

Chapter 25

Pre-Lecture Videos

1. Which of the following steps is considered the first step in the managerial decision-making process?
 - **Identify the objective of the decision**
2. An analysis that evaluates differential revenues and costs in order to determine the differential impact on income of two alternative courses of action is called **incremental** analysis.
3. **Sunk** costs are costs that have been incurred in the past, cannot be recouped, and are not relevant to future decisions.
4. The revenue that is forgone from an alternative use of an asset, such as cash, is called **an opportunity cost**.
5. All of the following are cost-plus methods to determine selling price *except* **fixed cost concept**.
6. Which of the following determine normal selling price?
 - **Cost amount per unit plus markup**
7. Target cost is computed by **expected selling price minus desired profit**.
8. A point in the manufacturing process where the demand for the company's product exceeds the ability to produce the product is known as **production bottleneck**.
9. In a production bottleneck operation, the best measure of profitability is the **unit contribution margin per production bottleneck constraint**.
10. The last step when applying the total cost concept would be to **determine the normal selling price by adding the markup per unit to the cost per unit**.
11. Under the **variable cost concept**, only costs that change are included in the cost amount per unit to which the markup is added.

Mini Quiz

1. **The theory of constraints** is a manufacturing strategy that focuses on reducing the influence of bottlenecks on the production process.
2. For an airline, all of the following are mostly fixed costs per flight: **crew salaries, airport fees paid by the airline, and plane depreciation**.
3. For a particular Rocky Airlines flight, the plane has 250 seats, 220 tickets have been sold for an average price of \$140, the fixed costs per flight are \$20,000, and the variable costs per passenger are \$40. What is the contribution margin per passenger?
 - $140 - 40 = 100$
4. Muy Bueno Bakery sells its special chocolate cake for \$35. The total cost to produce the cake is \$26. Of this amount, \$4 per unit is selling costs. The total variable cost is \$17. The desired profit is \$9 per unit. What is the markup percentage on product cost?
 - $\frac{9+4}{22} = 59\%$
5. Which of the following statements is not true when a company has a production bottleneck?
 - **The product with the lowest unit contribution margin per production bottleneck hour is the most profitable product per bottleneck hour.**

6. Differential profit (loss) is the **difference between the differential revenue and the differential costs that are expected from a course of action compared to an alternative.**
7. Under product costing, the normal selling price is determined by **adding the markup per unit to the product cost per unit.**
8. For high-fixed-cost services businesses, during periods when the demand on fixed capacity is high, **prices are higher.**
9. Rumba Dance Hall is considering offering a wedding reception package that includes the ballroom rental, decorations, a wedding cake, punch, and paper goods for \$6,000. Currently, the company is renting the ballroom with no extras at \$4,500. The extras will cost \$800. Is the new package profitable and, if so, by how much?
 - o **Increases profits by** $6000 - 4500 - 800 = 700$
10. Muy Bueno Bakery sells three different products. Currently, it is not able to meet all of its customer demand. Using the following information, what is the most profitable product?

	Cake	Pie	Cookies
Contribution margin	\$18	\$11	\$3
Production hours	2	1.5	0.25
Unit contribution margin per bottleneck hour	$\frac{18}{2} = 9$	$\frac{11}{1.5} = 7.33$	$\frac{3}{.25} = 12$

- o **Cookies**
11. Under the product cost method, which costs are included in the cost amount per unit?
 - o **Only the costs of manufacturing the product**
 12. In a differential analysis report, the third amount column contains the **differential effects of choosing Alternative 2 over Alternative 1.**
 13. When a company has a production bottleneck, it should use **unit contribution margin** to determine how to maximize its profits.
 14. A bottleneck occurs when production is slowed down **within a process that is not able to meet the amount of production required.**
 15. Muy Bueno Bakery sells three different products. Currently, it is not able to meet all of its customer demand. Using the following information, what price of the cake is needed to meet the same contribution margin as the cookies?

	Cake	Pie	Cookies
Unit contribution margin	\$18	\$11	\$3
Production bottleneck hours	2	1.5	0.25
Variable cost	\$12	\$7	\$1
Unit contribution margin per bottleneck hour	\$9	\$7.33	\$12
Current selling price	\$30	\$18	\$5

$$12 = \frac{x - 12}{2} \quad (1)$$

-

$$24 = x - 12$$

$$x = 24 + 12$$

$$x = 36$$

16. Muy Bueno Bakery sells three different products. Currently, it is not able to meet all of its customer demand. Using the following information, what price of the cake is needed to meet the same contribution margin as the pie?

	Cake	Pie	Cookies
Unit contribution margin	\$18	\$11	\$3
Production bottleneck hours	3	1	0.30
Variable cost	\$12	\$7	\$1
Unit contribution margin per bottleneck hour	\$6	\$11	\$10
Current selling price	\$30	\$18	\$5

$$11 = \frac{x - 12}{3} \quad (2)$$

-

$$33 = x - 12$$

$$x = 33 + 12$$

$$x = 45$$

17. The unit contribution margin per bottleneck constraint is expressed by which of the following formulas?
- **Unit contribution margin / bottleneck process hours per unit**

Practice Exercises

- Plymouth Company owns equipment with a cost of \$600,000 and accumulated depreciation of \$375,000 that can be sold for \$300,000, less a 4% sales commission. Alternatively, Plymouth Company can lease the equipment for four years for a total of \$320,000, at the end of which there is no residual value. In addition, the repair, insurance, and property tax expense that would be incurred by Plymouth Company on the equipment would total \$40,000 over the four-year lease.
 - Prepare a differential analysis on August 7 as to whether Plymouth Company should lease (Alternative 1) or sell (Alternative 2) the equipment

Differential Analysis Lease Equipment (Alt. 1) or Sell Equipment (Alt. 2) August 7	Lease Equipment (Alternative 1)	Sell Equipment (Alternative 2)	Differential Effects (Alternative 2)
Revenues	320000	300000	$300000 - 320000 = -20000$
Costs	-40000	$300000 * 4\% = -12000$	$-12000 - -40000 = 28000$
Profit (Loss)	$320000 - 40000 = 280000$	$300000 - 12000 = 288000$	$-20000 + 28000 = 8000$

2. Should Plymouth Company lease (Alternative 1) or sell (Alternative 2) the equipment?

▪ **Sell the equipment**

2. Product Tango has revenue of \$1,150,000, variable cost of goods sold of \$850,000, variable selling expenses of \$275,000, and fixed costs of \$125,000, creating an operating loss of \$(100,000).

1. Prepare a differential analysis as of February 13 to determine if Product Tango should be continued (Alternative 1) or discontinued (Alternative 2), assuming fixed costs are unaffected by the decision. If an amount is zero, enter "0". If required, use a minus sign to indicate a loss.

Differential Analysis Continue Product Tango (Alt. 1) or Discontinue Product Tango (Alt. 2) February 13	Continue Product Tango (Alternative 1)	Discontinue Product Tango (Alternative 2)	Differential Effects (Alternative 2)
Revenues	1150000	0	$0 - 1150000 = -1150000$
Costs:			
Variable cost of goods sold	-850000	0	$0 - -850000 = 850000$
Variable selling and admin. expenses	-275000	0	$0 - -275000 = 275000$
Fixed costs	-125000	-125000	$-125000 - -125000 = 0$
Profit (Loss)	-100000	-125000	$-125000 - -100000 = -25000$

2. Determine if Product Tango should be continued (Alternative 1) or discontinued (Alternative 2).

▪ **Continued**

3. A company manufactures various-sized plastic bottles for its medicinal product. The manufacturing cost for small bottles is \$55 per unit (100 bottles), including fixed costs of \$12 per unit. A proposal is offered to purchase small bottles from an outside source for \$36 per unit, plus \$3 per unit for freight.

1. Prepare a differential analysis dated January 25 to determine whether the company should make (Alternative 1) or buy (Alternative 2) the bottles, assuming fixed costs are unaffected by the decision. If an amount is zero, enter "0".

Differential Analysis Make Bottles (Alt. 1) or Buy Bottles (Alt. 2) January 25	Make Bottles (Alternative 1)	Buy Bottles (Alternative 2)	Differential Effects (Alternative 2)
Unit costs:			
Purchase price	0	36	$36 - 0 = 36$
Freight	0	3	$3 - 0 = 3$
Variable costs	$55 - 12 = 43$	0	$0 - 43 = -43$
Fixed factory overhead	12	12	$12 - 12 = 0$
Total unit costs	55	51	$51 - 55 = -4$

2. Determine whether the company should make (Alternative 1) or buy (Alternative 2) the bottles.

▪ **Buy the bottles**

4. A machine with a book value of \$80,000 has an estimated five-year life. A proposal is offered to sell the old machine for \$50,500 and replace it with a new machine at a cost of \$75,000. The new machine has a five-year life with no residual value. The new machine would reduce annual direct labor costs from \$11,200 to \$7,400.
1. Prepare a differential analysis dated April 11 on whether to continue with the old machine (Alternative 1) or replace the old machine (Alternative 2). If an amount is zero, enter "0". If required, use a minus sign to indicate a loss.

Differential Analysis Continue Old Machine (Alt. 1) or Replace Old Machine (Alt. 2) April 11	Continue with Old Machine (Alternative 1)	Replace Old Machine (Alternative 2)	Differential Effects (Alternative 2)
Revenues:			
Proceeds from sale of old machine	0	50500	$50500 - 0 = 50500$
Costs:			
Purchase price	0	-75000	$-75000 - 0 = -75000$
Direct labor (5 years)	$-11200 * 5 = -56000$	$-7400 * 5 = -37000$	$-37000 - -56000 = 19000$
Profit (Loss)	$0 - 56000 = -56000$	$50500 - 75000 - 37000 = -61500$	$-61500 - -56000 = -5500$

2. Should the company continue with the old machine (Alternative 1) or replace the old machine (Alternative 2)?

▪ **Continue with the old machine**

5. Product J19 is produced for \$11 per gallon. Product J19 can be sold without additional processing for \$18 per gallon, or processed further into Product R33 at an additional cost of \$7 per gallon. Product R33 can be sold for \$24 per gallon.
1. Prepare a differential analysis dated April 30 on whether to sell Product J19 (Alternative 1) or process further into Product R33 (Alternative 2). If required, use a minus sign to indicate a loss.

Differential Analysis Sell Product J19 (Alt. 1) or Process Further into Product R33 (Alt. 2) April 30	Sell Product J19 (Alternative 1)	Process Further into Product R33 (Alternative 2)	Differential Effects (Alternative 2)
Revenues, per unit	18	24	$24 - 18 = 6$
Costs, per unit	-11	$-11 - 7 = -18$	$-18 - -11 = -7$
Profit (loss), per unit	$18 - 11 = 7$	$24 - 18 = 6$	$6 - 7 = -1$

2. Should Product J19 be sold (Alternative 1) or processed further into Product R33 (Alternative 2)?

▪ **Sell Product J19**

6. Product A is normally sold for \$9.60 per unit. A special price of \$7.20 is offered for the export market. The variable production cost is \$5.00 per unit. An additional export tariff of 15% of revenue must be paid for all export products. Assume there is sufficient capacity for the special order.

1. Prepare a differential analysis dated March 16 on whether to reject (Alternative 1) or accept (Alternative 2) the special order. *Round your answers to two decimal places.* If an amount is zero, enter "0".

Differential Analysis Reject Order (Alt. 1) or Accept Order (Alt. 2) March 16	Reject Order (Alternative 1)	Accept Order (Alternative 2)	Differential Effects (Alternative 2)
Revenues, per unit	0	7.20	$7.2 - 0 = 7.20$
Costs:			
Variable manufacturing costs, per unit	0	-5.00	$-5 - 0 = -5.00$
Export tariff, per unit	0	$-7.2 * 15\% = -1.08$	$-1.08 - 0 = -1.08$
Profit (loss), per unit	0	$7.2 - 5 - 1.08 = 1.12$	$1.12 - 0 = 1.12$

2. Should the special order be rejected (Alternative 1) or accepted (Alternative 2)?

▪ **Accept the special order**

7. Green Thumb Garden Tools Inc. produces and sells home and garden tools and equipment. A lawnmower has a total cost of \$230 per unit, of which \$160 is product cost and \$70 is selling and administrative expenses. In addition, the total cost of \$230 is made up of \$120 variable cost and \$110 fixed cost. The desired profit is \$58 per unit.

Determine the markup percentage on product cost.

- $\frac{58+70}{230-70} = 80\%$

8. Product K has a unit contribution margin of \$120. Product L has a unit contribution margin of \$100. Product K requires five furnace hours, while Product L requires four furnace hours.

Determine the unit contribution margin per production bottleneck hour for each product, assuming the furnace is a bottleneck constraint.

- Product K: $\frac{120}{5} = 24$
- Product L: $\frac{100}{4} = 25$

9. On August 1, Rantoul Stores Inc. is considering leasing a building and purchasing the necessary equipment to operate a retail store. Alternatively, the company could use the funds to invest in \$1,000,000 of 4% U.S. Treasury bonds that mature in 15 years. The bonds could be purchased at face value. The following data have been assembled:

Item	Value
Cost of store equipment	\$1,000,000
Life of store equipment	15 years
Estimated residual value of store equipment	\$50,000
Yearly costs to operate the store, excluding depreciation of store equipment	\$200,000
Yearly expected revenues—years 1–6	\$300,000
Yearly expected revenues—years 7–15	\$400,000

Required:

1. Prepare a differential analysis as of August 1 presenting the proposed operation of the store for the 15 years (Alternative 1) as compared with investing in U.S. Treasury bonds (Alternative 2). If an amount is zero, enter "0".

Differential Analysis Operate Retail (Alt. 1) or Invest in Bonds (Alt. 2) August 1	Operate Retail (Alternative 1)	Invest in Bonds (Alternative 2)	Differential Effects (Alternative 2)
Revenues	5400000	600000	$600000 - 5400000 = -4800000$
Costs:			
Costs to operate store	−3000000	0	$0 - -300000 = 300000$
Cost of equipment less residual value	−950000	0	$0 - -950000 = 950000$
Profit (loss)	$5400000 - 3000000 - 950000 = 1450000$	600000	$600000 - 1450000 = -850000$

2. Based on the results disclosed by the differential analysis, should the proposal be accepted?
 ■ Yes
 3. If the proposal is accepted, what would be the total estimated operating income of the store for the 15 years?
 ■ $5400000 - (3000000 + 950000) = 1450000$

Homework Exercises

1. Hill Co. can further process Product O to produce Product P. Product O is currently selling for \$60 per pound and costs \$42 per pound to produce. Product P would sell for \$82 per pound and would require an additional cost of \$13 per pound to produce.

The differential revenue of producing Product P is \$22 per pound.

◦ $82 - 60 = 22 \rightarrow \text{True}$

2. Make-or-buy options often arise when a manufacturer has excess productive capacity in the form of unused equipment, space, and labor.
 - **True**
3. When a bottleneck occurs in a process used in the production of multiple products, the company must determine the contribution margin for each product and give priority to the product that has the lowest contribution margin per bottleneck hour.
 - **False**
4. Under the variable cost method, only variable costs are included in the cost amount per unit to which the markup is added.
 - **True**
5. The amount of increase or decrease in cost that is expected from a particular course of action as compared with an alternative is **differential cost**.
6. Delaney Company is considering replacing equipment that originally cost \$600,000 and has accumulated depreciation of \$420,000 to date. A new machine will cost \$790,000 and the old equipment can be sold for \$8,000. The sunk cost in this situation is $600000 - 420000 = 180000$
7. Starling Co. is considering disposing of a machine with a book value of \$12,500 and estimated remaining life of five years. The old machine can be sold for \$1,500. A new high-speed machine can be purchased at a cost of \$25,000. It will have a useful life of five years and no residual value. It is estimated that the annual variable manufacturing costs will be reduced from \$26,000 to \$23,500 if the new machine is purchased. The five-year differential effect on profit from replacing the machine is a(n) **decrease of** $12500 - 23500 = (11000)$
8. Mallard Corporation uses the product cost method of product pricing. Below is cost information for the production and sale of 45,000 units of its sole product. Mallard desires a profit equal to a 12% return on invested assets of \$800,000.

Item	Value
Fixed factory overhead cost	\$82,000
Fixed selling and administrative costs	45,000
Variable direct materials cost per unit	5.50
Variable direct labor cost per unit	7.65
Variable factory overhead cost per unit	2.25
Variable selling and administrative cost per unit	0.90

The unit selling price for the company's product is 21.25

9. Widgeon Co. manufactures three products: Bales, Tales, and Wales. The selling prices are \$55, \$78, and \$32, respectively. The variable costs for each product are \$20, \$50, and \$15, respectively. Each product must go through the same processing in a machine that is limited to 2,000 hours per month. Bales take 5 hours to process; Tales 7 hours; and Wales 1 hour.

Assuming that Widgeon Co. can sell all of the products it can make, the maximum contribution margin it can earn per month is 34000

10. Swan Company produces its product at a total cost of \$43 per unit. Of this amount, \$8 per unit is selling and administrative costs. The total variable cost is \$30 per unit, and the desired profit is \$20 per unit.

The markup percentage on variable cost is 110%.

Accept Business at Special Price

11. Product A is normally sold for \$47 per unit. A special price of \$31 is offered for the export market. The variable production cost is \$26 per unit. An additional export tariff of 14% of revenue must be paid for all export products. Assume there is sufficient capacity for the special order.
1. Prepare a differential analysis dated March 16 on whether to reject (Alternative 1) or accept (Alternative 2) the special order. *If required, round your answers to two decimal places.* If an amount is zero, enter "0".

Differential Analysis Reject Order (Alt. 1) or Accept Order (Alt. 2) March 16	Reject Order (Alternative 1)	Accept Order (Alternative 2)	Differential Effect on Income (Alternative 2)
Revenues, per unit	0	31	$0 - 31 = 31$
Costs:			
Variable manufacturing costs, per unit	0	26	$0 - 26 = -26$
Export tariff, per unit	0	$31 * 14\% = 4.34$	$0 - 4.34 = -4.34$
Income (Loss), per unit	0	$31 - 26 - 4.34 = .66$	$.66 - 0 = .66$

2. Should the special order be rejected (Alternative 1) or accepted (Alternative 2)?

- Accept the special order

Differential Analysis Involving Opportunity Costs

12. On July 1, Coastal Distribution Company is considering leasing a building and buying the necessary equipment to operate a public warehouse. Alternatively, the company could use the funds to invest in \$740,000 of 5% U.S. Treasury bonds that mature in 14 years. The bonds could be purchased at face value. The following data have been assembled:

Item	Value
Cost of store equipment	\$740,000
Life of store equipment	14 years
Estimated residual value of store equipment	\$75,000
Yearly costs to operate the warehouse, excluding depreciation of store equipment	\$175,000
Yearly expected revenues—years 1-7	\$280,000
Yearly expected revenues—years 8-14	\$240,000

Required:

1. Prepare a differential analysis as of July 1 presenting the proposed operation of the warehouse for the 14 years (Alternative 1) as compared with investing in U.S. Treasury bonds (Alternative 2). If an amount is zero, enter "0". If required, use a minus sign to indicate a loss.

■

Differential Analysis Operate Warehouse (Alt. 1) or Invest in Bonds (Alt. 2) July 1	Operate Warehouse (Alternative 1)	Invest in Bonds (Alternative 2)	Differential Effects (Alternative 2)
Revenues	$(280000 * 7) + (240000 * 7) = 3640000$	$(740000 * 5\%) * 14 = 518000$	$3640000 - 518000 = 3122000$
Costs:			
Costs to operate warehouse	$-175000 * 14 = -2450000$	0	-2450000
Cost of equipment less residual value	$-740000 + 75000 = -665000$	0	$-665000 - 0 = -665000$
Profit (loss)	$3640000 - 2450000 - 665000 = 525000$	518000	$3122000 - 2450000 - 665000 = -7000$

2. Based on the results disclosed by the differential analysis, should the proposal be accepted?

■ Yes

3. If the proposal is accepted, what is the total estimated operating income of the warehouse for the 14 years?

■ $3640000 - (2450000 + 665000) = 525000$

Discontinue a Segment

13. Product Tango has revenue of \$194,700, variable cost of goods sold of \$114,000, variable selling expenses of \$31,100, and fixed costs of \$60,100, creating an operating loss of \$(10,500).

1. Prepare a differential analysis as of February 13 to determine if Product Tango should be continued (Alternative 1) or discontinued (Alternative 2), assuming fixed costs are unaffected by the decision. If an amount is zero, enter "0". If required, use a minus sign to indicate a loss.

Differential Analysis Continue Product Tango (Alt. 1) or Discontinue Product Tango (Alt. 2) February 13	Continue Product Tango (Alternative 1)	Discontinue Product Tango (Alternative 2)	Differential Effect on Income (Alternative 2)
Revenues	194700	0	$0 - 194700 = -194700$
Costs:			
Variable cost of goods sold	-114000	0	$0 - -114000 = 114000$
Variable selling and admin. expenses	-31100	0	$0 - -31100 = 31100$
Fixed costs	-60100	-60100	$-60100 - -60100 = 0$
Profit (Loss)	$194700 - 114000 - 31100 - 60100 = -10500$	-60100	$-60100 - -10500 = -49600$

2. Determine if Product Tango should be continued (Alternative 1) or discontinued (Alternative 2).

- **Continued**

Lease or Sell

14. Kincaid Company owns equipment with a cost of \$362,900 and accumulated depreciation of \$53,100 that can be sold for \$273,700, less a 3% sales commission. Alternatively, Kincaid Company can lease the equipment for three years for a total of \$287,600, at the end of which there is no residual value. In addition, the repair, insurance, and property tax expense that would be incurred by Kincaid Company on the equipment would total \$14,900 over the three year lease.

1. Prepare a differential analysis on August 7 as to whether Kincaid Company should lease (Alternative 1) or sell (Alternative 2) the equipment. If required, use a minus sign to indicate a loss.

Differential Analysis Lease Equipment (Alt. 1) or Sell Equipment (Alt. 2) August 7	Lease Equipment (Alt 1)	Sell Equipment (Alt 2)	Differential Effect on Income (Alt 2)
Revenues	287600	273700	$273700 - 287600 = -13900$
Costs	14900	$273700 * 3\% = 8211$	$14900 - 8211 = 6689$
Income (Loss)	$287600 - 14900 = 272700$	$273700 - 8211 = 265489$	$-13900 - -6689 = -7211$

2. Should Kincaid Company lease (Alternative 1) or sell (Alternative 2) the equipment?

- **Lease the equipment**

Make or Buy

15. A company manufactures various-sized plastic bottles for its medicinal product. The manufacturing cost for small bottles is \$148 per unit (100 bottles), including fixed costs of \$33 per unit. A proposal is offered to purchase small bottles from an outside source for \$103 per unit, plus \$9 per unit for freight.

1. Prepare a differential analysis dated January 25 to determine whether the company should make (Alternative 1) or buy (Alternative 2) the bottles, assuming fixed costs are unaffected by the decision. If an amount is zero, enter "0".

Differential Analysis Make Bottles (Alt 1) or Buy Bottles (Alt 2) January 25	Make Bottles (Alt 1)	Buy Bottles (Alt 2)	Differential effect on income (Alt 2)
Sales price	0	0	0
Unit Costs:			
Purchase price	0	-103	-103
Freight	0	-9	-9
Variable costs	$-148 - 33 = -115$	0	-115
Fixed factory overhead	-33	-33	0
Income (Loss)	-148	$-33 - 103 - 9 = -145$	$-148 - -145 = -3$

2. Determine whether the company should make (Alternative 1) or buy (Alternative 2) the bottles.

- **Buy the bottles**

Process or Sell

16. Product J19 is produced for \$3.38 per gallon. Product J19 can be sold without additional processing for \$4.01 per gallon, or processed further into Product R33 at an additional cost of \$0.36 per gallon. Product R33 can be sold for \$4.32 per gallon.

1. Prepare a differential analysis dated April 30 on whether to sell Product J19 (Alternative 1) or process further into Product R33 (Alternative 2). *Round your answers to the nearest cent.* If required, use a minus sign to indicate a loss.

Differential Analysis Sell Product J19 (Alt. 1) or Process Further into Product R33 (Alt. 2) April 30	Sell Product J19 (Alternative 1)	Process Further into Product R33 (Alternative 2)	Differential Effects (Alternative 2)
Revenues, per unit	4.01	4.32	$4.32 - 4.01 = .31$
Costs, per unit	3.38	$3.38 + .36 = 3.74$.36
Profit (loss), per unit	$4.01 - 3.38 = .63$	$4.32 - 3.74 = .58$	$.31 - .36 = -.05$

2. Should Product J19 be sold (Alternative 1) or processed further into Product R33 (Alternative 2)?

- **Sell Product J19**

Replace Equipment

17. A machine with a book value of \$247,500 has an estimated six-year life. A proposal is offered to sell the old machine for \$217,400 and replace it with a new machine at a cost of \$283,900. The new machine has a six-year life with no residual value. The new machine would reduce annual direct labor costs from \$50,000 to \$40,000.

1. Prepare a differential analysis dated April 11 on whether to continue with the old machine (Alternative 1) or replace the old machine (Alternative 2). If an amount is zero, enter "0". If required, use a minus sign to indicate a loss.

Differential Analysis Continue Old Machine (Alt. 1) or Replace Old Machine (Alt. 2) April 11	Continue with Old Machine (Alternative 1)	Replace Old Machine (Alternative 2)	Differential Effects (Alternative 2)
Revenues:			
Proceeds from sale of old machine	0	217400	-217400
Costs:			
Purchase price	0	-283900	-283900
Direct labor (6 years)	50000 * 6 = 300000	40000 * 6 = 240000	300000 - 240000 = 60000
Profit (Loss)	0 - 300000 = -300000	217400 - 283900 - 240000 = -306500	-306500 - -300000 = -6500

2. Should the company continue with the old machine (Alternative 1) or replace the old machine (Alternative 2)?

- **Continue with the old machine**

Quiz

1. Magpie Corporation uses the total cost method of product pricing. Below is cost information for the production and sale of 60,000 units of its sole product. Magpie desires a profit equal to a 25% return on invested assets of \$700,000.

Item	Value
Fixed factory overhead cost	\$38,700
Fixed selling and administrative costs	7,500
Variable direct materials cost per unit	4.60
Variable direct labor cost per unit	1.88
Variable factory overhead cost per unit	1.13
Variable selling and administrative cost per unit	4.50

The markup percentage on total cost for Magpie's product is $\frac{700000 \times 25\%}{38700 + 7500 + [(4.6 + 1.88 + 1.13 + 4.5) \times 60000]} = 22.6\%$

2. All of the following should be considered in a make-or-buy decision **quality issues with the supplier, future growth in the plant and other production opportunities, and cost savings**.

3. The amount of increase or decrease in revenue that is expected from a particular course of action as compared with an alternative is **differential revenue**.
4. Carmen Co. can further process Product J to produce Product D. Product J is currently selling for \$20.00 per pound and costs \$15.75 per pound to produce. Product D would sell for \$38.00 per pound and would require an additional cost of \$8.55 per pound to produce.
- The differential revenue of producing Product D is $38 - 20 = \$18.00 \text{ per pound}$.
5. Dotterel Corporation uses the variable cost method of product pricing. Below is cost information for the production and sale of 35,000 units of its sole product. Dotterel desires a profit equal to an 11.2% return on invested assets of \$350,000.

Item	Value
Fixed factory overhead cost	\$105,000
Fixed selling and administrative costs	35,000
Variable direct materials cost per unit	4.34
Variable direct labor cost per unit	5.18
Variable factory overhead cost per unit	0.98
Variable selling and administrative cost per unit	0.70

The dollar amount of desired profit from the production and sale of Dotterel's product is
 $350000 * 11.2\% = 39200$

6. Widgeon Co. manufactures three products: Bales, Tales, and Wales. The selling prices are \$55, \$78, and \$32, respectively. The variable costs for each product are \$20, \$50, and \$15, respectively. Each product must go through the same processing in a machine that is limited to 2,000 hours per month. Bales take 5 hours to process; Tales 7 hours; and Wales 1 hour.

Assuming that Widgeon Co. can sell all of the products it can make, the maximum contribution margin it can earn per month is

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	Bales	Tales	Wales
Unit selling price	\$55	\$78	\$32
Unit variable cost	(20)	(50)	(15)
Unit contribution margin	\$35	\$28	\$17
Processing time per unit	$\div 5$	$\div 7$	$\div 1$
Unit contribution margin per processing bottleneck hour	\$7	\$4	\$17

$$2000 * 17 = 34000$$

7. Stryker Industries received an offer from an exporter for 15,000 units of product at \$17.50 per unit. The acceptance of the offer will not affect normal production or domestic sales prices. The following data are available:

Item	Value
Domestic unit sales price	\$20
Unit manufacturing costs:	
Variable	11
Fixed	1

The amount of profit or loss from acceptance of the offer is a

- o

Differential Analysis Reject Order (Alternative 1) or Accept Order (Alternative 2)	Reject Order (Alternative 1)	Accept Order (Alternative 2)	Differential Effect on Income (Alternative 2)
Revenues	\$0	$15000 * 17.5 = 262,500$	\$262,500
Costs	0	$15000 * -11 = -165,000$	(165,000)
Profit (loss)	\$0	\$97,500	97500 profit

8. Mighty Safe Fire Alarm is currently buying 50,000 motherboards from MotherBoard, Inc., at a price of \$65 per board. Mighty Safe is considering making its own boards. The costs to make the board are as follows: direct materials, \$32 per unit; direct labor, \$10 per unit; and variable factory overhead, \$16 per unit. Fixed costs for the plant would increase by \$75,000. Which option should be selected and why?

- o

Differential Analysis Make (Alternative 1) or Buy (Alternative 2) Motherboards	Make Motherboard (Alternative 1)	Buy Motherboard (Alternative 2)	Differential Effects (Alternative 2)
Unit costs:			
Purchase price	\$0.00	\$(65.00)	\$(65.00)
Direct material	(32.00)	0.00	32.00
Direct labor	(10.00)	0.00	10.00
Variable factory overhead	(16.00)	0.00	16.00
Fixed costs	$\frac{75000}{50000} = -1.5$	0.00	1.50
Total unit costs	\$(59.50)	\$(65.00)	\$(5.50)

If making them... $5.5 * 50000 = 275000$ increase in profits

9. Differential revenue is the amount of profit that would result from the best available alternative proposed use of cash.
 - **False**
10. Which of the following methods of applying the cost-plus approach to product pricing includes only total manufacturing costs in the cost amount to which the markup is added?
 - **product cost method**
11. The revenue that is forgone from an alternative use of an asset, such as cash, is called **opportunity cost**.
12. Contractors who sell to government agencies would be most likely to use which of the following cost methods in pricing their products?
 - **total costmethod**
13. Flyer Company sells a product in a competitive marketplace. Market analysis indicates that its product would probably sell at \$48 per unit. Flyer management desires a 12.5% profit margin on sales. Flyer's current full cost for the product is \$44 per unit.
 If the company cannot cut costs any lower than they already are, the profit margin on sales to meet the market selling price would be $\frac{48-44}{48} = 8.3\%$
14. Mallard Corporation uses the product cost method of product pricing. Below is cost information for the production and sale of 45,000 units of its sole product. Mallard desires a profit equal to a 12% return on invested assets of \$800,000.

Item	Value
Fixed factory overhead cost	\$82,000
Fixed selling and administrative costs	45,000
Variable direct materials cost per unit	5.50
Variable direct labor cost per unit	7.65
Variable factory overhead cost per unit	2.25
Variable selling and administrative cost per unit	0.90

The unit selling price for the company's product is

$$\frac{775000}{45000} + \left(\frac{(12\% * 800000) + (0.9 * 45000) + 45000}{(5.5 * 45000) + (7.65 * 45000) + [(2.25 * 45000) + 82000]} * 17.22 \right) = 21.25$$

15. The condensed income statement for Hayden Corp. for the past year is as follows:

	Product T	Product U
Sales	\$680,000	\$320,000
Costs:		
Variable costs	\$(540,000)	\$(220,000)
Fixed costs	(145,000)	(40,000)
Total costs	\$(685,000)	\$(260,000)
Income (loss)	\$(5,000)	\$60,000

Management is considering the discontinuance of the manufacture and sale of Product T at the beginning of the current year. The discontinuance would have no effect on the total fixed costs and expenses or on the sales of Product U. The amount of change in profit for the current year that will result from the discontinuance of Product T is a

- o

Differential Analysis Continue Product T (Alternative 1) or Discontinue Product T (Alternative 2)	Continue Product T (Alternative 1)	Discontinue Product T (Alternative 2)	Differential Effects (Alternative 2)
Revenues	$680000 + 320000 = 1,000,000$	\$320,000	\$(680,000)
Costs:			
Variable costs	$540000 + 220000 = -760,000$	(220,000)	540,000
Fixed costs	$145000 + 40000 = -185,000$	(185,000)	0
Profit (loss)	\$55,000	\$(85,000)	140000 decrease

16. Farris Company is considering a cash outlay of \$500,000 for the purchase of land, which it could lease for \$40,000 per year. If alternative investments are available that yield a 15% return, the opportunity cost of the purchase of the land is $500000 * 15\% = 75000$
17. Keating Co. is considering disposing of equipment that cost \$50,000 and has \$40,000 of accumulated depreciation to date. Keating Co. can sell the equipment through a broker for \$25,000 less a 5% commission. Alternatively, Gunner Co. has offered to lease the equipment for five years for a total of \$48,750. Keating will incur repair, insurance, and property tax expenses estimated at \$8,000 over the five-year period. At lease-end, the equipment is expected to have no residual value. The net differential profit or loss from the sell alternative is a
- o

Differential Analysis Lease Equipment (Alternative 1) or Sell Equipment (Alternative 2)	Lease Equipment (Alternative 1)	Sell Equipment (Alternative 2)	Differential Effects (Alternative 2)
Revenues	\$48,750	\$25,000	\$(23,750)
Costs	(8,000)	$25000 * 5\% = -1250$	6,750
Profit (loss)	\$40,750	\$23,750	17000 loss

18. Delaney Company is considering replacing equipment that originally cost \$600,000 and has accumulated depreciation of \$420,000 to date. A new machine will cost \$790,000. The sunk cost in this situation is $600000 - 420000 = 180000$
19. Magpie Corporation uses the total cost method of product pricing. Below is cost information for the production and sale of 60,000 units of its sole product. Magpie desires a profit equal to a 25% return on invested assets of \$700,000.

Item	Value
Fixed factory overhead cost	\$38,700
Fixed selling and administrative costs	7,500
Variable direct materials cost per unit	4.60
Variable direct labor cost per unit	1.88
Variable factory overhead cost per unit	1.13
Variable selling and administrative cost per unit	4.50

The dollar amount of desired profit from the production and sale of Magpie's product is
 $700000 * 25\% = 175000$

Chapter 26

Pre-Lecture Videos

- Which of the following capital investment evaluation methods use present values?
 - Net present value method**
- A common characteristic found in capital investment evaluation methods that use present values is **an interest rate**.
- Assume that management is evaluating the purchase of a new machine as follows:

Cost of new machine: \$800,000

Residual value: \$0

Estimated total income from machine: \$300,000

Expected useful life: 5 years

The average rate of return of a new equipment is **15%**.
- All of the following are advantages of using the average rate of return method: **it is easy to compute, it includes the entire amount of income earned over the life of the proposal, it emphasizes accounting income, which is often used by investors and creditors in evaluating management performance.**
- Which of the following is a disadvantage of using the net present value method of evaluating an investment proposal?
 - It assumes cash flows can be reinvested at the minimum desired rate of return.**
- The present value index is computed as **total present value of net cash flow divided by amount to be invested.**
- Internal Rate of Return (IRR)** method of evaluating an investment proposal uses present value concepts to compute the rate of return based on the investment's expected net cash flows.
- A general increase in price levels is called **inflation**.

9. Qualitative considerations that may influence capital investment analysis include the investment proposal's impact on all of the following except **income taxes**.
10. The process by which management allocates funds among competing capital investment proposals is called **capital rationing**.
11. With capital rationing, alternative proposals are initially screened by establishing minimum standards and applying which of the following methods?
 - **Cash payback and average rate of return methods**

Mini Quiz

1. Which of the following factors does not have an impact on the outcome of a capital investment decision?
 - **Equal proposal lives**
2. In capital rationing, alternative proposals that survive initial screening by cash payback and average rate of return methods are further analyzed using **net present value and internal rate of return methods**.
3. All of the following are advantages of using the average rate of return: **the average rate of return method emphasizes accounting income, which is often used by investors and creditors in evaluating management performance, the average rate of return method includes the entire amount of income earned over the life of the proposal, and the average rate of return is easy to compute.**
4. Which of the following is a method of analyzing capital investment proposals that ignores present value?
 - **Cash payback**
5. All of the following are factors that may complicate capital investment analysis: **currency exchange rates, qualitative factors, and revenue estimates**.
6. The management of Cooper Corporation is considering the purchase of a new machine costing \$420,000. The company's desired rate of return is 10%. The present value factors for \$1 at compound interest of 10% for 1 through 5 years are 0.909, 0.826, 0.751, 0.683, and 0.621, respectively. In addition to this information, use the following data in determining the acceptability of the proposed purchase:

Year	Operating Income	Net Cash Flow
1	\$100,000	\$180,000
2	40,000	120,000
3	20,000	100,000
4	10,000	90,000
5	10,000	90,000

What is the present value index for this investment?

- $$\frac{(180000*.909)+(120000*.826)+(100000*.751)+(90000*.683)+(90000*.621)}{420000} = 1.08$$
7. A disadvantage of the net present value method is that **it is more complex to use than methods that do not use present value**.
 8. Which of the following statements regarding capital investments is not true?

- They involve investments of an immaterial amount.
9. At the end of the capital rationing process, **proposals that are selected for funding are included in the capital expenditures budget, unfunded proposals may be reconsidered if funds later become available, and accepted proposals are ranked and compared with the funds available.**
10. Based on the following sensitivity analysis of a proposed investment in equipment, which of the following statements is true?

Estimated Annual Net Cash Flow	300,000 400,000	\$500,000
Present value of annual net cash flows ($\times 4.487$)	1,346,100 1,794,800	\$2,243,500
Present value of residual value	22,600	22,600
Total present value	1,368,700 1,817,400	\$2,266,100
Amount to be invested	(1,300,000)	(1,300,000)
Net present value	68,700 517,400	\$ 966,100

- **The investment in the equipment is justified at any level of cash flows estimated in the analysis.**
11. The expected average rate of return for a proposed investment of \$44,000 in a fixed asset using straight-line depreciation, with a useful life of 4 years, no residual value, and an expected total net income of \$11,000, is **12.5%**.
12. The interest rate used in net present value analysis is referred to as the **hurdle rate**.
13. One of the complicating factors of capital investment analyses is the uncertainty related to estimating **cash flows, revenues, and expenses**.
14. Two managerial accounting tools useful in considering the uncertainty of estimates are **sensitivity analysis and expected value analysis**.
15. The process by which management plans, evaluates, and controls long-term investment decisions involving fixed assets is called **capital investment** analysis.
16. Capital rationing uses all of the following measures to determine the funding of projects **considering qualitative factors, ranking the proposals with the available funds, and establishing minimum standards by applying the cash payback and the average rate of return**.
17. In capital rationing, alternative proposals are initially screened by establishing minimum standards, using **cash payback and average rate of return methods**.
18. Given the following incomplete sensitivity analysis, what is the net present value of annual cash flows of \$300,000?

Estimated Annual Net Cash Flow	300,000 400,000	\$500,000
Present value of annual net cash flows ($\times 4.487$)	?? 1,794,800	\$2,243,500
Present value of residual value	24,000	24,000
Total present value	?? 1,818,800	\$2,267,500
Amount to be invested	(1,500,000)	(1,500,000)
Net present value	?? 318,800	\$767,500

o **\$(129,900)**

19. The expected value of the annual net cash flows is determined by multiplying each of the possible annual net cash flows by its **probability of occurring**.

Practice Exercises

Average Rate of Return

1. Determine the average rate of return for a project that is estimated to yield total income of \$936,000 over eight years, has a cost of \$1,200,000, and has a \$100,000 residual value.

o
$$\frac{\frac{936000}{8}}{\frac{1200000+100000}{2}} = 18\%$$

2. The following data are accumulated by Watershed Inc. in evaluating two competing capital investment proposals:

	Project A	Project Z
Amount of investment	\$55,000	\$50,000
Useful life	12 years	15 years
Estimated residual value	\$5,000	\$6,000
Estimated total income over the useful life	\$57,600	\$63,000

Determine the expected average rate of return for each project.

o Project A:
$$\frac{\frac{57600}{12}}{\frac{55000+5000}{2}} = 16\%$$

Project Z:
$$\frac{\frac{63000}{15}}{\frac{50000+6000}{2}} = 15\%$$

Cash Payback Period

3. A project has estimated annual net cash flows of \$42,500. It is estimated to cost \$374,000.

Determine the cash payback period. *Round your answer to one decimal place.*

- o $\frac{374000}{42500} = 8.8$

Cash Payback Period for a Service Company

4. Jane's Clothing Inc. is evaluating two capital investment proposals for a retail outlet, each requiring an investment of \$975,000 and each with a seven-year life and expected total net cash flows of \$1,050,000. Location 1 is expected to provide equal annual net cash flows of \$150,000, and Location 2 is expected to have the following unequal annual net cash flows:

Year	Value
1	\$275,000
2	225,000
3	180,000
4	175,000
5	120,000
6	40,000
7	35,000

Determine the cash payback period for both location proposals.

- o Location 1: $\frac{975000}{150000} = \mathbf{6.5 \text{ years}}$

Location 2: $275000 + 225000 + 180000 + 175000 + 120000 = \mathbf{5 \text{ years}}$

Internal Rate of Return

5. A project is estimated to cost 463,565 and provide annual net cash flows of \$115,000 for nine years.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

Determine the internal rate of return for this project, using the *Present Value of an Annuity of \$1 at Compound Interest* table shown above.

- $\frac{463565}{115000} = 4.031 \rightarrow \text{cross check with table} \rightarrow 20\%$

Internal Rate of Return Method

6. The internal rate of return method is used by Testerman Construction Co. in analyzing a capital expenditure proposal that involves an investment of \$113,550 and annual net cash flows of \$30,000 for each of the six years of its useful life.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year		6%	10%	12%	15%	20%
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

1. Determine a present value factor for an annuity of \$1, which can be used in determining the internal rate of return. *If required, round your answer to three decimal places.*
 - $\frac{113550}{30000} = 3.785$
2. Using the factor determined in part (a) and the present value of an annuity of \$1 table above, determine the internal rate of return for the proposal.
 - *cross check with table -> 15%*

Net Present Value

7. A project has estimated annual net cash flows of \$80,000 for seven years and is estimated to cost \$325,000. Assume a minimum acceptable rate of return of 6%. Use the **Present Value of an Annuity of \$1 at Compound Interest** table below.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

Determine (a) the net present value of the project and (b) the present value index. If required, use the minus sign to indicate a negative net present value.

1. Net present value of the project *round to the nearest dollar*: $(80000 * 5.582) - 325000 = 121560$
2. Present value index *round to two decimal places*: $\frac{446560}{325000} = 1.37$

Net Present Value Method

8. The following data are accumulated by Geddes Company in evaluating the purchase of \$150,000 of equipment, having a four-year useful life:

	Net Income	Net Cash Flow
Year 1	\$42,500	\$80,000
Year 2	27,500	65,000
Year 3	12,500	50,000
Year 4	2,500	40,000

Present Value of \$1 at Compound Interest					
Year	6%	10%	12%	15%	20%
1	0.943	0.909	0.893	0.870	0.833
2	0.890	0.826	0.797	0.756	0.694
3	0.840	0.751	0.712	0.658	0.579
4	0.792	0.683	0.636	0.572	0.482
5	0.747	0.621	0.567	0.497	0.402
6	0.705	0.564	0.507	0.432	0.335
7	0.665	0.513	0.452	0.376	0.279
8	0.627	0.467	0.404	0.327	0.233
9	0.592	0.424	0.361	0.284	0.194
10	0.558	0.386	0.322	0.247	0.162

1. Assuming that the desired rate of return is 15%, determine the net present value for the proposal. **If required, round to the nearest dollar.** Use the table of the present value of \$1 presented above.

- Present value of net cash flow:
 $(80000 * .87) + (65000 * .756) + (50000 * .658) + (40000 * .572) = 174520$
- Amount to be invested: 150000
- Net present value: $174520 - 150000 = 24520$

2. Would management be likely to look with favor on the proposal?

- **Yes**, because the net present value indicates that the return on the proposal is **greater** than the minimum desired rate of return of 15%.

Net Present Value—Unequal Lives

9. Project 1 requires an original investment of \$125,000. The project will yield cash flows of \$50,000 per year for 10 years. Project 2 has a computed net present value of \$135,000 over an eight-year life. Project 1 could be sold at the end of eight years for a price of \$8,000.

Use the *Present Value of \$1 at Compound Interest* and the *Present Value of an Annuity of \$1 at Compound Interest* tables shown below.

Present Value of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		0.890	0.826	0.797	0.756	0.694
3		0.840	0.751	0.712	0.658	0.579
4		0.792	0.683	0.636	0.572	0.482
5		0.747	0.621	0.567	0.497	0.402
6		0.705	0.564	0.507	0.432	0.335
7		0.665	0.513	0.452	0.376	0.279
8		0.627	0.467	0.404	0.327	0.233
9		0.592	0.424	0.361	0.284	0.194
10		0.558	0.386	0.322	0.247	0.162

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

1. Determine the net present value of Project 1 over an eight-year life, with residual value, assuming a minimum rate of return of 12%. If required, round to the nearest dollar.

$$\blacksquare \quad (50000 * 4.968) + (8000 * .404) - 125000 = 126632$$

2. Which project provides the greatest net present value?

- Project 2

Net Present Value Method, Internal Rate of Return Method, and Analysis for a Service Company

10. The management of Advanced Alternative Power Inc. is considering two capital investment projects. The estimated net cash flows from each project are as follows:

Year	Wind Turbines	Biofuel Equipment
1	\$280,000	\$300,000
2	280,000	300,000
3	280,000	300,000
4	280,000	300,000

The wind turbines require an investment of \$887,600, while the biofuel equipment requires an investment of \$911,100. No residual value is expected from either project.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

Required:

1.

1. Compute the net present value for each project. Use a rate of 6% and the present value of an annuity of \$1 in the table above. If required, round to the nearest dollar.

	Wind Turbines	Biofuel Equipment
Present value of annual net cash flows	$280000 * 3.465 = 970200$	$300000 * 3.465 = 1039500$
Less amount to be invested	887600	911100
Net present value	$970200 - 887600 = 82600$	$1039500 - 911100 = 128400$

2. Compute a present value index for each project. If required, round your answers to two decimal places.

	Present Value Index
Wind Turbines	$\frac{970200}{887600} = 1.09$
Biofuel Equipment	$\frac{1039500}{911100} = 1.14$

2. Determine the internal rate of return for each project by (a) computing a present value factor for an annuity of \$1 and (b) using the present value of an annuity of \$1 in the table above. If required, round your present value factor answers to three decimal places and internal rate of return to the nearest whole percent.

	Wind Turbines	Biofuel Equipment
Present value factor for an annuity of \$1	$\frac{887600}{280000} = 3.170$	$\frac{911100}{300000} = 3.037$
Internal rate of return	10%	12%

3. The net present value, present value index, and internal rate of return all indicate that the **biofuel equipment** is/are a better financial opportunity compared to the **wind turbines**, although both investments meet the minimum return criterion of 6%.

Homework Exercises

- Care must be taken when making capital investment decisions, since a long-term commitment of funds is involved and operations could be affected for many years.
 - True
- The methods of evaluating capital investment proposals can be grouped into two general categories referred to as (1) the average rate of return and (2) the cash payback methods.
 - False
- The excess of the cash flowing in from revenues over the cash flowing out for expenses is termed net discounted cash flow.
 - False
- The expected period of time between the date of an investment and the recovery in cash of the amount invested is called the discount period.

- **False**

5. A company is planning to purchase a machine that will cost \$24,000, have a 6-year life, and have no salvage value. The company expects to sell the machine's output of 3,000 units evenly throughout each year. Total operating income generated over the life of the machine is estimated to be \$12,000. The machine will generate net cash inflows of \$6,000 per year. The average rate of return for the machine is 16.7%.

- **True**

6. Which of the following methods of evaluating capital investment proposals uses the concept of present value to compute a rate of return?

- **internal rate of return**

7. The management of Nebraska Corporation is considering the purchase of a new machine costing \$490,000. The company's desired rate of return is 10%. The present value factors for \$1 at compound interest of 10% for 1 through 5 years are 0.909, 0.826, 0.751, 0.683, and 0.621, respectively. In addition to the foregoing information, use the following data in determining the acceptability:

Year	Operating Income	Net Cash Flow
1	\$100,000	\$180,000
2	40,000	120,000
3	40,000	100,000
4	10,000	90,000
5	10,000	120,000

The cash payback period for this investment is **4 years**.

8. Which of the following statements regarding the cash payback period is true?

- **The shorter the payback, the possibility of obsolescence will be less likely.**

9. The formula for determining the present value factor for an annuity of \$1 is **amount to be invested / equal annual net cash flows**.

10. The rate of earnings is 12% and the cash to be received in 2 years is

10,000. Determine the present value amount, using the following partial table of present value of \$1 at compound interest.

Year	6%	10%	12%
1	0.943	0.909	0.893
2	0.890	0.826	0.797
3	0.840	0.751	0.712
4	0.792	0.683	0.636

- 7970

Average Rate of Return

11. Determine the average rate of return for a project that is estimated to yield total income of \$264,000 over five years, has a cost of \$459,400, and has a \$68,600 residual value. Round to the nearest whole number.

$$\circ \quad \frac{\frac{264000}{5}}{\frac{459400+68600}{2}} = 20\%$$

12. The following data are accumulated by Watershed Inc. in evaluating two competing capital investment proposals:

	Project A	Project Z
Amount of investment	\$84,000	\$32,000
Useful life	4 years	5 years
Estimated residual value	0	0
Estimated total income over the useful life	\$8,400	\$7,200

Determine the expected average rate of return for each project. Round your answers to one decimal place.

$$\circ \quad \text{Project A: } \frac{\frac{8400}{4}}{\frac{84000}{2}} = 5\%$$

$$\text{Project Z: } \frac{\frac{7200}{5}}{\frac{32000}{2}} = 9\%$$

Cash Payback Period

13. A project has estimated annual net cash flows of \$38,500. It is estimated to cost \$146,300.

Determine the cash payback period. *Round your answer to one decimal place.*

$$\circ \quad \frac{146300}{38500} = 3.8 \text{ years}$$

Cash Payback Period for a Service Company

14. Jane's Clothing Inc. is evaluating two capital investment proposals for a retail outlet, each requiring an investment of \$225,000 and each with an eight-year life and expected total net cash flows of \$360,000. Location 1 is expected to provide equal annual net cash flows of \$45,000, and Location 2 is expected to have the following unequal annual net cash flows:

Year	Value
Year 1	\$101,000
Year 2	77,000
Year 3	47,000
Year 4	43,000
Year 5	32,000
Year 6	24,000
Year 7	19,000
Year 8	17,000

Determine the cash payback period for both location proposals.

- Location 1: **5 years**
- Location 2: **3 years**

Internal Rate of Return

15. A project is estimated to cost \$379,080 and provide annual net cash flows of \$90,000 for five years.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year		6%	10%	12%	15%	20%
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

Determine the internal rate of return for this project, using the *Present Value of an Annuity of \$1 at Compound Interest* table shown above.

- $\frac{379080}{90000} = 4.212\text{--}6\%$

Internal Rate of Return Method

16. The internal rate of return method is used by Testerman Construction Co. in analyzing a capital expenditure proposal that involves an investment of \$20,790 and annual net cash flows of \$6,000 for each of the four years of its useful life.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

1. Determine a present value factor for an annuity of \$1 which can be used in determining the internal rate of return. *If required, round your answer to three decimal places.*
 - $\frac{20790}{6000} = 3.465$
2. Using the factor determined in part (a) and the present value of an annuity of \$1 table above, determine the internal rate of return for the proposal.
 - consult table...6%

Net Present Value

17. A project has estimated annual net cash flows of \$12,500 for two years and is estimated to cost \$37,500. Assume a minimum acceptable rate of return of 12%. Use the **Present Value of an Annuity of \$1 at Compound Interest** table below.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

Determine (a) the net present value of the project and (b) the present value index. If required, use the minus sign to indicate a negative net present value.

- Net present value of the project *round to the nearest dollar*: $(12500 * 1.69) - 37500 = -16375$
- Present value index *rounded to two decimal places*: $\frac{37500 - 16375}{37500} = .56$

Net Present Value Method

18. The following data are accumulated by Geddes Company in evaluating the purchase of \$149,500 of equipment, having a four-year useful life:

	Net Income	Net Cash Flow
Year 1	\$44,000	\$75,000
Year 2	27,000	58,000
Year 3	13,000	44,000
Year 4	(1,000)	29,000

Present Value of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		0.890	0.826	0.797	0.756	0.694
3		0.840	0.751	0.712	0.658	0.579
4		0.792	0.683	0.636	0.572	0.482
5		0.747	0.621	0.567	0.497	0.402
6		0.705	0.564	0.507	0.432	0.335
7		0.665	0.513	0.452	0.376	0.279
8		0.627	0.467	0.404	0.327	0.233
9		0.592	0.424	0.361	0.284	0.194
10		0.558	0.386	0.322	0.247	0.162

1. Assuming that the desired rate of return is 6%, determine the net present value for the proposal. Use the table of the present value of \$1 presented above. *If required, round to the nearest dollar.* If required, use the minus sign to indicate a negative net present value.

- Present value of net cash flow:
 $(75000 * .943) + (58000 * .89) + (44000 * .84) + (29000 * .792) = 182273$
- Amount to be invested: 149500
- Net present value: $182273 - 149500 = 32773$

2. Would management be likely to look with favor on the proposal?

- Yes , because the net present value indicates that the return on the proposal is **greater** than the minimum desired rate of return of 6%.

Net Present Value—Unequal Lives

19. Project 1 requires an original investment of \$62,100. The project will yield cash flows of \$10,000 per year for 10 years. Project 2 has a computed net present value of \$14,600 over a eight-year life. Project 1 could be sold at the end of eight years for a price of \$48,000.

Use the *Present Value of \$1 at Compound Interest* and the *Present Value of an Annuity of \$1 at Compound Interest* tables shown below.

Present Value of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		0.890	0.826	0.797	0.756	0.694
3		0.840	0.751	0.712	0.658	0.579
4		0.792	0.683	0.636	0.572	0.482
5		0.747	0.621	0.567	0.497	0.402
6		0.705	0.564	0.507	0.432	0.335
7		0.665	0.513	0.452	0.376	0.279
8		0.627	0.467	0.404	0.327	0.233
9		0.592	0.424	0.361	0.284	0.194
10		0.558	0.386	0.322	0.247	0.162

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

1. Determine the net present value of Project 1 over a eight-year life with residual value, assuming a minimum rate of return of 10%. If required, round to the nearest dollar.

- $(10000 * 5.335) + (48000 * .467) - 62100 = 13666$

2. Which project provides the greatest net present value?

▪ **Project 2**

Net Present Value Method, Internal Rate of Return Method, and Analysis for a Service Company

20. The management of Style Networks Inc. is considering two TV show projects. The estimated net cash flows from each project are as follows:

Year	After Hours	Sun Fun
1	\$320,000	\$290,000
2	320,000	290,000
3	320,000	290,000
4	320,000	290,000

After Hours requires an investment of \$913,600, while *Sun Fun* requires an investment of \$880,730. No residual value is expected from either project.

Present Value of an Annuity of \$1 at Compound Interest		6%	10%	12%	15%	20%
Year						
1		0.943	0.909	0.893	0.870	0.833
2		1.833	1.736	1.690	1.626	1.528
3		2.673	2.487	2.402	2.283	2.106
4		3.465	3.170	3.037	2.855	2.589
5		4.212	3.791	3.605	3.353	2.991
6		4.917	4.355	4.111	3.785	3.326
7		5.582	4.868	4.564	4.160	3.605
8		6.210	5.335	4.968	4.487	3.837
9		6.802	5.759	5.328	4.772	4.031
10		7.360	6.145	5.650	5.019	4.192

Required:

1.

1. Compute the net present value for each project. Use a rate of 10% and the present value of an annuity of \$1 in the above table. *If required, round to the nearest dollar.*

	After Hours	Sun Fun
Present value of annual net cash flows	$320000 * 3.170 = 1014400$	$290000 * 3.170 = 919300$
Amount to be invested	913600	880730
Net present value	$1014400 - 913600 = 100800$	$919300 - 880730 = 38570$

2. Compute a present value index for each project. *If required, round your answers to two decimal places.*

	Present Value Index
Wind Turbines	$\frac{1014400}{913600} = 1.11$
Biofuel Equipment	$\frac{919300}{880730} = 1.04$

2. Determine the internal rate of return for each project by (a) computing a present value factor for an annuity of \$1 and (b) using the present value of an annuity of \$1 table above. *If required, round your present value factor answers to three decimal places and internal rate of return to the nearest percent.*

	After Hours	Sun Fun
Present value factor for an annuity of \$1	$\frac{913600}{320000} = 2.855$	$\frac{880730}{290000} = 3.037$
Internal rate of return	15%	12%

3. The net present value, present value index, and internal rate of return all indicate that the **After Hours** TV show is a better financial opportunity compared to the **Sun Fun** TV show, although both investments meet the minimum return criterion of 10%.

Quiz

1. The management of River Corporation is considering the purchase of a new machine costing \$380,000. The company's desired rate of return is 6%. The present value factor for an annuity of \$1 at interest of 6% for 5 years is 4.212. In addition to the foregoing information, use the following data in determining the acceptability of this investment:

Year	Operating Income	Net Cash Flow
1	\$20,000	\$95,000
2	20,000	95,000
3	20,000	95,000
4	20,000	95,000
5	20,000	95,000

The cash payback period for this investment is $\frac{380000}{95000} = 4 \text{ years}$

2. An analysis of a proposal by the net present value method indicated that the present value of future cash inflows exceeded the amount to be invested. Which of the following statements best describes the results of this analysis?
 - o **The proposal is desirable, and the rate of return expected from the proposal exceeds the minimum rate used for the analysis.**
3. The excess of the cash flowing in from revenues over the cash flowing out for expenses is termed net discounted cash flow.
 - o **False**
4. All of the following qualitative considerations may influence capital investment analysis except the investment proposal's impact on **manufacturing sunk cost**.
5. The process by which management plans, evaluates, and controls investments in fixed assets is called capital investment analysis.
 - o **True**
6. All of the following are factors that may complicate capital investment analysis: **federal income tax ramifications, changes in price levels, and possible leasing alternatives.**
7. Following is a table for the present value of \$1 at compound interest:

Year	6%	10%	12%
1	0.943	0.909	0.893
2	0.890	0.826	0.797
3	0.840	0.751	0.712
4	0.792	0.683	0.636
5	0.747	0.621	0.567

Following is a table for the present value of an annuity of \$1 at compound interest:

Year	6%	10%	12%
1	0.943	0.909	0.893
2	1.833	1.736	1.690
3	2.673	2.487	2.402
4	3.465	3.170	3.037
5	4.212	3.791	3.605

Using the tables provided, the present value of \$8,000 to be received 1 year from today, assuming an earnings rate of 12%, is $8000 * .893 = 7144$

8. The management of California Corporation is considering the purchase of a new machine costing \$400,000. The company's desired rate of return is 10%. The present value factors for \$1 at compound interest of 10% for 1 through 5 years are 0.909, 0.826, 0.751, 0.683, and 0.621, respectively. In addition to the foregoing information, use the following data in determining the acceptability of this investment:

Year	Operating Income	Net Cash Flow
1	\$100,000	\$180,000
2	40,000	120,000
3	20,000	100,000
4	10,000	90,000
5	10,000	90,000

The present value index for this investment is

o

Year	Present Value of \$1 at 10%	Net Cash Flow	Present Value of Net Cash Flow
1	0.909	\$180,000	\$163,620
2	0.826	120,000	99,120
3	0.751	100,000	75,100
4	0.683	90,000	61,470
5	0.621	90,000	55,890
Total		\$580,000	\$473,830

$$\frac{500000}{473830} = 1.14$$

9. Which of the following provisions of the Internal Revenue Code can be used to reduce the amount of the income tax expense arising from capital investment projects?

- depreciation deduction

10. The management of Wyoming Corporation is considering the purchase of a new machine costing \$375,000. The company's desired rate of return is 6%. The present value factor for an annuity of \$1 at interest of 6% for 5 years is 4.212. In addition to the foregoing information, use the following data in determining the acceptability of this investment:

Year	Operating Income	Net Cash Flow
1	\$18,750	\$93,750
2	18,750	93,750
3	18,750	93,750
4	18,750	93,750
5	18,750	93,750

The average rate of return for this investment is $\frac{18750}{\frac{375000}{2}} = 10\%$

11. The **average rate of return** method of analyzing capital investment proposals divides the estimated average annual income by the average investment.
12. The amount of the average investment for a proposed investment of \$120,000 in a fixed asset with a useful life of 4 years, straight-line depreciation, no residual value, and an expected total income of \$21,600 for the 4 years is $\frac{120000}{2} = 60000$
13. Tennessee Corporation is analyzing a capital expenditure that will involve a cash outlay of \$109,332. Estimated cash flows are expected to be \$36,000 annually for 4 years. The present value factors for an annuity of \$1 for 4 years at interest of 10%, 12%, 14%, and 15% are 3.170, 3.037, 2.914, and 2.855, respectively. The internal rate of return for this investment is
- $\frac{109332}{36000} = 3.037 \dots \text{check problem for interest at rate of return} \rightarrow 12\%$
14. Following is a table for the present value of \$1 at compound interest:

Year	6%	10%	12%
1	0.943	0.909	0.893
2	0.890	0.826	0.797
3	0.840	0.751	0.712
4	0.792	0.683	0.636
5	0.747	0.621	0.567

Following is a table for the present value of an annuity of \$1 at compound interest:

Year	6%	10%	12%
1	0.943	0.909	0.893
2	1.833	1.736	1.690
3	2.673	2.487	2.402
4	3.465	3.170	3.037
5	4.212	3.791	3.605

Using the tables provided, the present value of \$30,000 to be received 3 years from today, assuming an earnings rate of 6%, is $30000 * .830 = 25200$

15. Which of the following is a method of analyzing capital investment proposals that ignores present value?
 - **average rate of return**
16. Which of the following is *not* an advantage of the average rate of return method?
 - **takes into consideration the time value of money**
17. Following is a table for the present value of \$1 at compound interest:

Year	6%	10%	12%
1	0.943	0.909	0.893
2	0.890	0.826	0.797
3	0.840	0.751	0.712
4	0.792	0.683	0.636
5	0.747	0.621	0.567

Following is a table for the present value of an annuity of \$1 at compound interest:

Year	6%	10%	12%
1	0.943	0.909	0.893
2	1.833	1.736	1.690
3	2.673	2.487	2.402
4	3.465	3.170	3.037
5	4.212	3.791	3.605

Using the tables provided, if an investment is made now for \$23,500 that will generate a cash inflow of \$8,000 a year for the next 4 years, the net present value of the investment, assuming an earnings rate of 10%, is $(8000 * 3.170) - 23500 = 1860$

18. The production department is proposing the purchase of an automatic insertion machine. It has identified 3 machines and has asked the accountant to analyze them to determine which of the proposals (if any) meet or exceed the company's policy of a minimum desired rate of return of 10% using the net present value method. Each of the assets has an estimated useful life of 10 years. The accountant has identified the following data:

	Machine A	Machine B	Machine C
Present value of future cash flows computed using 10% rate of return	\$305,000	\$295,000	\$300,000
Amount of initial investment	300,000	300,000	300,000

Which of the investments are acceptable?

o

	Machine A	Machine B	Machine C
Present value of future cash flows computed using 10% rate of return	\$305,000	\$295,000	\$300,000
Amount of initial investment	300,000	300,000	300,000
Net present value	$305000 - 300000 = 5000$	$295000 - 300000 = -5000$	$300000 - 300000 = 0$

Machines A and C

Chapter 27

Pre-Lecture Videos

1. **Lead time** measures the time interval between when a product enters production (started) and when it is completed (finished).
2. All of the following are lead time terms and classifications except **operating cycle** time.
3. If manufacturing processes are organized around a product, the company has a **product-oriented** layout.
4. The last step in Six Sigma is **control**.
5. In lean accounting, the journal entry to record all materials and conversion costs includes a debit to **raw and in process inventory**.
6. Which of the following are examples of nonfinancial performance?
 - o **lead time price quantity variance, setup time, and value-added ratio.**
7. Lean manufacturing normally uses nonfinancial measures to help guide **short-term operating performance**.
8. Activity analysis determines the cost of activities for the purpose of determining the cost of **quality, value-added activities, and processes**.
9. A cost of quality report normally includes which of the following?
 - o **Total activity cost for each quality cost classification, percent of total quality costs associated with each classification, and percent of each quality cost classification to sales.**

10. A process is a series of activities that converts an input into an output.

- True

Mini Quiz

1. Lopez Company incurred an activity cost of \$456,000 for inspecting 120,000 units of production. Management determined that the inspecting objectives could be met without inspecting every unit. Therefore, rather than inspecting 120,000 units of production, the inspection activity was limited to 30% of the production. What is the difference in the activity cost per unit on the 120,000 units after the improvement?
 - $\frac{.7 * 456000}{120000} = 2.66$
2. Which of the following is the process used by companies that produce products with high quality, low cost, and fast response availability?
 - **Lean manufacturing**
3. In lean manufacturing, the cell conversion cost rate is calculated as **budgeted conversion cost divided by planned hours of production**.
4. Costs of scrap and rework are classified as **internal failure costs**.
5. Which of the following is not one of the reasons a company would undertake activity analysis?
 - **To determine prevention costs**
6. Which of the following statements regarding lean principles for nonmanufacturing processes is not true?
 - **The goal of lean principles is to maximize the time consumed in a process.**
7. In lean accounting, all of the following are combined accounts except
 - **Finished goods inventory**
8. McPhee Company manufactures rugs in the cutting and assembly process. Rugs are manufactured in 70-rug batch sizes. The cutting time is 14 minutes per rug. The assembly time is 24 minutes per rug. It takes 18 minutes to move a batch of rugs from cutting to assembly. What is the value-added ratio?
 - $\frac{38}{[(14+24)*(70-1)]+18+38} = 1.4\%$
9. All of the following statements regarding traditional manufacturing are true except **traditional manufacturing practices decrease lead time to protect against uncertainty**.
10. Which of the following is not true when applying lean principles to hospital care?
 - **The overall cost of patient care will increase.**
11. The budgeted conversion costs for a just-in-time cell are \$244,720 for 3,800 production hours. Each unit produced by the cell requires 45 minutes of cell process time. During the month, 2,100 units are manufactured in the cell. The estimated materials cost is \$50 per unit. What is the journal entry if 2,000 units are completed and placed into finished goods?
 - $(50 + [\frac{244720}{3800} * \frac{45}{60}]) * 2000 = 196600$

Item		
Finished Good Inventory	196,600	
Raw and In Process Inventory		196,600

12. All of the following statements regarding lean manufacturing are true except **lean manufacturing principles increase inventory..**
13. Sarasota Company manufactures pillows in the cutting and assembly process. Pillows are manufactured in 40-pillow batch sizes. The cutting time is 4 minutes per pillow. The assembly time is 8 minutes per pillow. It takes 10 minutes to move a batch of pillows from cutting to assembly. What is the value-added ratio?
- $\frac{12}{(4+8)+[(4+8)*(40-1)]+10} = 2.4\%$
14. McPhee Company manufactures rugs in the cutting and assembly process. Rugs are manufactured in 70-rug batch sizes. The cutting time is 14 minutes per rug. The assembly time is 24 minutes per rug. It takes 18 minutes to move a batch of rugs from cutting to assembly. What is the value-added lead time?
- $14 + 24 = 38$

Practice Exercises

Cost of Quality Report

1. Meagher Solutions Inc. manufactures memory chips for personal computers. An activity analysis was conducted, and the following activity costs were identified with the manufacture and sale of memory chips:
 1. Identify the cost of quality classification for each activity.

Quality Activities	Activity Cost	Quality Cost Classification
Correct shipment errors	\$150,000	External failure
Disposing of scrap	95,000	Internal failure
Emergency equipment maintenance	125,000	Internal failure
Employee training	50,000	Prevention
Final inspection	80,000	Appraisal
Inspecting incoming materials	60,000	Appraisal
Preventive equipment maintenance	40,000	Prevention
Processing customer returns	90,000	External failure
Scrap reporting	45,000	Internal failure
Supplier development	15,000	Prevention
Warranty claims	250,000	External failure
Total	\$1,000,000	

2. Prepare a cost of quality report. Assume that the sales for the period were \$4,000,000. If required, round percents to one decimal place.

Meagher Solutions Inc. Cost of Quality Report			
Quality Cost Classification	Quality Cost	Percent of Total Quality Cost	Percent of Total Sales
Prevention	105000	$\frac{105000}{1000000} = 10.5\%$	$\frac{105000}{4000000} = 2.6\%$
Appraisal	140000	14%	3.5%
Internal failure	265000	26.5%	6.6%
External failure	490000	49%	12.3%
Total	1000000	100%	25%

3. The category with the fewest number of quality activities is **prevention costs**. Nearly fifty percent of the quality activity costs are **external failures**. The highest single cost is warranty claims, which is a(n) **external failure**. Disposing of scrap, emergency equipment maintenance, and scrap reporting are all **internal failures**.
2. A quality control activity analysis indicated the following four activity costs of a hotel:

Item	Value
Inspecting cleanliness of rooms	\$175,000
Processing lost customer reservations	40,000
Rework incorrectly prepared room service meal	20,000
Employee training	265,000
Total	\$500,000

Sales are \$4,000,000. Prepare a cost of quality report. *Round percent of sales to one decimal place.*

o

Cost of Quality Report			
Quality Cost Classification	Quality Cost	Percent of Total Quality Cost	Percent of Total Sales
Prevention	265000	$\frac{265000}{500000} = 53\%$	$\frac{265000}{4000000} = 6.6\%$
Appraisal	175000	35%	4.4%
Internal failure	20000	4%	0.5%
External failure	40000	8%	1.0%
Totals	500000	100%	12.5%

Lead Time

3. Blues Inc. manufactures jeans in the cutting and sewing process. Jeans are manufactured in 40-jean batch sizes. The cutting time is 5 minutes per jean. The sewing time is 20 minutes per jean. It takes 2 minutes to move a batch of jeans from cutting to sewing.

1. Compute the value-added, non-value-added, and total lead time of this process.

- Value-added lead time: $5 + 20 = 25$

- Non-value-added lead time: $[(5 + 20) * (40 - 1)] + 2 = 977$

- Total lead time: $25 + 977 = 1002$

2. Compute the value-added ratio. *Round to one decimal place.*

- $\frac{25}{1002} = 2.5\%$

Lean Accounting

4. The annual budgeted conversion costs for a lean cell are \$180,000 for 1,000 production hours. Each unit produced by the cell requires 20 minutes of cell process time. During the month, 600 units are manufactured in the cell. The estimated materials costs are \$30 per unit.

(Do not round per unit cost. If required, round your answers to the nearest dollar.)

Journalize the following entries for the month:

1. Materials are purchased to produce 500 units.

	Debt	Credit
Raw and In Process Inventory	$30 * 500 = 15000$	
Accounts Payable		15000

2. Conversion costs are applied to 600 units of production.

	Debt	Credit
Raw and In Process Inventory	$(\frac{180000}{1000} * \frac{20}{60}) * 600 = 36000$	
Conversion Costs		36000

3. The cell completes 450 units, which are placed into finished goods.

	Debt	Credit
Finished Goods Inventory	$(30 + 60) * 450 = 40500$	
Raw and In Process Inventory		40500

5. Vintage Audio Inc. manufactures audio speakers. Each speaker requires \$48 per unit of direct materials. The speaker manufacturing assembly cell includes the following estimated costs for the period:

Speaker assembly cell, estimated costs:	
Labor	\$30,000
Depreciation	12,000
Supplies	6,000
Power	2,000
Total cell costs for the period	\$50,000

The operating plan calls for 800 operating hours for the period. Each speaker requires 24 minutes of cell process time. The unit selling price for each speaker is \$90. During the period, the following transactions occurred:

- 1) Purchased materials to produce 2,000 speaker units.
- 2) Applied conversion costs to production of 1,800 speaker units.
- 3) Completed and transferred 1,700 speaker units to finished goods.
- 4) Sold 1,600 speaker units.

There were no inventories at the beginning of the period.

1. Journalize the summary transactions (1)-(4) for the period. If an amount box does not require an entry, leave it blank.

1	Raw and In Process Inventory	$2000 * 48 = 96000$
	Accounts Payable	96000
2	Raw and In Process Inventory	$\left[\frac{50000}{800} * \frac{24}{60}\right] * 1800 = 45000$
	Conversion Costs	45000
3	Finished Goods Inventory	$(48 + 25) * 1700 = 124100$
	Raw and In Process Inventory	124100
4 Sale	Accounts Receivable	$90 * 1600 = 144000$
	Sales	144000
4 Cost	Cost of Goods Sold	$(48 + 25) * 1600 = 116800$
	Finished Goods Inventory	116800

2. Determine the ending balance of raw and in process inventory and finished goods inventory.

- Raw and In Process Inventory, ending balance:
 $[48 * (2000 - 1800)] + [(48 + 25) * (1800 - 1700)] = 16900$

Finished Goods Inventory, ending balance: $(48 + 25) * (1700 - 1600) = 7300$

6. Westgate Inc. uses a lean manufacturing strategy to manufacture DVR (digital video recorder) players. The company manufactures DVR players through a single product cell. The budgeted conversion cost for the year is \$600,000 for 2,000 production hours. Each unit requires 21 minutes of cell process time. During March, 500 DVR players were manufactured in the cell. The materials cost per unit is \$60. The following summary transactions took place during March:

- 1) Materials were purchased for March production.
 - 2) Conversion costs were applied to production.
 - 3) 500 DVR players were assembled and placed in finished goods.
 - 4) 480 DVR players were sold for \$240 per unit.
1. Determine the budgeted cell conversion cost per hour.
 - $\frac{600000}{2000} = 300$
 2. Determine the budgeted cell conversion cost per unit.
 - $\frac{21}{60} * 300 = 105$
 3. Journalize the summary transactions (1)–(4) for March. If an amount box does not require an entry, leave it blank.

1	Raw and In Process Inventory	$500 * 60 = 30000$	
	Acconuts Payable		30000
2	Raw and In Process Inventory	$500 * 105 = 52500$	
	Conversion Costs		52500
3	Finished Goods Inventory	$500 * (60 + 105) = 82500$	
	Raw and In Process Inventory		82500
4 Sale	Accounts Receivable	$480 * 240 = 115200$	
	Sales		115200
4 Cost	Cost of Goods Sold	$480 * (60 + 105) = 79200$	
	Finished Goods Inventory		79200

Lean Features

7. Lean Features

Which of the following are features of a lean manufacturing system?

1. Smaller batch sizes

- Yes

2. Centralized maintenance areas
 - **No**
3. Employee involvement
 - **Yes**
4. Less wasted movement of material and people
 - **Yes**

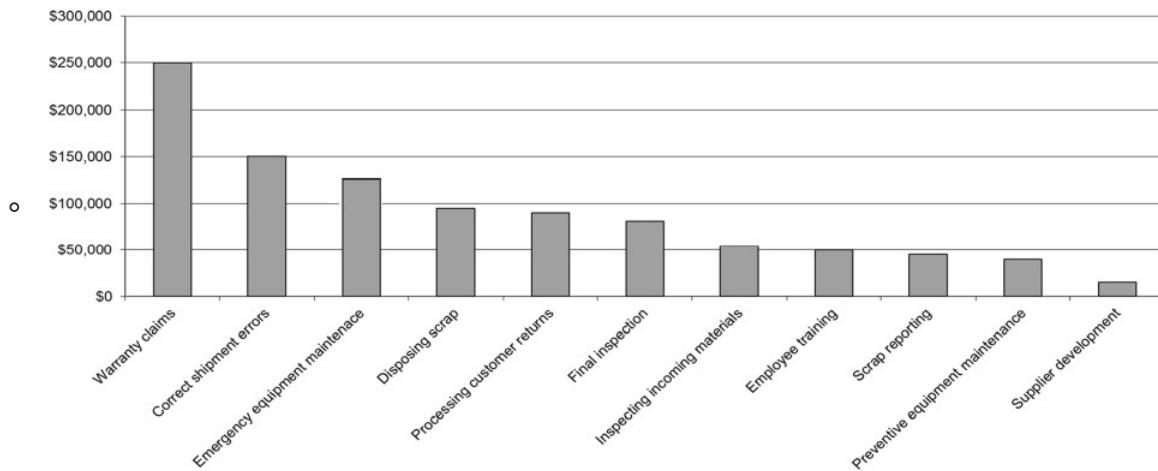
Pareto Chart

8. Meagher Solutions Inc. manufactures memory chips for personal computers. An activity analysis was conducted, and the following activity costs were identified with the manufacture and sale of memory chips:

Activities	Activity Cost
Correct shipment errors	\$150,000
Disposing of scrap	95,000
Emergency equipment maintenance	125,000
Employee training	50,000
Final inspection	80,000
Inspecting incoming materials	60,000
Preventive equipment maintenance	40,000
Processing customer returns	90,000
Scrap reporting	45,000
Supplier development	15,000
Warranty claims	250,000
Total activity cost	\$1,000,000

Select from the following the correct Pareto chart of these activities.

Pareto Chart of Quality Activities



Process Activity Analysis

9. Roen Company incurred an activity cost of \$105,600 for inspecting 40,000 units of production. Management determined that the inspecting objectives could be met without inspecting every unit. Therefore, rather than inspecting 40,000 units of production, the inspection activity was limited to a random selection of 5,000 units out of the 40,000 units of production.

Determine the inspection activity cost per unit on 40,000 units of total production both before and after the improvement. If required, round per unit amounts to the nearest cent.

- Inspection activity before improvement: $\frac{105600}{40000} = 2.64$
- Inspection activity after improvement: $\frac{5000 \times 2.64}{40000} = .33$

Homework Exercises

1. In the lean principles philosophy, unexpected downtime is the result of unreliable processes.
 - **True**
2. Lead time includes both value-added time and non-value-added time.
 - **True**
3. Lean manufacturing favors organizing work around products rather than around processes.
 - **True**
4. In a push manufacturing system, production is based on estimated customer demand.
 - **True**
5. In a lean environment, raw materials are delivered more frequently than in a traditional environment.
 - **True**
6. The cell conversion cost rate is very similar to the predetermined factory overhead rate because both include only factory overhead costs.
 - **False**
7. Lean practices and activity analyses are not suitable for adaptation to service businesses or administrative processes.
 - **False**

8. Which of the following is related to long lead times?
- **long setup times, large batch sizes, and large inventories**
9. Under a lean environment, employees have the responsibility and authority to **make decisions about operations, rather than waiting for management.**
10. Actions that transform a traditional manufacturing environment to a lean environment include all of the following *except* **increase raw materials and finished goods inventories.**
11. Sifton Electronics Corporation manufactures and assembles electronic motor drives for video cameras. The company assembles the motor drives for several accounts. The process consists of a lean cell for each customer. The following information relates to only one customer's lean cell for the coming year. For the year, projected labor and overhead was 7,370,000 and materials costs were 28 per unit. Planned production included 4,000 hours to produce 27,500 motor drives. Actual production for August was 1,600 units, and motor drives shipped amounted to 1,380 units. Conversion costs are applied based on units of production
- From the foregoing information, determine the production costs transferred to Finished Goods during August.
- $(\frac{7370000}{27500} + 28) * 1600 = 473600$
12. Which of the following results in fewer transactions in lean accounting?
- **The distinction between direct and indirect costs is eliminated., All manufacturing costs are combined into one account called Raw and In Process Inventory., and There is less movement of inventory between departments.**
13. Schedule of Activity Costs

Schedule of Activity Costs	
Quality Control Activities	Activity Cost
Process audits	\$50,000
Training of machine operators	28,000
Processing returned products	19,000
Scrap processing (disposal)	25,000
Rework	8,000
Preventive maintenance	30,000
Product design	46,000
Warranty work	12,000
Finished goods inspection	23,000

From the provided schedule of activity costs, determine the value-added costs.

- $50000 + 28000 + 30000 + 46000 + 23000 = 177000$

14. Schedule of Activity Costs

Schedule of Activity Costs	
Quality Control Activities	Activity Cost
Process audits	\$50,000
Training of machine operators	28,000
Processing returned products	19,000
Scrap processing (disposal)	25,000
Rework	8,000
Preventive maintenance	30,000
Product design	46,000
Warranty work	12,000
Finished goods inspection	23,000

From the provided schedule of activity costs, determine the external failure costs.

- $19000 + 12000 = 31000$

Lean Accounting

15. The annual budgeted conversion costs for a lean cell are \$237,600 for 3,300 production hours. Each unit produced by the cell requires 10 minutes of cell process time. During the month, 3,020 units are manufactured in the cell. The estimated materials costs are \$85 per unit.

(Round the per unit cost to the nearest cent and use in subsequent computations. If required, round your answers to the nearest dollar.)

Journalize the following entries for the month:

1. Materials are purchased to produce 3180 units.

	Debt	Credit
Raw and In Process Inventory	$85 * 3180 = 270300$	
Accounts Payable		270300

2. Conversion costs are applied to 3020 units of production.

	Debt	Credit
Raw and In Process Inventory	$(\frac{237600}{3300} * \frac{10}{60}) * 3020 = 36240$	
Conversion Costs		36240

3. The cell completes 2870 units, which are placed into finished goods.

	Debt	Credit
Finished Goods Inventory	$[85 + (\frac{237600}{3300} * \frac{10}{60})] * 2870 = 278390$	
Raw and In Process Inventory		278390

16. Vintage Audio Inc. manufactures audio speakers. Each speaker requires \$100 per unit of direct materials. The speaker manufacturing assembly cell includes the following estimated costs for the period:

Speaker assembly cell, estimated costs:	
Labor	\$69,080
Depreciation	9,270
Supplies	3,370
Power	2,520
Total cell costs for the period	\$84,240

The operating plan calls for 180 operating hours for the period. Each speaker requires 10 minutes of cell process time. The unit selling price for each speaker is \$271. During the period, the following transactions occurred:

- 1) Purchased materials to produce 445 speaker units.
- 2) Applied conversion costs to production of 425 speaker units.
- 3) Completed and transferred 405 speaker units to finished goods.
- 4) Sold 385 speaker units.

There were no inventories at the beginning of the period.

1. Journalize the summary transactions (1)-(4) for the period. If an amount box does not require an entry, leave it blank.

1	Raw and In Process Inventory	$445 * 100 = 44500$	
	Acconuts Payable		44500
2	Raw and In Process Inventory	$\left[\frac{84240}{180} * \frac{10}{60} \right] * 425 = 33150$	
	Conversion Costs		33150
3	Finished Goods Inventory	$(100 * 405) + (405 * \frac{84240}{180} * \frac{10}{60}) = 72090$	
	Raw and In Process Inventory		72090
4 Sale	Accounts Receivable	$271 * 385 = 104335$	
	Sales		104335
4 Cost	Cost of Goods Sold	$(100 * 385) + (385 * \frac{84240}{180} * \frac{10}{60}) = 68530$	
	Finished Goods Inventory		68530

2. Determine the ending balance of raw and in process inventory and finished goods inventory.

- Raw and In Process Inventory, ending balance: $44500 + 33150 - 72090 = 5560$
- Finished Goods Inventory, ending balance: $72090 - 68530 = 3560$

Quiz

1. Which of the following is an example of a nonfinancial measure of performance used in lean manufacturing?
 - **number of units scrapped, setup time, and lead time**
2. Which of the following underlying problems may be hidden by high raw materials, work in process, and finished goods inventory levels?
 - **poor quality, unreliable suppliers, and machine breakdowns**
3. Conan Electronics Corporation manufactures and assembles electronic motor drives for video cameras. The company assembles the motor drives for several accounts. The process consists of a lean cell for each customer. The following information relates to only one customer's lean cell. For the year, planned labor and overhead was \$80,000,000 and materials costs were \$25 per unit. Planned production included 9,600 hours to produce 76,800 motor drives. Actual production for the month of August was 5,200 units, and motor drives shipped amounted to 5,040 units. From the foregoing information, determine the cell conversion cost rate for applying conversion costs.
 - $\frac{80000000}{9600} = 8333$
4. **Traditional** manufacturing treats suppliers and customers as "arm's-length" independent entities.
5. Which of the following is a value-added activity?
 - **preventative maintenance**
6. Sifton Electronics Corporation manufactures and assembles electronic motor drives for video cameras. The company assembles the motor drives for several accounts. The process consists of a lean cell for each customer. The following information relates to only one customer's lean cell for the coming year. For the year, projected labor and overhead was \$7,370,000 and materials costs were \$28 per unit. Planned production included 4,000 hours to produce 27,500 motor drives. Actual production for August was 1,600 units, and motor drives shipped amounted to 1,380 units. Conversion costs are applied based on units of production

From the foregoing information, determine the production costs transferred to Cost of Goods Sold during August.

- $(\frac{7370000}{27500} + 28) * 1380 = 408480$

7. Which of the following is an example of value-added time?

- **processing time**

8. The cell conversion cost rate includes which of the following?

- **only direct labor and factory overhead**

9. Sifton Electronics Corporation manufactures and assembles electronic motor drives for video cameras. The company assembles the motor drives for several accounts. The process consists of a lean cell for each customer. The following information relates to only one customer's lean cell for the coming year. For the year, projected labor and overhead was \$7,370,000 and materials costs were \$28 per unit. Planned production included 4,000 hours to produce 27,500 motor drives. Actual production for August was 1,600 units, and motor drives shipped amounted to 1,380 units. Conversion costs are applied based on units of production

From the foregoing information, determine the production costs transferred to Finished Goods during August.

- $(\frac{7370000}{27500} + 28) * 1600 = 473600$

10. In a lean environment, process problems are more visible than they are in a traditional environment because **process problems cause production to shut down immediately.**

11. Sifton Electronics Corporation manufactures and assembles electronic motor drives for video cameras. The company assembles the motor drives for several accounts. The process consists of a lean cell for each customer. The following information relates to only one customer's lean cell for the coming year. For the year, projected labor and overhead was \$7,370,000 and materials costs were \$28 per unit. Planned production included 4,000 hours to produce 27,500 motor drives. Actual production for August was 1,600 units, and motor drives shipped amounted to 1,380 units. Conversion costs are applied based on units of production

From the foregoing information, determine the manufacturing cost per unit.

- $\frac{7370000}{27500} + 28 = 296$

12. Lean manufacturing focuses on reducing time, cost, and poor quality in processes.

- **True**

13. Schedule of Activity Costs

Quality Control Activities	Activity Cost
Process audits	\$48,300
Training of machine operators	26,300
Processing returned products	17,800
Scrap processing (disposal)	25,300
Rework	8,900
Preventative maintenance	28,500
Product design	45,900
Warranty work	9,600
Finished goods inspection	23,700

From the provided schedule of activity costs, determine the internal failure costs.

- $25300 + 8900 = 34200$

14. Which of the following are prevention costs?

- **preventative maintenance, operator training, and design engineering**

15. Which of the following is an objective of lean manufacturing?

- **eliminating waste**

16. Which of the following is considered non-value-added lead time?

- **moving from process to process**

17. Squirrel Co. operates in a lean manufacturing environment. For June production, Squirrel purchased 6,000 units of raw materials at \$6.00 per unit on account. The journal entry required to record this transaction is

-

	Debt	Credit
Raw and In Process Inventory	$6000 * 600 = 36000$	
Accounts payable		36000

18. A customer service department has the following resolution response time data:

	Average Response Time
First contact	0.25
Service scheduling	0.50
Wait for service	24.00
Service	1.50
Total resolution time	26.25

What is the value-added ratio (rounded to one decimal place) in this process?

- o $\frac{.25+.5+1.5}{26.25} = 8.6\%$

19. Schedule of Activity Costs

Quality Control Activities	Activity Cost
Process audits	\$50,000
Training of machine operators	28,000
Processing returned products	19,000
Scrap processing (disposal)	25,000
Rework	8,000
Preventive maintenance	30,000
Product design	46,000
Warranty work	12,000
Finished goods inspection	23,000

From the provided schedule of activity costs, determine the appraisal costs.

- o $50000 + 23000 = 73000$

20. Schedule of Activity Costs

Quality Control Activities	Activity Cost
Process audits	\$50,000
Training of machine operators	28,000
Processing returned products	19,000
Scrap processing (disposal)	25,000
Rework	8,000
Preventive maintenance	30,000
Product design	46,000
Warranty work	12,000
Finished goods inspection	23,000

From the provided schedule of activity costs, determine the non-value-added costs.

- $19000 + 25000 + 8000 + 12000 = 64000$

Chapter 28

Pre-Lecture Videos

1. Which of the following terms defines and links strategic objectives to the performance metrics of a company?
 - **Strategic performance measurement system**
2. **Performance measurement systems** are used by management to assess how well employees or units within a company meet the company's goals and objectives.
3. **Material price differences** are often used as metrics for measuring a purchasing department's performance.
4. The **balanced scorecard (BSC)** is the best-known strategic performance measurement system.
5. For a company's strategic objective to increase profits, management measures (tracks) market share and operating profit. Therefore, market share and operating profit are the company's **performance metrics**.
6. In the context of performance perspectives, performance in the **internal processes** perspective focuses on operational efficiencies.
7. In the context of the objectives of performance perspectives, performance in the **financial** perspective focuses on traditional accounting measures.
8. A **strategic objective** defines the purpose of an action taken within a company.
9. In the context of cognitive biases, **motivated reasoning** is the tendency for a person to see what they want to see in data.
10. In the context of cognitive biases, **surrogation** is the tendency to behave like the performance metrics are the strategic objectives.

11. When managers compare the performance of divisions within a company, they may ignore performance metrics that are unique to individual divisions. Instead managers may focus on prevalent performance metrics for all divisions. This bias is called the **common measures bias**.
12. Which of the following statements is true about corporate social responsibility (CSR)?
 - **Recruiters often use CSR activities to hire top talent interested in making a difference beyond the traditional financial results.**
13. Which of the following terms refers to a form of CSR information that helps managers evaluate the savings generated by using fewer natural resources in a company's operations?
 - **Eco-efficiency measure**
14. When corporate social responsibility (CSR) activities involve ensuring the ability to meet current needs without compromising the ability of future generations to meet their needs, the CSR activities are referred to as **sustainability efforts**.
15. Athena Books Company is contemplating the installation of a wastewater recycling system. The amount to be invested in this system is \$400,000. The system is expected to last 8 years and has no salvage value. Which of the following situations supports the installation of the recycling system? Assume the present value factor for an annuity of \$1 at 10% for 8 periods is 5.3349 and the present value factor for \$1 at 10% for 8 periods is 0.4665.
 - **The recycling system will yield a savings of \$78,000 per year.**
16. Which of the following are examples of a capital investment in a CSR objective?
 - **A paper mill invests in wastewater recycling to avoid the potential legal liability for river contamination.**
17. Which of the following statements is true?
 - **CSR investments that are legally mandated are justified by the requirements of the law rather than their immediate economic benefits.**

Mini Quiz

1. Common financial metrics include items such as **operating income, cash flow, and total revenue**.
2. Which of the following is an important strategic performance measurement system?
 - **The balanced scorecard**
3. A metric or measure is a representation of **something a person or company cares about**.
4. Which of the following are examples of leading indicators of future financial performance often used within the balanced scorecard?
 - **Customer satisfaction and employee training**
5. The levels or rates of improvement that management wants to achieve for performance metrics are known as **performance targets**.
6. A **strategic objective** defines the purpose of an action taken within a company, and **performance metrics** are used to assess performance in achieving these goals.
7. A **strategy** map shows the expected cause-and-effect relationships among strategic objectives, and a **measure** map shows the expected relationships among performance metrics.

8. Management at Illumination Inc. is adjusting the company's strategic objectives because the expected relationships shown in a balanced scorecard are not supported by statistical analyses. This process of using performance metrics to verify strategic objective expectations and adjust them if necessary is known as **strategic learning**.
9. The tendency for a person to see what they want to see in data is known as **motivated reasoning**.
10. Neon Company is implementing initiatives to take responsibility for the impact its operations have on society and to improve social well-being within and outside of the firm. Neon's efforts are known as **corporate social responsibility**.
11. A balanced scorecard that either includes corporate social responsibility activities in a separate corporate social responsibility performance perspective or integrates them into the existing four perspectives is known as a **sustainability balanced scorecard**.
12. In conjunction with CSR, metrics have been developed to help Blazer Company and its managers evaluate the savings generated by using fewer natural resources in the company's operations. These metrics are called **eco-efficiency measures**.
13. Logjam Lumber Company invests funds in replanting and reforestation. This is an example of which of the following possible CSR objectives?
 - **Minimize environmental degradation**
14. Certain CSR capital investment analyses can be completed using common tools such as calculating the net present value of the investment. Other capital investments may be evaluated **qualitatively and/or based on legal mandates**.
15. Durango Inc., a heavy equipment manufacturing company, is considering a proposal to invest funds in understanding potential customers' sustainability efforts. Durango's CSR investment proposals can be analyzed using **managerial accounting methods such as capital investment analysis**.
16. Which of the following is normally considered a lagging indicator of a company's financial performance?
 - **Actual sales**
17. Which of the following summarizes all the elements needed for a balanced scorecard performance measurement system?
 - **Performance perspectives, strategic objectives, strategic initiatives, performance metrics, performance targets**
18. Social psychological research has found that people are often motivated by intrinsic factors rather than by purely monetary compensation considerations. An example of this is that **people may sometimes work for lower pay because they are attracted by the CSR activities of the organization where they choose to work**.
19. Examples of farming and ranching techniques that have minimal impact on farm land include **mixed farming and crop rotation**.

Practice Exercises

1. 72 Inc. has developed a balanced scorecard with the following performance metrics:

Relative to the metric "customer satisfaction ratings," which of these performance metrics are leading indicators and which are lagging indicators?

 -

Item	Leading or Lagging
Total sales	Lagging indicators
Employee turnover	Leading indicators
Market share	Lagging indicators
Number of shipping errors	Leading indicators
Median training hours per employee	Leading indicators
Number of new customers	Lagging indicators

2. Bluetiful Inc. has the following strategic objectives on its balanced scorecard but is unsure how to measure them:

State which performance perspective each strategic objective should fall under, and suggest at least two possible performance metrics for each strategic objective listed.

o

Strategic Objective	Performance Perspective	Possible Performance Metrics
Increase profits	Financial	Market share
		Operating profit
		Gross profit
Obtain new customers	Customer	Number of new customers
		Percentage of sales from new customers
		Number of leads
Improve production efficiency	Internal processes	Average production time per product
		Total costs of production
		Average cost of production per product
Recruit top candidates	Learning and growth	Percentage of entry-level hires with master's degree
		Percentage of entry-level hires from top 10 colleges
		Percentage of interns from top 10 colleges who become full-time hires

3. Moses Moonrocks Inc. has developed a balanced scorecard with a measure map that suggests that the number of erroneous shipments has a direct effect on operating profit. The company estimates that every shipment error leads to a reduction of revenue by \$3,000 and increased costs of about \$2,000.

Item	Value
Sales	\$230,000
Cost of goods sold	150,000
Depreciation expense	30,000
Other expenses	20,000

If the company has the above budgeted sales and costs for next month (without accounting for any possible shipping errors), determine how many shipping errors the company can afford to have and still break even.

- Break-even shipping errors: $\frac{230000 - 150000 - 30000 - 20000}{3000 + 2000} = 6$

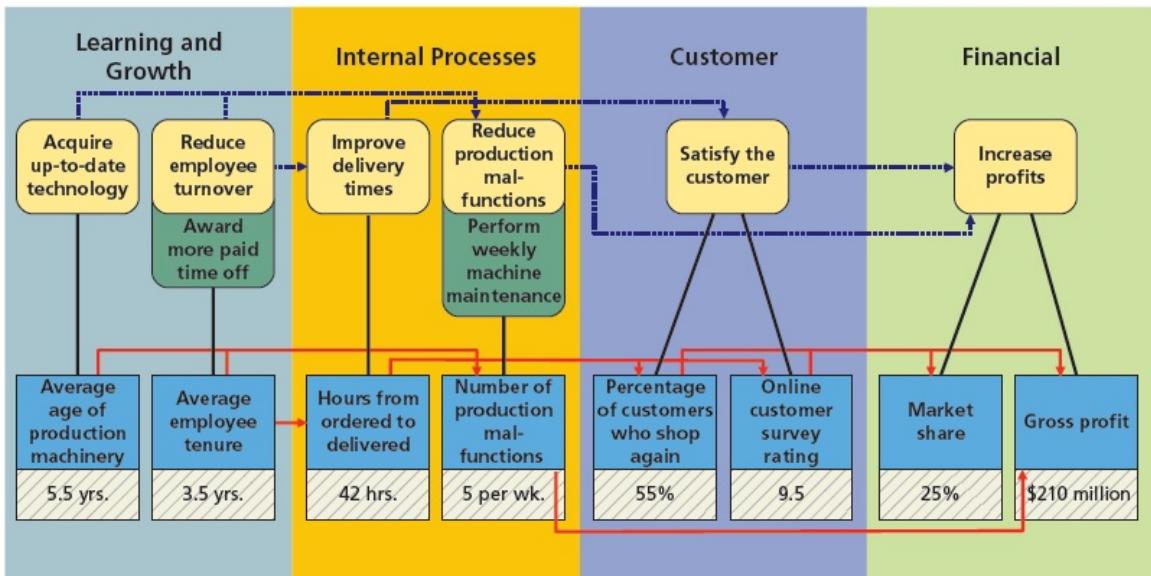
4. Gary's Gumbo is a locally owned restaurant in Houston, Texas, with eight locations. The owner recently developed a new recipe for the restaurant's signature gumbo dish. The owner decided to try out the dish in four of the company's locations. After one month, the owner had gathered the following data:

	Locations	with New	Gumbo	Recipe		Locations	with Old	Gumbo	Recipe
Location #	1	2	3	4		5	6	7	8
Number of orders	1,253	1,386	1,495	1,377		1,112	1,025	1,224	997
Number of customer complaints (about the dish)	34	36	44	32		12	9	6	8

After looking over the data, the owner happily noted that the number of orders of the signature gumbo dish at the locations where the new recipe had been used (locations 1–4) had increased in comparison to the traditional number of orders of the dish (locations 5–8). The owner then decided to implement the new recipe at the rest of the company's locations.

1. Identify whether the decision of introducing the new gumbo recipe in all locations is correct.
 - **The number of orders increased along with complaints so the decision of the company should be reconsidered.**
2. Identify the cognitive bias in this situation.
 - **The owner of the company accepted the positive feedback and ignored the negative feedback.**
5. Lonnie's Shipping Co. is considering switching to an all-electric fleet to minimize emissions. Lonnie wants to gradually implement this change over the next 10 years. The company currently has a fleet of 100 trucks, half of which are electric-powered. Upon consulting with Lonnie, you have determined that an appropriate course of action is to include this CSR activity as a strategic objective in the company's current balanced scorecard.
 1. Under which category of performance perspective can the CSR strategic objective of the company be included?
 - **Internal process based performance perspective**

2. Identify a performance metric for the CSR strategic objective.
 - **The number of electric-powered trucks in the fleet.**
3. Identify an appropriate yearly performance target for the performance metric selected in part (b).
 - **5% increase is demanded in performance to reach electric fleets for remaining 50 trucks in next ten years.**



6. 1. Using the given balanced scorecard, identify the strategic objectives of the company.
 - **Acquire up-to-date technology**
2. Using the given balanced scorecard, identify the statement that explains the strategic map.
 - Acquiring up-to-date technology reduces employee turnover and production malfunction. This in turn increases the level of satisfaction of the customer and profitability.
3. Using the given balanced scorecard, identify the statement that explains the measure map.
 - **Reducing the average age of production machinery and increasing the average employee tenure can reduce the number of production malfunctions. Increased average employee tenure decreases the hours from ordered to delivered, and Reduction in hours from ordered to delivered increases the online customer survey rating and the market share.**

7. The chief executive officer (CEO) of Cobalt Inc. just read an article written by a business professor at Harvard University describing the benefits of the lean philosophy. The CEO issued the following statement after reading the article:

This company will become a lean manufacturing company. Presently, we have too much inventory. To become lean, we need to eliminate the excess inventory. Therefore, I want all employees to begin reducing inventories until we make products "just-in-time." Thank you for your cooperation.

1. Lean manufacturing is **a philosophy that focuses on reducing time, cost, poor quality and uncertainty from a process.**
2. A CEO of a company suddenly commands that the company will become lean manufacturing company due to increased inventory. Identify the statement that suits the situation.
 - **The CEO of the company has not given any action plans and the inventories created are not because of the production excess alone. It may even due to poor quality of the product.**

8. The American textile industry has moved much of its operations offshore in the pursuit of lower labor costs. Textile imports have risen from under 5% of all textile production in the early 1960s to over 95% today. Offshore manufacturers make long runs of standard mass-market apparel items. These are then brought to the United States in container ships, requiring significant time between original order and delivery. As a result, retail customers must accurately forecast market demands for imported apparel items.

A textile retailer wishes to match the trend in the market and bring in new products before the competitor introduces the same. Whom should he approach and identify the reason for your answer.

- **Domestic manufacturer** because **Domestic manufacturers can be reached quickly and make small batches of orders which will be delivered within the short time** and **Offshore manufacturers are not the trend setters and the fashion may not be same to order a large quantity at a time.**

9. Rag Swag Inc. manufactures various styles of men's casual wear. Shirts are cut and assembled by a workforce that is paid by piece rate. This means that they are paid according to the amount of work completed during a period of time. To illustrate, if the piece rate is \$0.10 per sleeve assembled, and the worker assembles 800 sleeves during the day, then the worker would be paid \$80 ($800 \times \0.10) for the day's work.

The company is considering adopting a lean manufacturing philosophy by organizing work cells around various types of products and employing pull manufacturing. However, no change is expected in the compensation policy. On this point, the manufacturing manager stated the following:

"Piecework compensation provides an incentive to work fast. Without it, the workers will just goof off and expect a full day's pay. We can't pay straight hourly wages—at least not in this industry."

A garment company was following piece rate system for its employees and suddenly lean manufacturing system was introduced. The company wishes to continue with the same piece rate system. Identify the statement that suits the given situation.

- **A piece rate system is a traditional method that is not suitable for the lean manufacturing system. Because the piece rate system increases the inventory rather than efficiency.**

10. Furry Friends Inc. manufactures toy stuffed animals. The direct labor time required to cut, sew, and stuff a toy is 10 minutes per unit. The company makes two types of stuffed toys—a lion and a bear. The lion is assembled in lot sizes of 50 units per batch, while the bear is assembled in lot sizes of 8 units per batch. Since each product has direct labor time of 10 minutes per unit, management has determined that the lead time for each product is 10 minutes.

1. Lead time includes **value-added time, wait time, and other non-value-added time.**
2. A toy manufacturing unit produces two types of products and the labor time for each product is 10 minutes. The batch size of product A is 50 units and batch size of product B is 8 units. The company considers the lead time of the products is equal to the labor hour's. Is the decision correct and supports your answer by selecting the reason.

- **No**

3. Reason:

- **Lead time of the product includes value-added time, idle time and other non-value-added time.**

11. Vernon Inc. has analyzed the setup time on its computer-controlled lathe. The setup requires changing the type of fixture that holds a part. The average setup time has been 140 minutes, consisting of the following steps:

Item	Time (minutes)
Turn off machine and remove fixture from lathe	15
Go to tool room with fixture	15
Record replacement of fixture to tool room	18
Return to lathe	20
Clean lathe	20
Return to tool room	20
Record withdrawal of new fixture from tool room	12
Return to lathe	15
Install new fixture and turn on machine	5
Total setup time	140

1. A company plans to setup a machine to increase the productivity. The average setup time is 140 minutes. Do you think the management needs to minimize the setup time. Identify the reason that supports the answer.
 - **Yes**
2. Reason:
 - **The setup time should be considered because long setup time leads to increased economic cost of the setup.**
3. A company plans to setup a machine to increase the productivity. The average setup time is 140 minutes. The company wishes to control the setup time. Identify the statement that suits the given situation.
 - **Identify the wait time and non-value-added time and eliminate that with effective planning so that the setup time can be reduced.**
4. How much time would be required for a setup, using your suggestion in (b)?
 - $15 + 20 + 5 = 40$

12. Jackson Fabricators Inc. machines metal parts for the automotive industry. Under the traditional manufacturing approach, the parts are machined through two processes: milling and finishing. Parts are produced in batch sizes of 40 parts. A part requires 6 minutes in milling and 8 minutes in finishing. The move time between the two operations for a complete batch is 5 minutes.

Under the lean philosophy, the part is produced in a cell that includes both the milling and finishing operations. The operating time is unchanged; however, the batch size is reduced to 5 parts and the move time is eliminated.

Determine the value-added, non-value-added, and total lead times, and the value-added ratio under the traditional and lean manufacturing methods. If required, round percentages to one decimal place.

-

	Traditional Philosophy	Lean Manufacturing Philosophy
Value-added time	$6 + 8 = 14$	$6 + 8 = 14$
Non-value-added time	$[14 * (40 - 1)] + 5 = 551$	$[14 * (5 - 1)] + 0 = 56$
Total lead time	$14 + [14 * (40 - 1)] + 5 = 565$	$14 + [14 * (5 - 1)] + 0 = 56$
Value-added ratio (as a percent)	$\frac{14}{565} = 2.5\%$	$\frac{14}{70} = 20\%$

13. Williams Optical Inc. is considering a new lean product cell. The present manufacturing approach produces a product in four separate steps. The production batch sizes are 45 units. The process time for each step is as follows:

Process Step 1	5 minutes
Process Step 2	8 minutes
Process Step 3	4 minutes
Process Step 4	3 minutes

The time required to move each batch between steps is 5 minutes. In addition, the time to move raw materials to Process Step 1 is also 5 minutes, and the time to move completed units from Process Step 4 to finished goods inventory is 5 minutes.

The new lean layout will allow the company to reduce the batch sizes from 45 units to 3 units. The time required to move each batch between steps and the inventory locations will be reduced to 2 minutes. The processing time in each step will stay the same.

Determine the value-added, non-value-added, and total lead times, and the value-added ratio under the present and proposed production approaches. *If required, round percentages to one decimal place.*

o

	Present Approach	Proposed Approach
Value-added time	$5 + 8 + 4 + 3 = 20$	$5 + 8 + 4 + 3 = 20$
Non-value-added time	$[20 * (45 - 1)] + 25 = 905$	$[20 * (3 - 1)] + 10 = 50$
Total lead time	$20 + [20 * (45 - 1)] + 25 = 925$	$20 + [20 * (3 - 1)] + 10 = 70$
Value-added ratio (as a percent)	$\frac{20}{925} = 2.2\%$	$\frac{20}{70} = 28.6\%$

14. The following is an excerpt from an article discussing supplier relationships with the Big Three North American automakers.

"The Big Three select suppliers on the basis of lowest price and annual price reductions," said Neil De Koker, president of the Original Equipment Suppliers Association. "They look globally for the lowest parts prices from the lowest cost countries," De Koker said. "There is little trust and respect. Collaboration is missing." Japanese automakers want longterm supplier relationships. They select suppliers as a person would a mate. The Big Three are quick to beat down prices with methods such as electronic auctions or rebidding work to a competitor. The Japanese are equally tough on price but are committed to maintaining supplier continuity. "They work with you to arrive at a competitive price, and they are willing to pay because they want long-term

partnering," said Carl Code, a vice president at **Ernie Green Industries**. "They [**Honda (HMC)** and **Toyota (TM)**] want suppliers to make enough money to stay in business, grow, and bring them innovation." The Big Three's supply chain model is not much different from the one set by Henry Ford. In 1913, he set up the system of independent supplier firms operating at arm's length on short-term contracts. One consequence of the Big Three's low-price-at-all-costs mentality is that suppliers are reluctant to offer them their cutting-edge technology out of fear the contract will be resourced before the research and development costs are recouped.

Source: Robert Sherefkin and Amy Wilson, "Suppliers Prefer Japanese Business Model," *Rubber & Plastics News*, March 17, 2003, Vol. 24, No. 11.

1. The Japanese supply chain model is one based on **long-term** arrangements and partnership. The Japanese automobile manufacturers want their suppliers to be financially healthy because they rely on them for **innovation**. The Big Three automakers, in contrast, are only concerned about getting the best **short-term price** from their suppliers. The article seems to imply that the longer-term benefits from partnership are being ignored by the **Big Three supply chain model**. As a result, they are willing to view their supplier relationships as temporary-until the next best price comes along.
2. These suppliers support the Japanese system because it provides for win-win opportunities, whereby the customer and the supplier can both be successful. The suppliers are concerned about their margins being squeezed down to the point that they will be unable to maintain financial viability and/or provide the level of supplier service that will be demanded in the long term under the conventional **Big Three supplier model**. Suppliers are also concerned about the uncertainty of temporary or short-term contracts. Such demand volatility can add risk and cost to the **Big Three's** business over time.
3. Supply chain management is **often beneficial** to the customer. However, the customer may have to trade off between short-term and longer-term benefits. For example, supply chain management provides the supplier the financial incentives to invest in process and product innovation, invest in supply chain collaboration (such as EDI, RFID, and Internet collaboration), and share best practices, such as lean manufacturing principles, across business entities. Such investments provide the customer access to new technologies, new ideas, more efficient processes, and ultimately lower costs and higher value for all parties involved in the supply chain.
15. *Quickie Designs Inc.* uses teams in the manufacture of lightweight wheelchairs. Two features of its team approach are team hiring and peer reviews. Under team hiring, the team recruits, interviews, and hires new team members from within the organization. Using peer reviews, the team evaluates each member of the team with regard to quality, knowledge, teamwork, goal performance, attendance, and safety. These reviews provide feedback to the team member for improvement.

Using these two team approaches rather than managers to hire and evaluate employees have all the following advantages *except*:

- **Employee empowerment and job satisfaction will likely decrease with a team approach because it is more time consuming.**
- 16. The management of Daddy-O's fast-food franchise wants to provide hamburgers quickly to customers. It has been using a process by which precooked hamburgers are prepared and placed under hot lamps. These hamburgers are then sold to customers. In this process, every customer receives the same type of hamburger and dressing (ketchup, onions, mustard). If a customer wants something different, then a "special order" must be cooked to the customer's requirements. This requires the customer to wait several minutes, which often slows down the service line. Daddy-O's has been receiving more and more special orders from customers, which has been slowing service down considerably.

1. The present Daddy-O's service delivery system is an example of a **push** system. Under this system, the

customer wait time would be **short** only if the customer ordered a "standard" burger from the inventory.

2. Daddy-O's should introduce a new system designed so that a custom order is introduced **after** cooking. In this way, hamburgers are made to order without the use of **finished goods** inventory.
17. Eon Technologies has recently implemented a lean manufacturing approach. A production manager has approached the controller with the following comments:

I am very upset with our accounting system now that we have implemented our new lean manufacturing methods. It seems as if all I'm doing is paperwork. Our product is moving so fast through the manufacturing process that the paperwork can hardly keep up. For example, it just doesn't make sense to me to fill out daily labor reports. The employees are assigned to complete cells, performing many different tasks. I can't keep up with direct labor reports on each individual task. I thought we were trying to eliminate waste. Yet the information requirements of the accounting system are slowing us down and adding to overall lead time. Moreover, I'm still getting my monthly variance reports. I don't think that these are necessary. I have nonfinancial performance measures that are more timely than these reports. Besides, the employees don't really understand accounting variances. How about giving some information that I can really use?

As noted by the department manager, the accounting system for a lean system should consider all the following unique characteristics **except**:

- **There are more transactions to record under the lean system.**

18. Bright Night, Inc., manufactures light bulbs. Its purchasing policy requires that the purchasing agents place each quarter's purchasing requirements out for bid. This is because the Purchasing Department is evaluated solely by its ability to get the lowest purchase prices. The lowest bidder receives the order for the next quarter (90 working days).

To make its bulb products, Bright Night requires 36,000 pounds of glass per quarter. Bright Night received two glass bids for the third quarter, as follows:

Central Glass Company: \$30.00 per pound of glass. Delivery schedule: 36,000 (400 lbs. × 90 days) pounds at the beginning of July to last for 3 months.

Ithaca Glass Company: \$30.20 per pound of glass. Delivery schedule: 400 pounds per working day (90 days in the quarter).

Bright Night accepted Central Glass Company's bid because it was the low-cost bid.

Required:

1. A manufacturing company gets quotes from each supplier and allocates the purchase order to the company which quotes the lowest price with the expected quality. Is this process effective in long run? Identify reason that supports the answer.
 - **No**
2. A manufacturing company gets quotes from each supplier and allocates the purchase order to the company which quotes the lowest price with the expected quality. Are there any additional costs that are involved in bulk purchase for the quarter? Identify reason that supports the answer.
 - **No**

Reason:

- **The cost of storage, obsolescence, material management and wastages are ignored in this concept.**

3. Considering only inventory financing costs, what is the additional cost per pound of Central Glass Company's bid if the annual cost of money is 8%? (*Hint:* Determine the average value of glass inventory held for the quarter and multiply by the quarterly interest charge, then divide by the number of pounds.) *Round to the nearest cent.*

$$\blacksquare \quad \frac{\frac{36000}{2} * 30 * 2\%}{36000} = .3$$

Homework Exercises

1. Moses Moonrocks Inc. has developed a balanced scorecard with a measure map that suggests that the number of erroneous shipments has a direct effect on operating profit. The company estimates that every shipment error leads to a reduction of revenue by \$7,050 and increased costs of about \$4,700.

Item	Value
Sales	\$231,000
Cost of goods sold	149,000
Depreciation expense	17,000
Other expenses	18,000

If the company has the above budgeted sales and costs for next month (without accounting for any possible shipping errors), determine how many shipping errors the company can afford to have and still break even.

- Break-even shipping errors: $\frac{231000 - 149000 - 17000 - 18000}{7050 + 4700} = 4$
2. Henry's Cafe is a local restaurant that is growing quickly. While the company does not yet have a balanced scorecard, Henry has mentioned that being efficient in producing meals is a high priority of his business and appears to be a significant driver of profits. Henry tells you he gathers the following data: sales, cost of labor, employee turnover, labor hours, cost of ingredients, overhead costs, average training hours per employee, number of erroneous meals prepared, the time when orders were made (e.g., at 12:43 pm), the time when orders were delivered, and number of customers per day.
1. Under which performance perspective on the balanced scorecard should Henry's strategic objective to efficiently produce meals be placed?
 - **Internal processes**
 2. Identify the performance metrics that the owner should concentrate on to measure the strategic objective of producing efficient meals.
 - **minutes from ordered to delivered, labor hours per meal, number of erroneous meals prepared per hour, and cost of ingredients per meal and the number of meals per hour.**
 3. Identify whether the performance metrics you suggested in part (b) are leading or lagging indicators relative to a performance metric "total cost of production per meal."
 -

Performance Metric	Type of Indicator
Minutes from ordered to delivered	Leading
Labor hours per meal	Leading
Number of erroneous meals prepared per hour	Leading
Cost of ingredients per meal	Leading
Number of meals produced per hour	Leading

3. Gary's Gumbo is a locally owned restaurant in Houston, Texas, with eight locations. The owner recently developed a new recipe for the restaurant's signature gumbo dish. The owner decided to try out the dish in four of the company's locations. After one month, the owner had gathered the following data:

	Locations	with New	Gumbo	Recipe		Locations	with Old	Gumbo	Recipe
Location #	1	2	3	4		5	6	7	8
Number of orders	1,253	1,386	1,495	1,377		1,112	1,025	1,224	997
Number of customer complaints (about the dish)	34	36	44	32		12	9	6	8

After looking over the data, the owner happily noted that the number of orders of the signature gumbo dish at the locations where the new recipe had been used (locations 1–4) had increased in comparison to the traditional number of orders of the dish (locations 5–8). The owner then decided to implement the new recipe at the rest of the company's locations.

- Identify whether the decision of introducing the new gumbo recipe in all locations is correct.
 - The number of orders increased along with complaints so the decision of the company should be reconsidered.**
- Identify the cognitive bias in this situation.
 - The owner of the company accepted the positive feedback and ignored the negative feedback.
- Lonnie's Shipping Co. is considering switching to an all-electric fleet to minimize emissions. Lonnie wants to gradually implement this change over the next 10 years. The company currently has a fleet of 100 trucks, half of which are electric-powered. Upon consulting with Lonnie, you have determined that an appropriate course of action is to include this CSR activity as a strategic objective in the company's current balanced scorecard.
 - Under which category of performance perspective can the CSR strategic objective of the company be included?
 - Internal process based performance perspective**
 - Identify a performance metric for the CSR strategic objective.
 - The number of electric-powered trucks in the fleet.**
 - Identify an appropriate yearly performance target for the performance metric selected in part (b).
 - 5% increase is demanded in performance to reach electric fleets for remaining 50 trucks in next ten years.**
- American Express Company is a major financial services company noted for its American Express® card. Some of the performance measures used by the company on its balanced scorecard are listed below.

For each measure, identify whether the measure best fits the learning and growth, internal processes, customer, or financial performance perspective of the balanced scorecard.

- o

Performance Metric	Performance Perspective
Average card member spending	Customer
Number of Internet features	Internal processes
Cards in force	Internal processes
Number of merchant signings	Customer
Earnings growth	Financial
Number of new card launches	Learning and growth
Hours of credit consultant training	Learning and growth
Return on equity	Financial
Investment in information technology	Learning and growth
Revenue growth	Financial
Number of card choices	Learning and growth

6. Buffalo BBQ Restaurant is trying to become more efficient in training its chefs. It is experimenting with two training programs aimed at this objective. Both programs have basic and advanced training modules. The restaurant has provided the following data regarding the two programs after two weeks of implementation:

	Training Program A						Training Program B				
New chef #	1	2	3	4	5	6		7	8	9	10
Hours of basic training	23	23	30	19	21	26		24	30	29	25
Hours of advanced training	10	8	9	12	13	5		4	0	2	4
Number of chef mistakes	10	15	15	15	16	6		4	10	4	4

1. Compute the following performance metrics for each program:

- Program A: $\frac{23+23+30+19+21+10+8+9+12+13}{5} = 33.6$
- Program B: $\frac{26+24+30+29+25+5+4+0+2+4}{5} = 29.8$

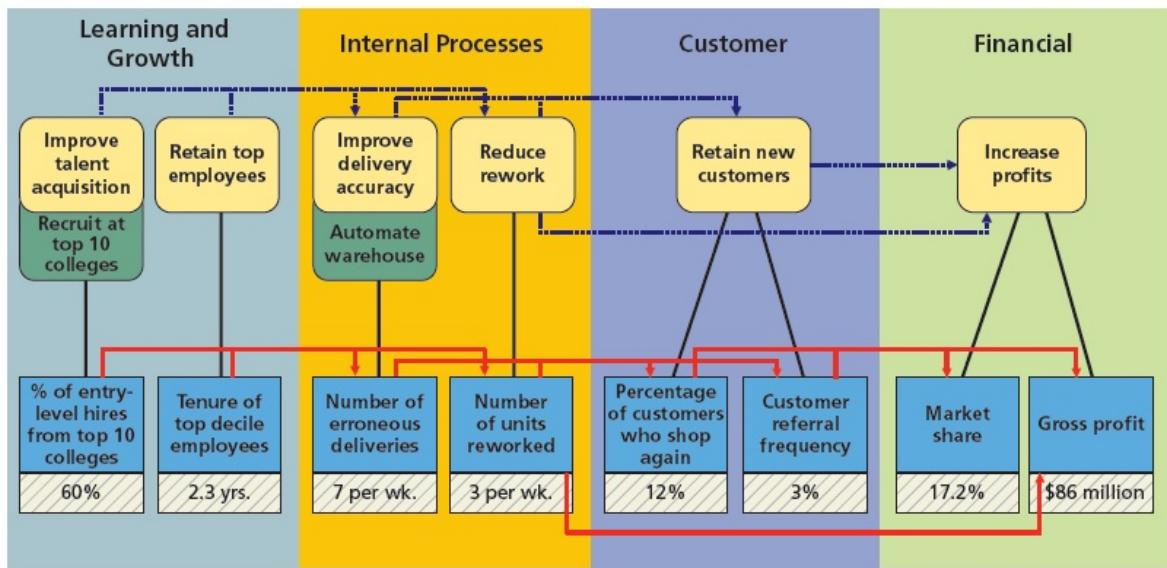
Average number of mistakes per chef, rounded to one decimal place.

- Program A: $\frac{10+15+15+15+16}{5} = 14.2$
- Program B: $\frac{6+4+10+4+4}{5} = 5.6$

2. Which program should the restaurant implement moving forward?

- **Program B**

7. The following is the balanced scorecard for Smith Company:



1. Using the given balanced scorecard, identify the strategic initiatives of the company.

- **Automated warehousing facility**

Using the given balanced scorecard, identify the performance perspectives of the company.

- **Learning and growth perspective, customer and internal processes, and financial perspectives.**

2. From the given balanced scorecard, identify the overall strategic objective of the company.

- **To increase the profitability of the business**

8. Coulson and Company is a large retail business that has a firm-wide balanced scorecard. Recently, management has discussed the need for the balanced scorecard to be more relevant to each individual department of the company. Specifically, management wants to come up with unique scorecards for its Public Relations and Inventory Management departments. For both departments, management recognizes that properly and efficiently training employees is important. For these purposes, management gathers data on the median training hours per employee and new employee performance review ratings. For the Inventory Management Department, management is focused on reducing stockouts (running out of certain inventory items) and keeping accurate inventory counts. For these purposes, the company tracks the number of back orders and discrepancies between the physical and record counts of inventory, respectively. For the Public Relations Department, management is focused on improving the public's CSR image of the company and attracting new customers. Management measures these objectives using Forbes CSR Rating of Coulson and Company and the number of new customers, respectively.

1. Identify a name that suits the scorecard of the public relation and inventory management departments.

- **Cascading scorecard**

2. Identify the common metrics for both the departments in the new unique scorecards.

- **Employee training hours and employee performance**

Identify the unique metrics of inventory management department.

- **Number of back orders and discrepancies in physical and record counts**

Identify the unique metrics for the public relations department.

▪ CSR ratings for Forbes and number of new customers

9. Silver Lining Inc. has a balanced scorecard with a strategy map that shows that delivery time and the number of erroneous shipments are expected to affect the company's ability to satisfy the customer. Further, the strategy map for the balanced scorecard shows that the hours from ordered to delivered affects the percentage of customers who shop again, and the number of erroneous shipments affects the online customer satisfaction rating. The following information is also available:

The company's target hours from ordered to delivered is 20.

Every hour over the ordered-to-delivered target results in a 0.5% decrease in the percentage of customers who shop again.

The company's target number of erroneous shipments per year is no more than 65.

Every error over the erroneous shipments target results in a 0.05 point decrease in the online customer satisfaction rating and an added future financial loss of \$600.

The company estimates that for every 1% decrease in the percentage of customers who shop again, future profit decreases by \$5,000 and market share decreases by 0.3%.

The company also estimates that for every 1 point decrease in the overall online customer satisfaction rating (on a scale of 1 to 10), future profit decreases by \$4,000 and market share decreases by 0.6%.

Using these estimates, determine how much future profit and future market share will change if:

Average hours from ordered to shipped is 27.5.

Average shipping time (hours from shipped to delivered) is 14.3.

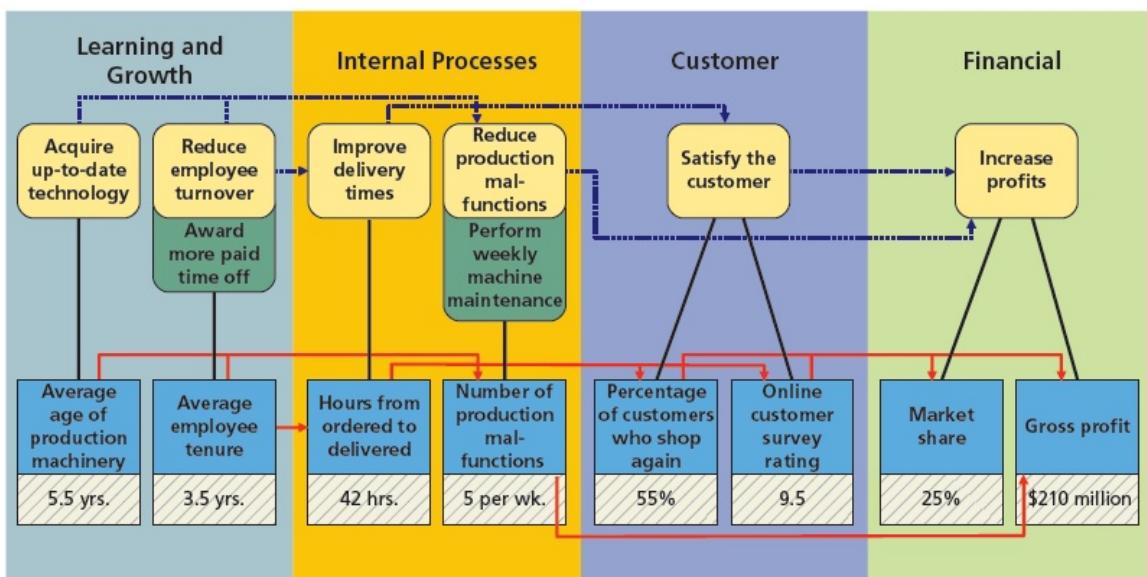
Number of erroneous shipments is 90.

- Total decrease in future profit:

$$([(27.5 + 14.3) - 20] * .1\%) * 5000 + [(90 - 65) * 600] + [(90 - 65) * .05 * 4000] = 25450$$

Total decrease in future market share:

$$([(27.5 + 14.3) - 20] * .1\% * .3\%) + [(90 - 65) * .05 * .6\%] = 1.08\%$$



10. 1. Using the given balanced scorecard, identify the strategic objectives of the company.

- Acquire up-to-date technology

Using the given balanced scorecard, identify the performance metrics of the company.

- **Number of production malfunctions, online customer survey rating, and average employee tenure.**

2. Using the given balanced scorecard, identify the statement that explains the strategic map.
 - **Acquiring up-to-date technology reduces employee turnover and production malfunction. This in turn increases the level of satisfaction of the customer and profitability.**
3. Using the given balanced scorecard, identify the statement that explains the measure map.
 - **Reducing the average age of production machinery and increasing the average employee tenure can reduce the number of production malfunctions, Increased average employee tenure decreases the hours from ordered to delivered, and Reduction in hours from ordered to delivered increases the online customer survey rating and the market share.**

11. Evaluating employee performance and making strategic decisions are two examples of how managerial accounting information is used.
 - **True**
12. Performance measurement systems are used to assess how well a company is performing toward meeting its own goals and objectives.
 - **True**
13. It is important to gather as many accounting metrics as possible because they have intrinsic value and do not need a context in which to be understood.
 - **False**
14. Material price variances are examples of metrics used for measuring a purchasing department's performance.
 - **False**
15. The balanced scorecard is a marginally effective strategic performance management system.
 - **False**
16. Cassie works at LoftCo, Inc., studying effective ways to retain the company's current customers. The performance measures she gathers include determining the number of customer returns each week. Cassie is focused on the internal processes perspective of the balanced scorecard performance management system.
 - **False**
17. Performance targets may be linked to employee incentives such as bonuses and additional days off.
 - **True**
18. The budgeted income statement and balance sheet are the most important components of a company's strategy map.
 - **False**
19. In the strategic learning process, Carli is trying to understand why the increase in the customer satisfaction rating at her company did not generate the expected increase in sales for the last quarter. It would be logical for her simply to conclude that customer satisfaction has nothing to do with increased sales.
 - **False**
20. Certain corporate social responsibility efforts, such as protecting the environment for future generations, are also referred to as sustainability efforts.
 - **True**

21. Waterfield Company is looking for a way to help its executive managers assess how the three divisions within the company are meeting the company's overall goals and objectives. The company is looking for a(n)
- **performance measurement system**
22. Waterfield Company has three decentralized segments. Executive managers are looking for a way to measure the performance of each segment. Which of the following metrics might be used for this purpose?
- **the residual income of each segment**
23. Which of the following is *not* one of the elements of the balanced scorecard?
- **strategic plan**
24. Juana and Carl are implementing a balanced scorecard for their company, DoltRight Manufacturing. They are considering various performance metrics for assessing progress toward strategic objectives. Which of the following would be a good choice of performance metric for the strategic objective listed?
- **The strategic objective of delighting the customer is measured by the number of repeat customers.**
25. Strategic learning results **not only by verifying strategic objective expectations but also by adjusting them when expected relationships are not supported by statistical analysis.**
26. Omega Energy Incorporated serves rural communities across the northeast with gas and home heating fuel. All of the following initiatives may be considered a part of the company's CSR efforts **except building a new corporate headquarters in order to downsize several regional offices and reduce overhead costs.**
27. Beaver Valley Oil Refinery produces various grades of petroleum products at its refinery operations. All of the following may be considered an initiative undertaken as a part of the company's CSR efforts **except providing training to the accounting staff so they better understand FASB requirements for applying accounting standards for financial reporting.**
28. Silver Lining Inc. has a balanced scorecard with a strategy map that shows that delivery time and the number of erroneous shipments are expected to affect the company's ability to satisfy the customer. Further, the strategy map for the balanced scorecard shows that the hours from ordered to delivered affects the percentage of customers who shop again, and the number of erroneous shipments affects the online customer satisfaction rating. The following information is also available:

The company's target hours from ordered to delivered is 30.

Every hour over the ordered-to-delivered target results in a 0.5% decrease in the percentage of customers who shop again.

The company's target number of erroneous shipments per year is no more than 55.

Every error over the erroneous shipments target results in a 0.05 point decrease in the online customer satisfaction rating and an added future financial loss of \$700.

The company estimates that for every 1% decrease in the percentage of customers who shop again, future profit decreases by \$6,000 and market share decreases by 0.3%.

The company also estimates that for every 1 point decrease in the overall online customer satisfaction rating (on a scale of 1 to 10), future profit decreases by \$4,000 and market share decreases by 0.6%.

Using these estimates, determine how much future profit and future market share will change if:

Average hours from ordered to shipped is 28.5.

Average shipping time (hours from shipped to delivered) is 14.3.

Number of erroneous shipments is 90.

$$\begin{aligned}
 & 28.5 + 14.3 = 42.8 && (3) \\
 & 42.8 - 30 = 12.8 \\
 & 12.8 * .5 = 6.4 = .64 \\
 & \quad 90 - 55 = 35 \\
 & \quad 35 * .05 = 1.75 \\
 & \circ \quad 35 * 700 = 24500 \\
 & \quad .64 * 6000 = 3840 \\
 & \quad .64 * .3 = .19 \\
 & \quad 1.75 * 4000 = 7000 \\
 & \quad 1.75 * .6 = 1.05
 \end{aligned}$$

Total decrease in future profit: $24500 + 3840 + 7000 = 35340$

Total decrease in future market share: $.19 + 1.05 = 1.24$

Quiz

1. James, an accountant at Forta Company, is preparing a report showing the production shift data for the previous day's production. This report will be shared with the production manager, Julia. This is an example of the role of managerial accounting at work.
 - **True**
2. Juana and Carl are reviewing their company's balanced scorecard strategic objectives when they discover a problem. Which of the following is *not* a correct matching of a strategic objective to its performance perspective in their company's BSC?
 - **The strategic objective in the financial perspective is to reduce shipping errors.**
3. AnaCarolina and Jaco work at Duke Manufacturing, and they are tasked with determining appropriate performance metrics for the internal processes perspective of Duke's balanced scorecard. Which of the following is the best metric for this situation?
 - **defective units produced**
4. Which of the following statements regarding CSR and sustainability reporting is true?
 - **The triple bottom line approach includes financial, social, and environmental performance components, Many corporations use a triple bottom line approach to sustainability reporting, and The Global Reporting Initiative is an international organization that develops the use of sustainability reporting standards.**
5. Nonfinancial performance measures in the balanced scorecard such as customer satisfaction are often **leading indicators** of future financial performance.
6. Waterfield Company has three decentralized segments. Executive managers are looking for a way to measure the performance of each segment. Which of the following metrics might be used for this purpose?
 - **the return on investment of each segment**
7. Performance targets **provide goals for employees**.
8. The tendency for managers to behave like the performance metrics are the strategic objectives is known as **surrogation**.
9. Ken and Laura are working toward implementing a balanced scorecard for their company. They ask their production and warehouse teams to provide several options regarding strategic initiatives for the internal processes perspective of the balanced scorecard. Which of the following suggestions made by the employees would be a good choice of a strategic initiative for this purpose?

- **automate the warehouse**
10. Motivated reasoning, surrogation, and common measures bias are three terms describing **cognitive or psychological biases that may impact decision making with the balanced scorecard**.
 11. Carolina, the accountant for Duke Manufacturing, tells Jacob, who works in customer service for Duke, that their company's customer satisfaction rating predicts sales revenue in dollars. Carolina's comment indicates that the customer satisfaction rating is a **leading indicator**.
 12. A company's balanced scorecard may include **both leading and lagging indicators**.
 13. Metrics that are later in the value chain are normally considered to be **lagging** indicators.
 14. Waterfield Company is looking for a way to help its executive managers assess how the three divisions within the company are meeting the company's overall goals and objectives. The company is looking for a **performance measurement system**.
 15. Alexander and Kristin are executive managers at Safety First Fall Safety Equipment Co. They decide to discontinue gathering data and calculating performance metrics within their organization because the company's balanced scorecard performance metrics have produced several quarters in a row of good news. They assume the positive results will continue. Alexander and Kristin have made this decision as a result of a cognitive bias known as **motivated reasoning**.
 16. Which of the following suggested that management efforts not directly related to increasing profits are similar to "stealing" from a company's shareholders?
 - **Milton Friedman**
 17. To minimize common measures bias when developing divisional balanced scorecards for unique divisions within a corporation, **one division may focus more heavily on a subset of the four perspectives, for example on learning and growth and internal processes, while other divisions focus on different perspectives, such as customer and financial**.
 18. A measure map is an important aspect of the balanced scorecard performance measurement system. Which of the following describes the role of the measure map?
 - **The measure map shows the expected relationships among the performance metrics chosen by the organization.**
 19. Which of the following is an example of a strategic performance measurement system?
 - **balanced scorecard**
 20. Omega Energy Incorporated serves rural communities across the northeast with gas and home heating fuel. All of the following initiatives may be considered a part of the company's CSR efforts **except building a new corporate headquarters in order to downsize several regional offices and reduce overhead costs**.

Chapters 25-28 Exam

Review

Average Rate of Return—New Product

1. Hana Inc. is considering an investment in new equipment that will be used to manufacture a smartphone. The phone is expected to generate additional annual sales of 7,200 units at \$172 per unit. The equipment has a cost of \$602,600, residual value of \$45,400, and an 8-year life. The equipment can only be used to manufacture the phone. The cost to manufacture the phone follows:

Cost per unit:			
	Direct labor	\$28.00	
	Direct materials	109.00	
	Factory overhead (including depreciation)	19.25	
		Total cost per unit	\$156.25

Determine the average rate of return on the equipment. If required, round to the nearest whole percent.

- o
$$\frac{\frac{(172*7200) - (156.25*7200)}{602600 + 45400}}{2} = 35\%$$

Cash Payback Period for a Service Company

2. Jane's Clothing Inc. is evaluating two capital investment proposals for a retail outlet, each requiring an investment of \$175,000 and each with an eight-year life and expected total net cash flows of \$280,000. Location 1 is expected to provide equal annual net cash flows of \$35,000, and Location 2 is expected to have the following unequal annual net cash flows:

Year	Value
Year 1	\$79,000
Year 2	60,000
Year 3	36,000
Year 4	34,000
Year 5	25,000
Year 6	19,000
Year 7	15,000
Year 8	12,000

Determine the cash payback period for both location proposals.

- o Location 1: $\frac{175000}{35000} = 5$
- Location 2: 3

Compute Lead Time

3. Jackson Fabricators Inc. machines metal parts for the automotive industry. Under the traditional manufacturing approach, the parts are machined through two processes: milling and finishing. Parts are produced in batch sizes of 65 parts. A part requires 4 minutes in milling and 7 minutes in finishing. The move time between the two operations for a complete batch is 8 minutes.

Under the lean philosophy, the part is produced in a cell that includes both the milling and finishing operations. The operating time is unchanged; however, the batch size is reduced to 3 parts and the move time is eliminated.

Determine the value-added, non-value-added, and total lead times, and the value-added ratio under the traditional and lean manufacturing methods. If required, round percentages to one decimal place.

-

	Traditional Philosophy	Lean Manufacturing Philosophy
Value-added time	$4 + 7 = 11$	$4 + 7 = 11$
Non-value-added time	$[11 * (65 - 1)] + 8 = 712$	$[11 * (3 - 1)] + 0 = 22$
Total lead time	$11 + 712 = 723$	$11 + 22 = 33$
Value-added ratio (as a percent)	$\frac{11}{723} = 1.5\%$	$\frac{11}{33} = 33.3$

Decision on Accepting Additional Business

4. Homestead Jeans Co. has an annual plant capacity of 65,000 units, and current production is 45,000 units. Monthly fixed costs are \$54,000, and variable costs are \$29 per unit. The present selling price is \$42 per unit. On November 12 of the current year, the company received an offer from Dawkins Company for 18,000 units of the product at \$32 each. Dawkins Company will market the units in a foreign country under its own brand name. The additional business is not expected to affect the domestic selling price or quantity of sales of Homestead Jeans Co.
 1. Prepare a differential analysis dated November 12 on whether to reject (Alternative 1) or accept (Alternative 2) the Dawkins order. If an amount is zero, enter "0". If required, use a minus sign to indicate a loss.

Differential Analysis Reject Order (Alt. 1) or Accept Order (Alt. 2) November 12			
	Reject Order (Alternative 1)	Accept Order (Alternative 2)	Differential Effects (Alternative 2)
Revenues	\$0	$18000 * 32 = 576000$	\$576000
Costs:			
Variable manufacturing costs	0	$18000 * 29 = -522000$	-522000
Profit (Loss)	\$0	$576000 - 522000 = 54000$	\$54000

2. Having unused capacity available is **relevant** to this decision. The differential revenue is **more** than the differential cost. Thus, accepting this additional business will result in a net **profit**.

3. What is the minimum price per unit that would produce a positive contribution margin? Round your answer to two decimal places.

- 29.01

Any selling price above \$29 (variable costs per unit) will produce a positive contribution margin.

Differential Analysis for a Lease or Sell Decision

5. Burlington Construction Company is considering selling excess machinery with a book value of \$281,300 (original cost of \$400,600 less accumulated depreciation of \$119,300) for \$277,100, less a 5% brokerage commission. Alternatively, the machinery can be leased for a total of \$286,800 for five years, after which it is expected to have no residual value. During the period of the lease, Burlington Construction Company's costs of repairs, insurance, and property tax expenses are expected to be \$26,300.

1. Prepare a differential analysis dated January 15 to determine whether Burlington Construction Company should lease (Alternative 1) or sell (Alternative 2) the machinery. If required, use a minus sign to indicate a loss.

Differential Analysis Lease (Alt. 1) or Sell (Alt. 2) Machinery January 15			
	Lease Machinery (Alternative 1)	Sell Machinery (Alternative 2)	Differential Effects (Alternative 2)
Revenues	286,800	277,100	$277100 - 286800 = -9,700$
Costs	-26,300	-13,855	$-13855 - -26300 = 12,445$
Profit (Loss)	$286800 - 26300 = 260,500$	$277100 - 13855 = 263,245$	$-9700 + 12445 = 2745$

2. On the basis of the data presented, would it be advisable to lease or sell the machinery?

- **Sell the machinery**

Lean Accounting

6. Com-Tel Inc. manufactures and assembles two models of smartphones—the Tiger Model and the Lion Model. The process consists of a lean cell for each product. The data that follow concern only the Lion Model lean cell.

For the year, Com-Tel Inc. budgeted these costs for the Lion Model production cell:

Conversion Cost Categories	Budget
Labor	\$228,100
Supplies	86,400
Utilities	31,100
Total	\$345000

Com-Tel plans 3,600 hours of production for the Lion Model cell for the year. The materials cost is \$82 per unit. Each assembly requires 18 minutes of cell assembly time. There was no May 1 inventory for either Raw and In Process Inventory or Finished Goods Inventory.

The following summary events took place in the Lion Model cell during May:

Electronic parts were purchased to produce 12,250 Lion Model assemblies in May.

Conversion costs were applied for 11,650 units of production in May.

11,420 units were completed and transferred to finished goods in May.

11,080 units were shipped to customers at a price of \$384 per unit.

If required, round your answers to the nearest cent.

- Determine the budgeted cell conversion cost per hour.

- $\frac{345600}{3600} = 96.00$

- Determine the budgeted cell conversion cost per unit.

- $96 * \frac{18}{60} = 28.80$

- Journalize the summary transactions (a) through (d). If an amount box does not require an entry, leave it blank.

■

Part	Type		
a.	Raw and In Process Inventory	$12250 * 82 = 1,004,500$	
	Accounts Payable		1,004,500
b.	Raw and In Process Inventory	$11650 * 28.80 = 335,520$	
	Conversion Costs		335,520
3.	Finished Goods Inventory	$11420 * (82 + 28.80) = 1,265,336$	
	Raw and In Process Inventory		1,265,336
4. Sale	Accounts Receivable	$11080 * 384 = 4,254,720$	
	Sales		4,254,720
4. Cost	Cost of Goods Sold	$11080 * (82 + 28.80) = 1,227,664$	
	Finished Goods Inventory		1,227,664

- Determine the ending balance in Raw and In Process Inventory and Finished Goods Inventory.

- Raw and In Process Inventory: $1004500 + 335520 - 1265336 = 74684$

- Finished Goods Inventory: $1265336 - 1227664 = 37672$

5. Lean accounting is different from traditional accounting because it is more **simplified** and uses **minimal** control. As a result, the number of transactions are **reduced**. In many lean operations, purchased materials are charged to a "**raw and in process inventory**" account. Direct labor is **included as a conversion cost of the cell**. Often, nonfinancial performance measures, such as **lead time or quality measures**, are used to monitor performance.

Make-or-Buy Decision for a Service Company

7. The Theater Arts Guild of Dallas (TAG-D) employs five people in its Publication Department. These people lay out pages for pamphlets, brochures, magazines, and other publications for the TAG-D productions. The pages are delivered to an outside company for printing. The company is considering an outside publication service for the layout work. The outside service is quoting a price of \$13 per layout page. The budget for the Publication Department for the current year is as follows:

Item	Value
Salaries	\$224,000
Benefits	36,000
Supplies	21,000
Office expenses	39,000
Office depreciation	28,000
Computer depreciation	24,000
Total	\$372,000

The department expects to lay out 24,000 pages for the current year. The Publication Department office space and equipment would be used for future administrative needs, if the department's function were purchased from the outside.

1. Prepare a differential analysis dated February 22 to determine whether TAG-D should lay out pages internally (Alternative 1) or purchase layout services from the outside (Alternative 2). If an amount is zero, enter "0".

▪

Differential Analysis Lay Out Pages Internally (Alt. 1) or Purchase Layout Services (Alt. 2) February 22			
	Lay Out Pages Internally (Alternative 1)	Purchase Layout Services (Alternative 2)	Differential Effects (Alternative 2)
Costs:			
Purchase price of layout work	0	$24000 * 13 = 312000$	312000
Salaries	224000	0	$0 - 224000 = -224000$
Benefits	36000	0	$0 - 36000 = -36000$
Supplies	21000	0	$0 - 21000 = -21000$
Office expenses	39000	0	$0 - 39000 = -39000$
Office depreciation		0	0
Computer depreciation		0	0
Total costs	$224000 + 36000 + 21000 + 39000 = 320000$	312000	$312000 - 320000 = -8000$

2. The benefit from using an outside service is shown to be **greater** than performing the layout work internally. The fixed costs (depreciation expenses) in the budget are **irrelevant** to the decision. Thus, the work should **be** purchased from the outside on a strictly financial basis.
3. Before electing to **lay off** the five employees, the TAG-D should consider the **long-run impact** of the decision.

Net Present Value Method, Internal Rate of Return Method, and Analysis for a Service Company

8. The management of Advanced Alternative Power Inc. is considering two capital investment projects. The estimated net cash flows from each project are as follows:

Year	Wind Turbines	Biofuel Equipment
1	\$280,000	\$590,000
2	280,000	590,000
3	280,000	590,000
4	280,000	590,000

The wind turbines require an investment of \$724,920, while the biofuel equipment requires an investment of \$1,684,450. No residual value is expected from either project.

Present Value of an Annuity of \$1 at Compound Interest					
Year	6%	10%	12%	15%	20%
1	0.943	0.909	0.893	0.870	0.833
2	1.833	1.736	1.690	1.626	1.528
3	2.673	2.487	2.402	2.283	2.106
4	3.465	3.170	3.037	2.855	2.589
5	4.212	3.791	3.605	3.353	2.991
6	4.917	4.355	4.111	3.785	3.326
7	5.582	4.868	4.564	4.160	3.605
8	6.210	5.335	4.968	4.487	3.837
9	6.802	5.759	5.328	4.772	4.031
10	7.360	6.145	5.650	5.019	4.192

1.

- Compute the net present value for each project. Use a rate of 10% and the present value of an annuity of \$1 in the table above. If required, use the minus sign to indicate a negative net present value. If required, round to the nearest whole dollar.

	Wind Turbines	Biofuel Equipment
Present value of annual net cash flows	$280000 * 3.170 = 887,600$	$590000 * 3.170 = 1,870,300$
Less amount to be invested	724,920	1,684,450
Net present value	$887600 - 724920 = 162,680$	$1870300 - 1684450 = 185,850$

- Compute a present value index for each project. If required, round your answers to two decimal places.

	Present Value Index
Wind Turbines	$\frac{887600}{724920} = 1.22$
Biofuel Equipment	$\frac{1870300}{1684450} = 1.11$

2. Determine the internal rate of return for each project by (a) computing a present value factor for an annuity of \$1 and (b) using the present value of an annuity of \$1 in the table above. If required, round your present value factor answers to three decimal places and internal rate of return to the nearest whole percent.

	Wind Turbines	Biofuel Equipment
Present value factor for an annuity of \$1	$\frac{724920}{280000} = 2.589$	$\frac{1684450}{590000} = 2.855$
Internal rate of return	20	15

3. The net present value, present value index, and internal rate of return all indicate that the **wind turbines** is/are a better financial opportunity compared to the **biofuel equipment**, although both investments meet the minimum return criterion of 10%.

Performance metrics

9. Apples & Oranges Inc. is trying to become more efficient in shipping goods. It is experimenting with two new shipping procedure initiatives aimed at achieving this strategic objective. The company has provided the following data regarding the two procedures after one month of implementation:

	Shipping Procedure A	Shipping Procedure B
Number of shipping errors	133	132
Hours from ordered to shipped	15.3	19.2
Shipping time (hours from shipped to delivered)	6.7	9.5
Pounds of goods shipped	1,330,000	660,000
Number of shipments	350	300

1. Compute the following performance metrics for each program:

1. Average number of shipping errors per shipment, *rounded to two decimal places*.

- Procedure A: $\frac{133}{350} = .38$

- Procedure B: $\frac{132}{300} = .44$

2. Hours from ordered to delivered, *rounded to one decimal place*.

- Procedure A: $15.3 + 6.7 = 22.0$

- Procedure B: $19.2 + 9.5 = 28.7$

3. Average pounds of goods per shipment.

- Procedure A: $\frac{1330000}{350} = 3800$

- Procedure B: $\frac{660000}{300} = 2200$

2. Which program should the company implement moving forward?

- **Procedure A**

Exam
