be sold is 5,334.) To increase sales, management is considering an advertising program that will cost $1,000. Management estimates that the advertising program (the cost of which is fixed) will increase sales by 500 units. Should the company spend the money on the advertising program?

At first glance, you might say yes, because this will increase sales to 5,500 units, 166 more than required. But what about the increase to fixed costs that will result from the advertising expense? The increase in fixed costs will increase the number of units required to earn the required profit of $5,000, as follows:

$$\text{BEP}^{a} = \frac{\text{Present Fixed Costs + Proposed Advertising Fixed Cost + Required Profit}}{\text{Contribution Margin Per Unit}}$$

$$= (4{,}600 + 1{,}000 + 5{,}000) / 1.80 = 5{,}889 \text{ units}$$

Because of the increase in fixed costs, the breakeven point in number of units has increased to 5,889, and the 5,500 anticipated sales are not going to be adequate. But would the company's operating income increase or decrease as a result of the ad campaign? To answer that question, we set up an income statement **with** the advertising and an income statement **without** the advertising, and compare them:

	With Adv. Program	Without Adv. Program
No. of units sold	5,500	5,000
Total Revenue	22,000	20,000
Variable Cost @ $2.20	12,100	11,000
Fixed Cost	5,600	4,600
Operating Income	4,300	4,400

The two income statements show us that with the advertising program, operating income will actually be **less** than it would be without the advertising program.

[a] The term BEP is being used here even though in fact this is not the breakeven point, but rather a point at which a certain level of profit is achieved. The term target profit volume has been used before, but for simplicity, BEP is also used even when it is representing a volume required for a given level of profit.

Reducing the Sales Price to Increase Sales

Having determined that the advertising program as planned is not the solution to the problem, our firm wants to know whether cutting prices will increase sales enough to create the required profit. If the company cuts its price to $3.75 from $4.00, managers think they could sell 6,000 units, or 1,000 more. First, let's calculate the breakeven point using the contribution margin approach, to get an idea of whether this would do the job:

The contribution margin is now $3.75 – $2.20, or $1.55.

$$\text{BEP} = \frac{\text{Fixed Costs + Required Profit}}{\text{Contribution Margin Per Unit}}$$

($4,600 + $5,000) / $1.55 = 6,194 units

So we are still not at the breakeven point, because the 6,000 units projected is still less than the 6,194 units needed to make a $5,000 profit when the contribution margin is $1.55. But would reducing the price to $3.75 bring the company closer to its profit requirement, even if it were not enough to generate a $5,000 profit?

	With Price Cut	Without Price Cut
Price	$3.75	$4.00
No. units sold	6,000	5,000
Total Revenue	$22,500	$20,000
Variable Cost @ $2.20	13,200	11,000
Fixed Cost	4,600	4,600
Operating Income	$ 4,700	$ 4,400

Operating Income has improved by $300. However, management still has to answer some questions before it can decide whether to make the price cut. Some of these questions are:

1) Will the increased volume of business cause any increases in fixed costs? Remember that fixed costs are fixed only over the relevant range. An increase in sales volume from 5,000 units to 6,000 units is a 20% increase, and it might require some additional fixed costs. If additional facilities or administrative personnel would be required to support the increase, it could impact the analysis negatively.

2) Will the increased volume qualify the company for any quantity discounts on materials from suppliers that could lower its variable costs? If so, that will affect the analysis in a positive manner.

3) Will the company be able to raise the price again in the future, or will this be the price going forward?

So in the real world, this decision is more complex than just a simple analysis using the same fixed and variable costs as would be the case for sales of only 5,000 units.

If you are given a problem like this on the exam, look for factors that will change with an increase in sales, remembering that in the long run, **all** costs are variable costs. However, a problem will tell you if an increase in volume will result in a need for more production capacity. If nothing is said, assume that an increase in volume will **not** result in a need for more production capacity.

The following information is for the next three Questions: Moorehead Manufacturing Company produces two products. Fixed manufacturing cost is applied at a rate of $1.00 per machine hour.

Per Unit	XY-7	BD-4
Selling price	$4.00	$3.00
Variable manufacturing cost	2.00	1.50
Fixed manufacturing cost	.75	.20
Variable selling cost	1.00	1.00

The sales manager has had a $160,000 increase in the budget for advertising. The products are not substitutes for one another in the eyes of the company's customers.

Question 26: Suppose the sales manager chooses to devote the entire $160,000 to increased advertising for XY-7. The minimum increase in sales units of XY-7 required is:

a) 640,000 units

b) 160,000 units

c) 128,000 units

d) 80,000 units

Question 27: Suppose the sales manager chooses to devote the entire $160,000 to increased advertising for BD-4. The minimum increase in sales dollars of BD-4 required to offset the increased advertising would be:

a) $160,000

b) $320,000

c) $960,000

d) $1,600,000

Question 28: Suppose Moorehead has only 100,000 machine hours that can be made available to produce additional units of XY-7 and BD-4. If the potential increase in sales units for either product resulting from advertising is far in excess of this production capacity, which product should be advertised and what is the estimated increase in contribution margin earned?

a) Product XY-7 should be produced, yielding a contribution margin of $75,000.

b) Product XY-7 should be produced, yielding a contribution margin of $133,333.

c) Product BD-4 should be produced, yielding a contribution margin of $187,500.

d) Product BD-4 should be produced, yielding a contribution margin of $250,000.

(CMA Adapted)

Breakeven Analysis when More than One Product Is Sold

So far we have looked at situations when companies sell only one good. Very few companies sell only one good, however, so we will now expand our discussion of breakeven analysis to include situations when the company sells two or more goods. In these situations, in order to do CVP analysis, we will need to assume that the company has a **constant sales mix**.

The sales mix is the percentage of sales that each of the products/services represents of total sales. A sales mix problem may be presented as the mix of the **number of units sold** (a breakeven quantity), or it may be presented as the mix of the **total sales revenue** (a breakeven revenue). The problem is solved differently depending upon which type it is, so read the question carefully.

Sales *Quantity* Mix (Dollar Amount of Contribution per Basket)

To calculate a breakeven number of units for a company that sells more than one product, we will calculate the **weighted average contribution margin** for the product mix as a whole, and not for each individual product.

However, it is important to know that in reality, when there is more than one product is sold, **there is no single breakeven point because the breakeven point depends upon the sales mix**. In reality, an almost unlimited number of combinations of sales can lead to the breakeven point. However, on the exam we assume a **constant sales mix**, and therefore, there is only one breakeven point, no matter how many different products there are.

What we do to determine the breakeven point when there are multiple products is create a basket of goods. We will determine the contribution from each basket of goods and use this contribution to determine the breakeven point in the number of baskets. The basket will consist of the proper ratio of the different goods that are sold - X% of Product A, Y% of Product B, and Z% of Product C.

Once we calculate the contribution per basket, everything else will be done as it was done before. When we are finished, we will have the **breakeven total number of baskets**. This number of baskets then needs to be multiplied by the number of units of each product in the basket to determine the quantity of each unit at which the company will break even.

> Note: There are different ways to calculate this basket because it is mathematical, and it is possible that you know or will see another way to do it. The critical thing is that you get the correct answer.

Two examples of this calculation of breakeven point with a mix of products follow:

Example: Let us assume that the unit sales of a company are made up of 40% of Product A and 60% of Product B. The selling prices are $4.00 for Product A and $3.00 for B. Variable costs are $2.50 and $1.75 for Products A and B, respectively. Fixed costs for the company are $75,000. Determine how many of each product needs to be sold to break even.

We will start by calculating the contribution margin per unit for each product individually:

	Product A	Product B
	40%	60%
Sale price per unit	$4.00	$3.00
Less: Variable cost per unit	2.50	1.75
Contribution margin per unit	$1.50	$1.25

Next, we calculate the contribution per basket based on the percentages of each item. This results in a weighted average contribution margin for the product mix as a whole:

Contribution per Basket = (.40 × $1.50) + (.60 × $1.25) = $1.35

Next, we divide the fixed costs by the contribution per basket to get the breakeven number of baskets:

$75,000 / $1.35 = **55,555.55 baskets**

Our last step will be to determine 40% and 60% of the total number of units, which is 55,555.55 (we don't need to round until we have done the last step):

55,555.55 × .40 = 22,222.22, or **22,223 units of Product A**

55,555.55 × .60 = 33,333.33, or **33,334 units of Product B**

Second Method to Solve this Question

This could also be solved in a different manner by assuming that the basket is made up of not one unit (.4 of which is Product A and .6 of which is Product B), but rather in which the basket is made up of 10 individual units, 4 of which are Product A and 6 of which are Product B. In this case, the weighted average contribution per basket containing 10 units will be $13.50 [(4 × $1.50) + (6 × $1.25) = $13.50.

Therefore, the breakeven point in baskets will be only 5,555.55. However, the breakeven point for each product will still be the same, because in each basket there are 4 units of Product A (giving a total of 22,223 units of Product A) and 6 units of Product B (giving a total of 33,334 units of Product B).

Example: A company's basket of sales consists of 25 units of Product A, 5 units of Product B, and 20 units of Product C. The company's fixed costs are $50,000. Selling prices and variable costs are as follows:

	Item A	Item B	Item C
Selling price/unit	10.00	6.00	8.00
Variable cost/unit	5.00	4.00	4.50
Contribution margin/unit	5.00	2.00	3.50
Number of units	25	5	20

The total contribution margin for the basket is ($5 × 25) + ($2 × 5) + ($3.50 × 20) = $205. We now use the contribution margin of the basket, which is $205, to calculate the breakeven number of **baskets**:

$$\frac{\$50{,}000}{\$205} = 243.90 \textbf{ baskets}$$

Each basket consists of 25 units of A, 5 units of B, and 20 units of C. So the 243.90 baskets consist of:

Product A:	243.90 × 25	=	6,098 units
Product B:	243.90 × 5	=	1,220 units
Product C:	243.90 × 20	=	4,878 units
Total breakeven quantity			12,196 units

To prove this result, we can develop a Contribution Income Statement:

	A	B	C	Total
	6,098 units	1,220 units	4,878 units	12,196 units
Revenue	60,980	7,320	39,024	107,324
Variable Costs	30,490	4,880	21,951	57,321
Contribution Margin	30,490	2,440	17,073	50,003
Fixed Costs				50,000
Net Income (difference due to rounding)				3

Sales *Revenue* Mix (Contribution Margin *Ratio* for the Basket)

If you are asked to calculate a breakeven point for a company that sells more than one product and the breakdown between/among the products sold is given as a percentage of the **total sales revenue**, instead of calculating the weighted average contribution margin for the product mix, you will calculate the **weighted average contribution margin ratio** for the product mix.

Example: Assume that the sales revenue of a company is made up of 40% of Product A and 60% of Product B. The selling prices are $4.00 for Product A and $3.00 for Product B. Variable costs are $2.50, or 62.5% of the sales price, and $1.75, or 58.3% of the sales price, for Products A and B, respectively. Fixed costs for the company are $75,000. Determine how many of each product needs to be sold to break even.

We will start by calculating the contribution margin ratio per unit for each product individually:

	Product A		Product B	
	40% of sales rev	C M Ratio	60% of sales rev	C M Ratio
Sale price per unit	$4.00		$3.00	
Less: Variable cost per unit	2.50		1.75	
Contribution margin per unit	$1.50	37.50%	$1.25	41.67%

Next, we calculate the **weighted average contribution margin ratio** per unit:

Weighted Average Contribution Margin Ratio/Unit = (.40 × .375) + (.60 × .4167) = .40

We now divide fixed costs by the weighted average contribution margin ratio to get the breakeven revenue in total:

$$\$75,000 / .40 = \$187,500$$

Our last step will be to determine 40% and 60% of the total breakeven revenue:

$$\text{Revenue for A} = \$187,500 \times .40 = \$75,000$$

$$\text{Revenue for B} = \$187,500 \times .60 = \$112,500$$

Note: Do not expect that 40% of the number of units as calculated in the earlier example will equate to 40% of the amount of sales dollars as calculated in this example. Since Product A and Product B have different sales prices, the solutions will not be equivalent.

Effect of Changes in Sales Mix

Change in Sales *Quantity or Revenue* Mix

A company's **sales quantity mix** is the combination of **quantities** sold of each of its products or services. And its **sales revenue mix** is a combination of the revenues received from the sale of each of its products/services. If the company's sales mix changes, operating income can change, even if total revenue does not change, depending on the contribution margins of each of the individual products/services in the mix.

In reality, when there is more than one product or service, **there is no unique breakeven quantity or revenue**, because the breakeven point depends upon the sales mix. As we have seen, we can make an assumption about the sales mix and thereby calculate a breakeven point for that sales mix. However, if the sales mix changes, the breakeven point will also change. The effect on the breakeven point will be as follows (all other things being equal):

- If the product(s) with **higher** contribution margins increase in proportion to those with lower contribution margins, operating income will increase and the breakeven point in number of units and amount of revenue will **decrease**. This is a more beneficial mix.
- If the product(s) with **lower** contribution margins increase in proportion to those with higher contribution margins, operating income will decrease and the breakeven point in number of units and revenue will **increase**. This is a less beneficial mix.

This is because the sales mix determines the **weighted average contribution margin per unit,** as well as the **weighted average contribution margin ratio per unit**. If higher contribution margin items increase in the product mix, the weighted average contribution margin (and the weighted average contribution margin ratio) will increase, and vice versa. In turn, the weighted average contribution margin per unit determines operating income and the breakeven quantity, since Fixed Costs ÷ Weighted Average Contribution Margin Per Unit = Breakeven Point. And the weighted average contribution margin ratio per unit determines the breakeven revenue. Therefore, the higher the weighted average contribution margin per unit, the lower the breakeven point, and vice versa.

The following information is for the next three Questions: MultiFrame Company has the following revenue and cost budgets for the two products it sells.

	Plastic Frames	Glass Frames
Budgeted unit sales	100,000	300,000
Sales price	$10.00	$15.00
Direct materials	(2.00)	(3.00)
Direct labor	(3.00)	(5.00)
Fixed overhead	(1.95)	(2.60)
Net income per unit	$3.05	$4.40

The budgeted unit sales equal the current unit demand, and total fixed overhead for the year is budgeted at $975,000. Assume the company plans to maintain the same mix ratio. In numerical calculations, MultiFrame rounds to the nearest cent and unit.

Question 29: The total number of units that MultiFrame needs to produce and sell to break even is:

a) 150,000 units

b) 354,545 units

c) 177,273 units

d) 300,000 units

Question 30: The total number of units needed to break even if the budgeted direct labor costs were $2 for plastic frames instead of $3 is:

a) 154,028 units

b) 144,444 units

c) 156,000 units

d) 146,177 units

Question 31: The total number of units needed to break even if sales were budgeted at 150,000 units of plastic frames and 300,000 units of glass frames with all other costs remaining constant is:

a) 171,958 units

b) 418,455 units

c) 153,947 units

d) 365,168 units

(CMA Adapted)

Question 32: The Smith Company produces two products: 158-D and 074-J. 158-D accounts for 35% of Smith's total sales revenue, while 074-J accounts for the remainder. The variable cost for 158-D is 45% of its selling price, while 074-J's variable cost is 55% of its selling price. If Smith's fixed costs are $250,000, what is the company's total breakeven revenue?

a) $485,437

b) $515,464

c) $505,051

d) $495,050

(HOCK)

Choosing Between Two Cost Options

In order to determine which of two cost options is preferable, we must develop two cost formulas, one for each of the two options. Then we set the left sides of the two formulas equal to one another, as in the following example, and solve for the variable. This is the amount at which the two options are equal to each other, which enables management to make a decision based on what the expected quantity is.

Example: JJ Motors, Inc. employs 45 sales personnel to market its line of luxury automobiles. The average car sells for $23,000, and a 6% commission is paid to the salesperson. JJ Motors is considering a change to a commission arrangement that would pay each salesperson a salary of $2,000 per month plus a commission of 2% of the sales made by that salesperson. Determine the amount of total monthly car sales at which JJ Motors would be indifferent as to which plan it selects.

Solution:

Under the existing system, the cost formula is: $.06S = C$

Under the proposed option, the cost formula is: $(2{,}000 \times 45) + .02S = C$

As in the previous example, we don't need to know at this point what C is. We only need to know that we want C to be the same for each equation. So we set the two left sides of the two equations equal to one another. We now have an equation with just one unknown, "S". We will solve for S to get the level of sales at which the compensation to the sales staff will be the same under both cost structures:

$$.06S = (2{,}000 \times 45) + .02S$$

$$.04S = 90{,}000$$

$$S = \$2{,}250{,}000$$

If JJ Motors expects that its level of sales per month will be $2,250,000 or more, it would be better to offer the salespeople $2,000 per month plus 2% commission, because the **marginal cost** for each car sold over the level of $2,250,000 would be only 2% of the sales price. Under the straight commission arrangement, JJ's marginal cost for each car sold over the level of $2,250,000 would be 6% of the sales price.

However, if JJ Motors expects that its level of sales per month will be less than $2,250,000, it would be better to offer the salespeople a straight sales commission of 6%. For example, if sales were $2,000,000, cost under the straight commission arrangement would be:

$$\$2{,}000{,}000 \times .06 = \$120{,}000$$

And under the salary plus commission compensation schedule, total cost would be:

$$(\$2000 \times 45) + .02(\$2{,}000{,}000) = \$90{,}000 + \$40{,}000 = \$130{,}000$$

Question 33: KJCarter's Used Cars would like to hire a new salesperson. There are 2 candidates who each have different expectations regarding their compensation. One candidate would like to have a fixed salary of $45,000 per year. The second candidate would like to be paid by a commission of 5% of sales. KJCarter believes that the individual sales person has very little impact on the level of sales. At what level of expected sales from this position would it not matter to Carter which salesperson is hired.

a) $800,000

b) $900,000

c) $1,000,000

d) $1,100,000

(HOCK)

Choosing Between Production Options

CVP analysis and the concepts of marginal analysis can also be used when a company is faced with a question regarding which product to produce in order to maximize profits (or some other strategy) in a situation when it can produce only one product out of two or more possible products.

These types of questions on the exam will most likely require you to determine either the level of revenue or the level of units of output at which the company will be indifferent to the different options available. This point of indifference will be the point at which the **profit under each choice is the same.**

These types of questions are solved by using the profit and/or cost equations and the revenue for each product and setting them equal to each other. The point at which these equations equal each other is the point at which the company is indifferent as to which product it produces.

When we are trying to find the point at which profits for each product are equal, we will in every case use the profit formulas for each product and set the two formulas equal to each another. Then, if we are also trying to find the point at which revenues for each product are equal, we will also use the revenue formulas for each option and set those two formulas equal to one another.

The standard profit formula written in a longer form) is:

Profit = (sales price × units sold) – (variable cost per unit × units sold) – fixed costs

This can also be written as follows (using ***contribution per unit***):

Profit = (Contribution Margin per unit × units sold) – fixed costs

The basic **revenue** formula is:

Revenue = (sales price per unit × units sold)

Algebraic Note: In any situation where there are two unknowns, as is the case in the example above, you must have two formulas in order to solve the problem. In the second formula, you express one of the unknowns in terms of the other unknown and then substitute this value into the first equation to create an equation with one unknown. In a CVP analysis problem, the two formulas will probably be the profit formula and the revenue formula.

Example: Farnokia Sports Company has decided to manufacture treadmills. It will begin with a single model, and if that sells well, it will expand to produce a full line of treadmills. It is making the decision about which of two prototypes to produce initially. The following projections have been made by the Marketing, Engineering, and Production Departments:

	Per Unit Data	
	Treadmill A	Treadmill B
Selling Price	$800.00	$680.00
Variable Costs	350.00	330.00
Contribution Margin	$450.00	$350.00

Fixed costs will total $375,000 if Treadmill A is produced and $300,000 if Treadmill B is produced. Farnokia Sports' income tax rate is 30%.

First Question: What is the total sales revenue for each treadmill where Farnokia Sports Company will make the same profit or loss, regardless of which treadmill model it decides to produce initially?

Solution:

Let A = the quantity of Treadmill A

Let B = the quantity of Treadmill B

We have two unknowns: A and B. The net income equations for each (disregarding income tax, because it does not differ between the alternatives and thus is not relevant) are:

450A - 375,000 = N where N = Net Income

350B - 300,000 = N where N = Net Income

N, whatever it is (and what it is does not matter at this point), will be the same for both products. Therefore, we can set the two left sides of the equations equal to one another and create one equation:

450A - 375,000 = 350B - 300,000

Since we have an equation with two unknowns, we need another equation that will express A in terms of B or B in terms of A. We will plug the second equation into the first equation so that the first equation can be expressed in terms of only one unknown.

The second equation we will use, which expresses A in terms of B, consists of the revenue equations for both treadmills:

800A = 680B

Explanation: At prices of $800 for A and $680 for B, 800A and 680B each represent total revenue for each product. Since we are looking for the level of revenue that is the same for both products, we set the two revenue equations equal to one another.

Dividing both sides by 800 will give us A expressed in terms of B:

A = 680B / 800 = .85B

Going back to our first equation, we substitute .85B where A appears and then solve for B:

(450 × .85B) - 375,000 = 350B - 300,000

382.5B - 375,000 = 350B - 300,000

32.5B = 75,000

B = 2,308 (actually, 2,307.69)

So the quantity of Treadmill B that will produce the revenue level that will create the same net income for both Treadmill A and Treadmill B is 2,308, and the revenue is:

2,308 × $680 = $1,569,440

And now that we know what B is (2,308), we can easily find A by going back to either our first equation (the profit equation) or our second equation (the revenue equation). We will compute this using the revenue equation to prove our answer:

800A = 680B

800A = 680 × 2,308

800A = 1,569,440

A = 1,962 (actually 1,961.8)

1,962 × $800 = $1,569,600, which is essentially the same revenue amount we got for Treadmill B (the minor difference is due to rounding).

Proof: To prove this answer, we can simply set up two small income statements for these levels of sales (1,962 units of A and 2,308 units of B) at which the revenues are equal to each other except for rounding differences: $1,569,600 and $1,569,440.

		Treadmill A		Treadmill B
Sales revenue	(1,962 × $800)	$1,569,600	(2,308 × $680)	$1,569,440
Variable Costs	(1,962 × $350)	(686,700)	(2,308 × $330)	(761,640)
Contribution Margin		882,900		807,800
Fixed Costs		(375,000)		(300,000)
Net income		$ 507,900	(Difference due to rounding)	$ 507,800

Second Question: If we had been asked simply to find a **single quantity of units that would be the same result for both options** and that would create the same level of net income for both options, the calculation would have been much simpler. Our equation (again, disregarding income tax because it is not relevant) would be, once again, the two net income equations set equal to one another. Now, however, we have only one unknown, because we are looking for one quantity that will be common to both treadmills. So we will use Q for the quantity:

$$\begin{aligned} 450Q - 375{,}000 &= 350Q - 300{,}000 \\ 100Q &= 75{,}000 \\ Q &= 750 \end{aligned}$$

Proof:

At a quantity of 750 of Treadmill A, income will be: (450 × 750) - 375,000 = $(37,500)

At a quantity of 750 of Treadmill B, income will be: (350 × 750) - 300,000 = $(37,500)

If, as in the example above, there are different **fixed** costs for each of the two options, these fixed costs also need to be included in the formula. If there is no difference in fixed costs between the options, fixed costs are not relevant and do not need to be included in the formula as they will simply be eliminated against each other.

In either case, once the number of units of each product required to produce the same revenue for each product option has been determined, it is a simple matter of multiplying one of the unit numbers by that product's selling price to see what the total revenue would be under that option.

Fixed Versus Variable Cost Inputs

Frequently, manufacturing can be done in more than one way. Many times, one option involves higher fixed costs than another option but has lower variable costs than the other option. For instance, one machine might have a high purchase cost but lower operating costs than another machine. When there is a trade-off between high fixed costs/low variable costs and low fixed costs/high variable costs, the high fixed cost/low variable costs option will become more attractive as volume increases.

How can we know what the volume needs to be in order for the high fixed cost option to become feasible? Breakeven analysis can be used to find the level of sales and production where sales greater than that level will make the high fixed cost option more favorable, and sales below that level will make the low fixed-cost option more favorable. That level is called the **indifference point**, where the two options are equally favorable.

We will again use two equations and set them equal to one another. However, this time we have only one variable to worry about, the quantity, because we are looking for one quantity that will fulfill both equations and make them result in the same amount of total cost.

Example: FJJ Industries is planning to redesign the package it uses for its product, a marble chess set, and to make the package out of recyclable material. It has a choice of two machines for making the new package: Machine A, which will cost $25,000 or Machine B, which will cost $10,000. Both machines will produce the package with the same quality. Machine A is highly automated and does not require an operator. Machine B is labor intensive and requires an operator. Because of the difference in labor costs, FJJ has estimated that the variable cost for Machine A's production will be $.50 per unit, whereas the variable cost for Machine B's production will be $2.50 per unit. At what volume of production and sales will FJJ be indifferent between the two machines?

Solution:

We will create two equations, one to represent the total cost of production with Machine A and one to represent the total cost of production with Machine B, letting Q represent the quantity, and then set the two equations equal to one another and solve for Q.

The cost of production with Machine A is:
25,000 + .5Q

The cost of production with Machine B is:
10,000 + 2.5Q

Our equation is:
25,000 + .5Q = 10,000 + 2.5Q

To solve for Q, we first simplify the equation by subtracting 10,000 from both sides and by subtracting .5Q from both sides. The result is:

15,000 = 2Q

Now, we can easily solve for Q by dividing both sides by 2:

Q = 7,500

If volume is expected to be greater than 7,500 units, it will be more economical to purchase Machine A. But if volume is expected to be less than 7,500 units, Machine B will be more economical. And if volume is expected to be exactly 7,500 units, the total cost of the two machines will be exactly the same.

Proof:

25,000 + .5Q, Q = 7,500: 25,000 + .5(7,500) = $28,750
10,000 + 2.5Q, Q = 7,500: 10,000 + 2.5(7,500) = $28,750

The following information is for the next two Questions: Siberian Ski Company recently expanded its manufacturing capacity, which will allow it to produce up to 15,000 pairs of cross-country skis of the mountaineering model or the touring model. The Sales Department assures management that it can sell between 9,000 pairs and 13,000 pairs of either product this year. Because the models are very similar, Siberian Ski will produce only one of the two models.

The following information was compiled by the Accounting Department.

	Per Unit (Pair) Data	
	Mountaineering	Touring
Selling price	$88.00	$80.00
Variable costs	$52.80	$52.80

Fixed costs will total $369,600 if the mountaineering model is produced but will be only $316,800 if the touring model is produced. Siberian Ski is subject to a 40% income tax rate.

Question 34: The total sales revenue at which Siberian Ski Company would make the same profit or loss regardless of the ski model it decided to produce is:

a) $880,000

b) $422,400

c) $924,000

d) $686,400

Question 35: If the Siberian Ski Company Sales department could guarantee the annual sale of 12,000 pairs of either model, Siberian Ski would:

a) Produce 12,000 pairs of touring skis because they have a lower fixed cost.

b) Not care which model is produced because each model has the same variable cost per unit.

c) Produce 12,000 pairs of mountaineering skis because they have a lower breakeven point.

d) Produce 12,000 pairs of mountaineering skis because they are more profitable.

(CMA Adapted)

Product-Mix Decisions Under Constraints

A decision about what product or products to produce may need to be made under a situation of **constraint**. A constraint exists when one or more of the factors of production are limited in some way. This type of decision would be required if a plant were operating at full capacity and management wanted to maximize net income without being able to increase capacity.

One result of the limiting factor is that it may eliminate a number of the solutions under consideration simply because they are not possible. In the decision-making process, this limiting factor must be kept in mind and somehow dealt with. Dealing with limiting factor is called the **Theory of Constraints**.

Decisions made under situations of constraint are usually short-run decisions. In the short run, managers must do the best they can with the resources they have. In the long run, however, capacity can be expanded and constraints eliminated, or at least reduced.

When operating at capacity, operating income is maximized by maximizing contribution margin **per unit of the resource that is limiting either the production or the sale of products.** If a company has several different products and has more than one limiting factor, linear programming can be used to find the product mix that will maximize net income.

Example: Carl Corporation has only 3,000 machine hours available to produce its products. It is operating at full capacity and can sell all the products it manufactures. Carl Corporation produces two products: racks for electronic equipment and file cabinets. The price and variable costs and the number of machine hours required to produce each product are as follows:

	Per Unit Data	
	Racks	File Cabinets
Selling Price	$450.00	$600.00
Variable Costs	200.00	300.00
Contribution margin	$250.00	$300.00
Machine hours/unit	2	4

Which product should Carl Corporation use its available 3,000 machine hours to produce, assuming fixed costs are the same under either option?

Solution:

Since the constraint is the number of machine hours, Carl should produce the product that provides the highest contribution per machine hour.

The rack's contribution margin per machine hour is $250 ÷ 2, or **$125**.

The file cabinet's contribution margin per machine hour is $300 ÷ 4, or **$75**.

Even though the contribution margin for one file cabinet is higher than the contribution margin for one rack, since the racks have the higher contribution per machine hour, Carl should produce only racks. Racks return a higher contribution per unit of the scarce resource.

Proof:

Using 3,000 machine hours, Carl Corporation would be able to produce 1,500 racks, since each rack requires 2 machine hours. Thus, the total contribution margin for racks during a month's time would be 1500 × $250, or $375,000.

Using the same 3,000 machine hours, Carl Corporation would be able to produce 750 file cabinets, since each file cabinet requires 4 machine hours. The total contribution margin for file cabinets during a month's time would be 750 × $300, or only $225,000.

Therefore, in the short run, under the existing constraint of 3,000 machine hours available per month, producing only racks will maximize operating income.

Question 36: United Industries manufactures three products at its highly automated factory. The products are very popular, with demand far exceeding the company's ability to supply the marketplace. To maximize profit, management should focus on each product's:

a) Gross margin

b) Segment margin

c) Contribution margin ratio

d) Contribution margin per machine hour

(CMA Adapted)

CVP and Conditions of Risk and Uncertainty

Since CVP analysis is used for decision-making, it necessarily involves assumptions about the future. Basing a decision on assumptions about the future introduces the elements of risk and uncertainty into the process. **Risk** relates to the probability that an outcome has been predicted correctly. If the probability of an event occurring is close to 100%, there is less risk than if the event has a low probability of occurring. **Uncertainty** occurs when there is no basis to draw a conclusion one way or the other.

There are several methods through which risk and uncertainty are addressed when using CVP analysis.

The Use of Sensitivity Analysis With CVP Analysis

Sensitivity analysis is one way of dealing with uncertainty in decision-making. Sensitivity analysis answers the question "what if." If some underlying assumption changes or is not achieved, what will happen to the result? By looking at how much the results change as an assumption changes, the decision-maker is able to identify what the critical factors are and what must be controlled as much as possible. When CVP analysis is being used, the underlying assumption will be one of either sales or costs. Sensitivity analysis is used to determine the changes in profits that could take place if sales levels change, if prices change, or if costs change.

For instance, if there is a chance that sales will fall below the forecasted levels, management would want to revise any plans it may have to make new investments in increased production capacity. The increased production capacity would not be needed if sales decrease, and furthermore, if sales decrease, the company may need to cut its fixed costs in order to maintain its profitability.

Example #1: Here is an example of a sensitivity analysis using CVP analysis, where the number of units sold, the price and the fixed cost are held constant, but the variable cost per unit changes:

Variable Cost Per Unit =	$20	$25	$30	$45
Sales - 6,000 units @ $50	$300,000	$300,000	$300,000	$300,000
Variable cost for 6,000 units	120,000	150,000	180,000	270,000
Contribution margin	$180,000	$150,000	$120,000	$30,000
Fixed Cost	100,000	100,000	100,000	100,000
Profit	$ 80,000	$ 50,000	$ 20,000	$(70,000)

Example #2: Here is an example of a sensitivity analysis where the number of units sold changes while the sales price and variable cost per unit, as well as fixed costs, remain the same. Since the number of units sold changes, total sales revenue, total variable cost and the total contribution margin will all be affected by the changing volume levels:

Number of Units Sold =	6,000	5,000	4,000	3,000
Sales @ $50	$300,000	$250,000	$200,000	$150,000
Variable cost @ $25	150,000	125,000	100,000	75,000
Contribution margin	$150,000	$125,000	$100,000	$ 75,000
Fixed Cost	100,000	100,000	100,000	100,000
Profit	$50,000	$25,000	$ 0	$(25,000)

In the example above, the unit contribution margin is $50– $25, which equals $25. The contribution margin ratio is $25 ÷ $50, or 50%. This means that each $1 change in sales affects profits (upward or downward) by $.50. We can see that above, because for each $50,000 decline in sales, profit declines by $25,000.

The **margin of safety** is an aspect of sensitivity analysis. It is the amount of the excess of budgeted sales levels over breakeven sales levels. In other words, it measures the amount by which sales can fall and the company can still remain profitable, or at worst, break even.

Margin of safety may be expressed as either revenue or units. If expressed in revenues, it is the actual or budgeted revenue minus the revenue at the breakeven point. If expressed in units, it is the actual or budgeted sales quantity minus the breakeven quantity.

Margin of Safety = Sales – Breakeven Sales

The **margin of safety ratio** is the margin of safety expressed as a percentage of sales:

Margin of Safety Ratio = Margin of Safety / Sales

The margin of safety ratio is useful in comparing the risk of two products or for assessing the amount of risk in any one product. A product with a relatively low margin of safety is riskier than a product with a relatively high margin of safety.

Example: Here is the calculation of the margin of safety at the level of 6,000 units of sales in the second example above. The breakeven sales level, as we can see in the sensitivity analysis, is 4,000 units.

Number of Units Sold =	6,000	5,000	4,000	3,000
Sales @ $50	$300,000	$250,000	$200,000	$150,000
Variable cost @ $25	150,000	125,000	100,000	75,000
Contribution margin	$150,000	$125,000	$100,000	$ 75,000
Fixed Cost	100,000	100,000	100,000	100,000
Profit	$50,000	$25,000	$ 0	$(25,000)

Margin of safety in units = 6,000 – 4,000 = 2,000 units.

Margin of safety in sales dollars = 2,000 units × sales price of $50 = $100,000. Note that $100,000 is also the difference between sales revenue at the level of 6,000 units and sales revenue at the level of 4,000 units. Therefore:

Margin of safety in sales dollars = $300,000 – $200,000 = $100,000.

Margin of safety ratio = 2,000 / 6,000 = 33 1/3 %.

And, Margin of safety ratio = $100,000 / $300,000 = 33 1/3%.

Using this concept in another manner, by subtracting the margin of safety from the level of sales, we can calculate the breakeven point.

Expected Value

When there are several possible outcomes, the choice of which outcome to use in a decision model can be determined by using the **expected value** of the outcome. The **expected value** is determined by:

1) Identifying the possible outcomes and assigning a probability to each possible outcome. All of these probabilities must be between 0 and 1, and must total to 1;
2) Multiplying each quantitative outcome by its assigned probability; and
3) Summing the results of step #2 above.

The sum of the results will be the **expected value**, which will be a weighted average of the possible outcomes, using each outcome's probability as its weight. This expected value is then used as the assumption in the decision model. Expected value is covered in more detail in Part 1 in the Quantitative Analysis section.

Deterministic Approach

Under the deterministic approach we simply **select the level of output or sales that is most likely** and use this number. This is obviously easier, but it does not take into account any of the variables that exist in the determination of actual output.

The following information is for the next four Questions: Gleason Co. has two products ready for introduction, a frozen dessert and ready-to-bake breakfast rolls. However, plant capacity is limited, and only one product can be introduced at present. Therefore, Gleason has conducted a market study, at a cost of $26,000, to determine which product will be more profitable. The results of the study follow.

Sales of Desserts at $1.80/unit		Sales of Rolls at $1.20/unit	
Volume	Probability	Volume	Probability
250,000	.30	200,000	.20
300,000	.40	250,000	.50
350,000	.20	300,000	.20
400,000	.10	350,000	.10

The costs associated with the two products have been estimated by Gleason's cost accounting department and are shown as follows.

	Dessert	Rolls
Ingredients per unit	$.40	$.25
Direct labor per unit	.35	.30
Variable overhead per unit	.40	.20
Production tooling*	$48,000	$25,000
Advertising	$30,000	$20,000

* Production tooling as treated as a current operating expense rather than capitalizing it.

Question 37: According to Gleason's market study, the expected value of the sales volume of the breakfast rolls is:

a) 125,000 units

b) 260,000 units

c) 275,000 units

d) Some amount other than those given

Question 38: Applying a deterministic approach, Gleason's revenue from sales of frozen desserts would be:

a) $549,000

b) $540,000

c) $216,000

d) Some amount other than those given.

Question 39: The expected value of Gleason's operating profit directly traceable to the sale of frozen desserts is:

a) $198,250

b) $150,250

c) $120,250

d) Some amount other than those given.

Question 40: In order to recover the costs of production tooling and advertising for the breakfast rolls, Gleason's sales of the breakfast rolls would have to be:

a) 37,500 units

b) 100,000 units

c) 60,000 units

d) Some amount other than those given

(CMA Adapted)

High-Low Points Method

The High-Low Points Method is often used to separate fixed from variable costs when they are not segregated in the information we have. For this, we use the highest and lowest observed values of the cost driver within the relevant range.

If, for example, we need to segregate fixed production costs from variable production costs when all we have is a single total cost amount, we will take the month of the highest level of production or usage and the month of the lowest level of production or usage. By comparing the differences in production with the differences in total costs between these two months, we can determine approximately what amount of the costs are variable and what amount are fixed. The steps to calculate this are the following:

1) Calculate the Variable Cost Per Unit by dividing the difference between the highest and lowest costs by the difference between the highest and lowest production volumes:

$$\frac{\textbf{Difference in Costs}}{\textbf{Difference in Units}} = \textbf{Variable Cost per Unit}$$

This calculation gives us the variable cost per unit. We know this because the difference in costs between the two months is related only to variable costs (since we are assuming that all other costs are fixed and therefore unchanging with changes in production volume).

2) Multiply the Variable Cost per Unit by the unit volume at either the highest or the lowest production volume to get the total variable cost at that level.

3) Subtract the total variable cost from the total cost at that level to get the fixed cost.

Another way of estimating the variable cost per unit using the High-Low Points method is to set up two equations in two variables, with one equation representing the highest level and one equation representing the lowest level. The two variables are Fixed Costs and Variable Costs. Then, subtract one equation from the other equation to eliminate the Fixed Cost as a variable and solve the remainder for the Variable Cost.

Both methods are illustrated in the following example:

Example: Ray Corporation experienced the following total production costs during the past year at the following monthly levels of production:

Ray Corporation
Production Volumes and Costs

	Production in Units	Total Production Costs
January	6,257,000	$1,500,000
February	4,630,000	1,200,000
March	5,200,000	1,300,000
April	5,443,000	1,350,000
May	5,715,000	1,400,000
June	3,000,000	900,000
July	3,543,000	1,000,000
August	3,815,000	1,050,000
September	5,715,000	1,400,000
October	6,800,000	1,600,000
November	6,529,000	1,550,000
December	5,172,000	1,300,000

What is Ray Corporation's Fixed Cost and what is its Variable Cost per Unit?

The highest and the lowest values are:

	Production in Units	Total Production Costs
October	6,800,000	$1,600,000
June	3,000,000	900,000

Using the first method to estimate the variable cost per unit:

$$\frac{\text{Difference in Costs}}{\text{Difference in Units}} = \frac{\$700,000}{3,800,000} \quad \$.1842105 \text{ variable cost/unit}$$

Using the second method (two equations) to estimate the variable cost per unit:

$$\begin{array}{rrrrr} & FC & + & 6,800,000\ VC & = & \$1,600,000 \\ - & FC & + & 3,000,000\ VC & = & 900,000 \\ \hline & 0 & + & 3,800,000\ VC & = & \$\ 700,000 \\ & & & VC & = & \$.1842105 \end{array}$$

Whichever way we choose to calculate the Variable Cost per Unit, the next step is to put the Variable Cost per Unit into an equation to calculate Fixed Cost. For this step, we can use either the lowest or the highest volume-cost equation. Here we will use the highest.

FC = Total Cost − Variable Cost

FC = $1,600,000 − (6,800,000 × .1842105) = $347,369

We can prove this Fixed Cost amount by putting it into the equation for the lowest point values:

$347,369 + (3,000,000 × .1842105) = $900,000

So Fixed Cost is $347,369, and Variable Cost is $.1842105 per unit.

Additional Questions

The following information is for the next three Questions: Donnelly Corp. manufactures and sells T-shirts imprinted with college names and slogans. Last year, the shirts sold for $7.50 each and the variable cost to manufacture them was $2.25 per unit. The company needed to sell 20,000 shirts to break even. The net after-tax income last year was $5,040. Donnelly's expectations for the coming year include:

- The sales price of the T-shirts will be $9.
- Variable costs will increase by one-third.
- Fixed costs will increase by 10%.
- The income tax rate of 40% will be unchanged.

Question 41: The selling price that would maintain the same contribution margin rate as last year is:

a) $9.00

b) $8.25

c) $10.00

d) $9.75

Question 42: The number of T-shirts Donnelly Corp. must sell to break even in the coming year is:

a) 17,500

b) 19,250

c) 20,000

d) 22,000

Question 43: Sales for the coming year are expected to exceed last year's by 1,000 units. If this occurs, Donnelly's sales volume in the coming year will be:

a) 22,600

b) 21,960

c) 23,400

d) 21,000

(CMA Adapted)

Risk Assessment

In the Statement on Management Accounting: Enterprise Risk Management: Frameworks, Elements and Integration[b], risk is defined as "Any event or action that can keep an organization from achieving its objectives."

As you see, this is in a sense a "negative" definition. Risks are events that might cause harm to a business. They are not certain to occur, but if they occur, they will have a negative impact on the business. This is in slight contrast to the term uncertainty. Uncertainty means that it is unknown if an event will occur or not. When we use the term uncertainty we may be discussing something that would have a positive impact on the business. Uncertainty is not always negative.

Four Categories of Risk

SMA: ERMF identifies four common categories of risk. These are:

1) **Strategic Risks** include risks that are on a more global, or macro, level for the business. Examples include: strategy risks, the economy, global market conditions, political risk and risks that are connected to the company itself, such as reputation risk, brand risk, leadership risk and the risk of customers changing.

   Because these risks are so global in nature, it is difficult for a company to do anything to directly or actively manage, or reduce (mitigate) the risks associated with these events. The company will need to identify them, and be aware of them and monitor them. However, it is unlikely that the company will be able to actively influence the global economy or the political situations where they operate.

2) **Operational Risks** are the risks that that result from inadequate or failed internal processes, people or systems. Because these are items that are more directly under the influence of management, the company is in a better position to mitigate these risks through their own actions.

   Operational risk also includes legal risk and compliance risk. **Legal risk** is the risk that is associated with uncertainty due to legal actions or uncertainty in the applicability or interpretation of contracts, laws or regulations where the company operates. **Compliance risk** is the current or future risk to profits or the company's assets as a result of violations of, or nonconformance with, laws, rules, regulations, required practices, internal policies and procedures, or ethical standards.

3) **Financial Risks** are the risks that are connected to the financial health of the company. Examples include volatility of foreign currencies, volatility of interest rates, volatility of prices of commodities (inputs), credit risk, liquidity risk and market risk.

4) **Hazard Risk** is the category of risk that is able to be insured against. Common examples are natural disasters, property insurance, key person life insurance, and any other unexpected event that can be insured against.

In the definitions of the different risks above, the term volatility was used. **Volatility** is something that impacts risk. By definition, volatility has to do with the consistency of results. If the sales fluctuates greatly from day-to-day, there is great volatility in sales. Volatility increases risk because there is more uncertainty about the future, and there is a greater chance that the future results will be poor.

Similar to volatility, the **time period** considered is also a crucial element in risk. The longer the time period considered, or the longer that a project will last, the greater the risk. Because of the longer time period there is a greater time period for something to wrong within.

> Note: You may have noted that as there is an increase in volatility and in time, not only is there a greater chance that there will poor results, but there is also a chance that the results will be better than usual, or better than hoped for. However, since the topic we are looking at is risk, we are interested in the negative events that might happen, not the positive events that might happen.

[b] This SMA will be referenced as SMA: ERMF.

Question 44: The lawyers of Regional Tobacco Company have recently informed management that they believe that the company may lose an ongoing court case and as a result will be forced to pay a large monetary damage. The characteristics of the court and judicial system that influence the frequency and severity of losses is known as

a) Moral hazard.

b) Compliance risk.

c) Speculative risk.

d) Legal hazard.

(HOCK)

Concepts of Losses

In the discussion of risk, there are different ways of measuring the potential loss that could occur from a specific risk. These terms include:

1) Expected Loss (given a set of probabilities)

2) Unexpected Loss

3) Maximum Possible Loss (also called Extreme or Catastrophic Loss)

Expected Loss

There are two different ways that the expected loss can be calculated. Both of these calculations and situations may be used by companies to identify priorities in risk management strategies.

For a specific event that has multiple probably outcomes, we can calculate the expected loss. This single number will represent the amount that the company expects to lose from this event.

Example: Assume that a company has determined that if an event occurs, the probabilities of different amounts of loss are as follows:

Probability	Amount of Loss
10%	$100,000
20%	$120,000
30%	$160,000
35%	$180,000
5%	$500,000

In this case the expected loss is calculated by multiplying each possible result by the percentage chance it has of occurring and adding these results together. As follows:

10%	*	$100,000	=	$10,000
20%	*	$120,000	=	$24,000
30%	*	$160,000	=	$48,000
35%	*	$180,000	=	$63,000
5%	*	$500,000	=	$25,000
				$170,000

Even though $170,000 is not one of the possible outcomes, it is the expected outcome given all of the different possible outcomes and the probabilities given to them. Obviously this process is greatly influenced by the percentage chance that is given to each of the different outcomes. If the $500,000 loss had been given a higher than 5% chance of occurring the expected loss would have been higher.

Expected loss can also be calculated for an event that may or may not happen. The expected loss is calculated by multiplying the dollar amount of expected loss by the probability of the event occurring. This will give a dollar amount that balances the amount of the loss with the probability of loss. This enables companies to better identify which risks are most important to them.

Example: There are four risks that the company has identified. For each risk there is the probability of occurrence and the expected amount of loss.

Probability	Amount of Loss
10%	$1,000,000
25%	$600,000
40%	$400,000
90%	$200,000

The expected value of each event is calculated by multiplying the dollar amount by the percent chance of occurrence. As follows:

10%	*	$1,000,000	=	$100,000
25%	*	$600,000	=	$150,000
40%	*	$400,000	=	$160,000
90%	*	$200,000	=	$180,000

As we see, the risk item that has the lowest dollar amount of loss is probably the most critical to the company because of the high likelihood that it will occur. This calculation will be only one of a number of tools that a company uses to identify and manage its risks, but it is a good starting point.

Unexpected Loss

The unexpected loss is the amount of loss that is in excess of the expected loss.

Note: Any individual item by itself is considered to be an unexpected loss. This is logical because if the loss is "expected," the company should have done something to prevent or insure against the loss.

Maximum Possible Loss

As the name implies, this is the worst case scenario. The greatest possible loss from a specific risk or event.

Responses to Risk

Once a company has identified a risk, management will need to determine the appropriate response to that risk. In doing so, management will consider the risk of loss, the amount of loss and the costs and benefits of the various risk responses. There are four different responses that a company may select between for a specific risk. These are:

1) **Avoiding the risk** involves the company eliminating the risky event or item. This might be done by selling (or otherwise disposing of) the business unit or product line. It might also include actions such as leaving a specific geographic area. In reality the problem with this action is that it is usually considered only after the risk event has occurred. Presumably the activity that is under consideration brings profit to the company and it is usually difficult to stop doing something that is profitable while it is still profitable.

2) **Reducing (mitigate) the risk** recognizes that the risk will continue to exist, but looks to reduce the risk. This might include actions such as expanding an existing product line, splitting an IT function into two geographically separate areas, and almost any example of diversification.

3) **Transferring (sharing) the risk** is when the risk of loss is wholly, or partially, transferred to another organization. The main examples of transferring risk is the purchase of insurance. By purchasing insurance the company is transferring the risk to the insurance company. Hedging, derivative transactions and selling stocks short (expecting the stock price to decrease) and other similar actions are also a way of transferring the risk. Transferring the risk may also be done without insurance as it may be included in the contract between the involved parties.

> Note: The purchase of insurance is one of the ways for a company to reduce (mitigate) risk. In the use of insurance, the company is not trying to prevent the unwanted event from occurring, but rather transferring the risk of loss should that event occur to another organization. For example, if a company buys insurance against hurricanes, there is nothing the company can do to prevent a hurricane from occurring, but through the insurance they are transferring the risk of loss from a hurricane to the insurance company.

4) **Exploiting (or accepting) the risk.** Exploiting risks is the process of responding to a positive situation by making further investments into a situation that is positive. Risk acceptance is the process of recognizing that there is a risk and that nothing is able to be done in a cost effective manner to manage that risk.

Question 45: Buckeye Conferencing leases meeting rooms to outside parties to use. The lease specifies that the outside party, not Buckeye Conferencing, will be liable for any damages resulting from the use of the meeting room, and that Buckeye Conferencing would be "held harmless" for these damages caused by the outside party. Buckeye Conferencing actions demonstrate

a) Riak retention.

b) Self-insurance.

c) Insurance risk transfer.

d) Noninsurance risk transfer.

(HOCK)

Inherent Risk and Residual Risk

Inherent risk is defined by SMA: ERMF as "The level of risk that resides with an event or process prior to management taking a mitigation action." The US Office of Management and Budget defines inherent risk as "the potential for waste, loss, unauthorized use, or misappropriation due to the nature of the activity itself."

This is the amount of risk that is naturally occurring in the event. It is often outside the control of management and is due to external factors or influences. For example, there are inherent risks that result simply from the size of an organization. A small organization faces inherent risks connected to being reliant on one large company, and a very large company has inherent risks connected to its size – it may face government regulation because of its size or may have inherent risks in management structure because of the size of its operations. Also, specific events or activities may have different levels of inherent risk. For example, derivatives are inherently more risky than accounts receivable.

Residual risk is defined by SMA: ERMF as "The level of risk that remains after management has taken action to mitigate the risk." There is almost always going to be some amount of residual risk, no matter how many actions are taken by management to reduce the risk of an event or project.

Benefits of Risk Management

Risk management is something that every company needs to undertake. Through proper risk management a company will be to reduce the probability that negative events happen and also the company will be able to reduce the amount of loss to the company when one of these negative events occurs.

Different organizations and industries will experience slightly different specific benefits from their process of risk management. However, some of the common ways in which organizations benefit from risk management include:

- Increasing shareholder value because of the process of minimizing losses and maximizing opportunities.
- Fewer disruptions to the operations of the business.
- Better utilization of the resources of the organization.
- Fewer shocks and unwelcome surprises.
- Providing more confidence to employees, stakeholders and governing and regulatory bodies.
- More effective strategic planning.
- Better cost control.
- Enables quick assessment and grasp of new opportunities.
- Provides better and more complete contingency planning.
- Improves the ability of the organization to meet objectives and achieve opportunities.
- Enables the quicker response to opportunities.

The Steps in the Risk Management Process

There are a number of different ways that the steps in the Risk Management Process may be broken down or listed. What is listed here is a general approach to the Risk Management Process. When applying this to a company, department or specific situation, some steps may need to be added or altered in order to take into account the specific situation and the state of the existing Risk Management Process in the company.

1) **Risk identification and analysis**. This requires the company to look at their internal business, the external environment, their business processes, their existing controls and any other impact on their business. This all needs to be considered while keeping in mind the strategic goals of the business as well as the threats and opportunities the business faces and the strengths and weaknesses within the business itself.

2) **Risk evaluation and assessment**. The risks that have been identified need to be evaluated against the criteria that the company has created for measuring the risk to the business. This will include assessing the likelihood of occurrence, the estimated amount of financial loss, any nonfinancial considerations such as the image of the company, impact on shareholders or anything else that the company has determined is significant. In essence, this is the process of trying to quantify the different risks so that comparisons are able to be made.

3) **Risk reporting**. When risks are identified and assessed, different people within the organization need to be informed about the results. Generally, people only need to be made aware of the risks that are connected to their jobs or departments. Additionally, it is more common for companies to make a report on risk assessment to its stakeholders.

4) **Deciding which risks must be addressed and in which order** (prioritization). After all of the risks have been identified, the company must decide which risks are the highest priority and will be addressed first. This decision will include both quantitative analysis (the dollar amount at risk) as well as qualitative analysis (what the item is and what it might represent, even if they dollar amount at risk is not large).

5) **Residual risk reporting**. After the risk management process has been completed, there may still be some residual risk that remains that is not able to be eliminated. This residual risk should be reported to the appropriate level (perhaps the board of directors) so that the decision maker can make a final determination if the company is willing to accept that amount of residual risk, or if further work must be done to reduce residual risk even further.

6) **Ongoing monitoring**. After the risk management strategies have been implemented, the company must continue to monitor the situation to ensure that the risk has been addressed as intended. Additionally, there must be an ongoing review and assessment of the Risk Management Process because what may have been working or relevant two years ago may no longer be working or no longer relevant.

Note: The **attitude of the company towards risk** will greatly influence this risk management process outlined above. For example, some companies may be less tolerant of risk. These companies will identify more specific risks that need to be managed than will a company that has a greater tolerance of risk. This attitude towards risk may come from the shareholders, contractual requirements, regulatory requirements, or the philosophy of management.

Managing Operational Risk

By definition, operational risks are those risks that are connected to the day-to-day operations of the business. These are the risks that that result from inadequate or failed internal processes, people or systems. Because of the nature of these risks, they are usually best managed at a lower level in the organization. They should be managed by the people who are working with these issues on a day-to-day basis.

One of the main ways of managing operation risk is through properly developed, implemented and maintained internal controls. Also, looking at the business processes and a continuous review of both the processes and the personnel in the company will be part of the process of managing operations risk.

Financial Risk Management Methods

Financial risk management creates economic value to the company by using financial instruments to manage exposure to risk, especially credit risk and market risk. Other policies and procedures other than financial instruments may also be used in financial risk management.

There are a number of different ways that a company can attempt to manage its financial risk. Among these include:

- Using forward contracts and options to hedge the risk of either foreign currency value fluctuations or fair value fluctuations,
- Having specific investment policies for the investment in both short-term and long-term investments,
- Using derivative instruments as a hedge process, and
- Using swaps to hedge an interest rate or fair value of an asset.

This is not a comprehensive list of financial risk management tools, but rather just a brief list of some of the more common tools used.

Qualitative Risk Assessment Tools

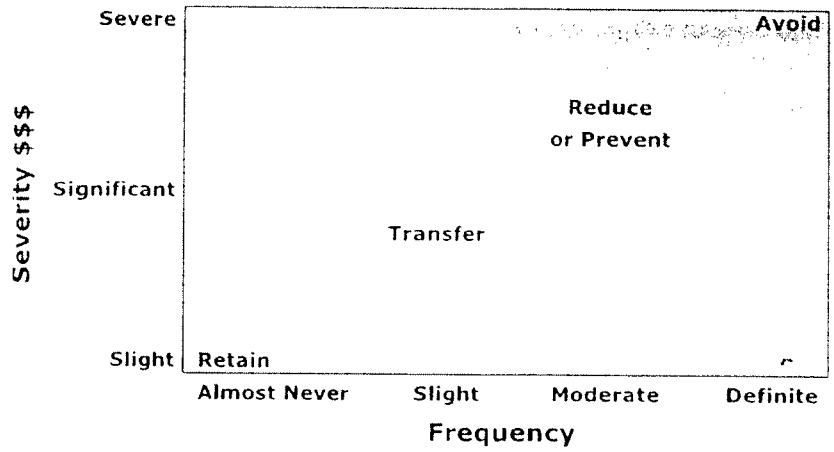
It was discussed briefly above the need for a company to assess its risks not only from a quantitative (dollar amount) perspective, but also from a qualitative perspective. A qualitative approach recognizes that some events may be serious and critical, even if there is not a large dollar amount at risk.

Another way that qualitative assessment is done is when the amount of loss is not calculated a specific amount, but the amount at risk is ranked from the most to the least for the different risk events that are evaluated.

The risk identification process also uses quantitative analysis of risks to even identify the risks that are facing the company.

A qualitative assessment is also performed when a company performs **risk ranking** to determine which risks are the highest priority. While there may be a financial element to this assessment, the company should be taking into a number of factors that are not able to be quantified, leading to a qualitative assessment.

A **risk map** is a visual depiction of the relative risks. For the different events, the probability of the event happening is on one axis and the amount of loss is on the other. This provides a visual way of identifying the risks that are both more likely to occur and that have a greater dollar amount at risk should the event occur. An example is below (which also includes the suggested risk response).



Question 46: When the likelihood of loss is high and the amount at risk is high, the most appropriate risk response would probably be:

a) Avoiding the risk in whatever manner is available.

b) Reducing the risk by trying to minimize the loss that might occur.

c) Transferring the risk to another party through hedging, or similar action.

d) Accepting the risk as the cost of reducing the risk will outweigh the potential benefits.

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