# 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?

   ◦ **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 | $\frac{18}{2} = 9$ | $\frac{11}{1.5} = 7.33$ | $\frac{3}{.25} = 12$ |

   ◦ **Cookies**

11. Under the product cost method, which costs are included in the cost amount per unit?

   ◦ **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 |

- $$12 = \frac{x - 12}{2} \tag{1}$$
$$24 = x - 12$$
$$x = 24 + 12$$
$$x = 36$$

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 |

- $$11 = \frac{x - 12}{3} \tag{2}$$
$$33 = x - 12$$
$$x = 33 + 12$$
$$x = 45$$

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

1. 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.

1. Prepare a differential analysis on August 7 as to whether Plymouth Company should lease (Alternative 1) or sell (Alternative 2) the equipment

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| Differential Analysis Lease Equipment (Alt. 1) or Sell Equipment (Alt. 2) August 7 | Lease Equipment (Alternative 1) | Sell Eqipment (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.

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| 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".

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| 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 | $0 - -300000 = 3000000$ |
| 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.

   - $82 - 60 = 22$ -> **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.

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| 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.

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| 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<br>Make Bottles (Alt 1) or Buy Bottles (Alt 2)<br>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<br>Sell Product J19 (Alt. 1) or Process Further into Product R33 (Alt. 2)<br>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 $\frac{700000*25\%}{38700+7500+[(4.6+1.88+1.13+4.5)*60000]} = 22.6\%$

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 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

   - 

|  | 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 | ÷5 | ÷7 | ÷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

- 
| 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?

- 
| 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
   $$\frac{775000}{45000} + \left(\frac{(12\%*800000)+[(.9*45000)+45000]}{(5.5*45000)+(7.65*45000)+[(2.25*45000)+82000]} * 17.22\right) = 21.25$$

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

- 

| 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

-

| 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

1. Which of the following capital investment evaluation methods use present values?
   - **Net present value method**
2. A common characteristic found in capital investment evaluation methods that use present values is **an interest rate**.
3. 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%**.

4. 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**.

5. 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.**

6. The present value index is computed as **total present value of net cash flow divided by amount to be invested**.

7. **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.

8. 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 (× 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 (× 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 |

   ◦ **$(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.

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

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.

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

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

# 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.*

   - $\dfrac{374000}{42500} = 8.8$

# 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.

- Location 1: $\dfrac{975000}{150000} =$ **6.5 years**

  Location 2: $275000 + 225000 + 180000 + 175000 + 120000 =$ **5 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 | | | | | |
|---|---|---|---|---|---|
| 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.

- $\frac{463565}{115000} = 4.031$ –> *cross check with table* –> **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 | | | | | |
|---|---|---|---|---|---|
| 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 | | | | | |
|---|---|---|---|---|---|
| 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 (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.
   - $(50000 * 4.968) + (8000 * .404) - 125000 = 126632$

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 | | | | | |
|--------------------------------------------------------|---|---|---|---|---|
| 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 |

*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

1. 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**

2. 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**

3. The excess of the cash flowing in from revenues over the cash flowing out for expenses is termed net discounted cash flow.

   ◦ **False**

4. 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.

    - $\dfrac{\frac{264000}{5}}{\frac{459400+68600}{2}} = 20\%$

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.

    - Project A: $\dfrac{\frac{8400}{4}}{\frac{84000}{2}} = 5\%$

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

## 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.*

    - $\dfrac{146300}{38500} =$ **3.8 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 | | | | | |
| --- | --- | --- | --- | --- | --- |
| 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.

- $\frac{379080}{90000} = 4.212 \sim$ **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 | | | | | |
|---|---|---|---|---|---|
| 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.*
   - $\frac{20790}{6000} = 3.465$
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 | | | | | |
|---|---|---|---|---|---|
| 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 (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*: $(12500 * 1.69) - 37500 = -16375$
2. 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 | | | | | |
|---|---|---|---|---|---|
| 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 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 | | | | | |
|---|---|---|---|---|---|
| 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 |

*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 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?

   - **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.

   - **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.

   - **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

- 

| 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

    - $\frac{109332}{36000} = 3.037$ **...check problem for interest at rate of return –>** $12\%$

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?

○

| | 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?

   ○ **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?

   ○ **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 | $2000 * 48 = 96000$ | |
| | Acconuts Payable | | 96000 |
| 2 | Raw and In Process Inventory | $[\frac{50000}{800} * \frac{24}{60}] * 1800 = 45000$ | |
| | 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**
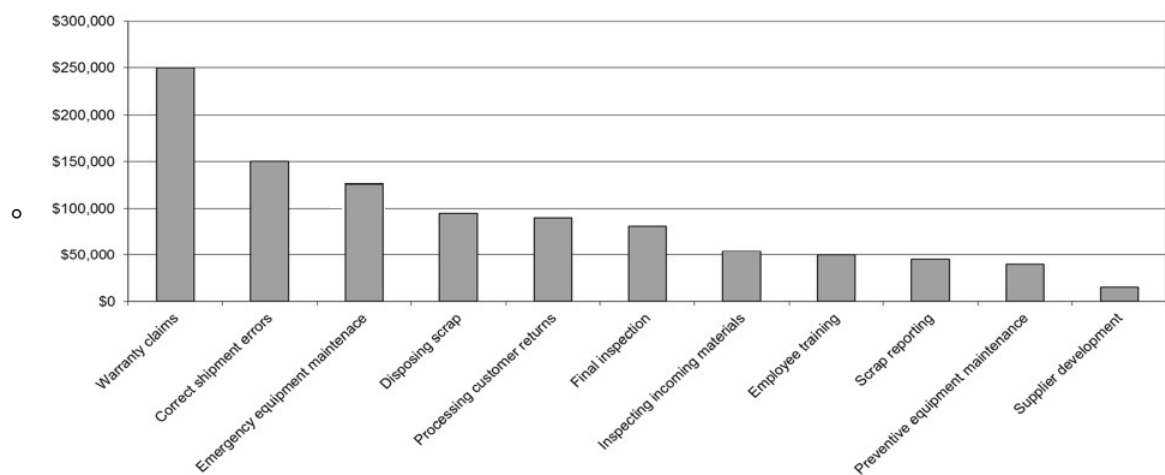
## Process Activity Analysis

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: $\frac{5000*2.64}{40000} = .33$

# 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 | $[\frac{84240}{180} * \frac{10}{60}] * 425 = 33150$ | |
| | 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?

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

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.

- $50000 + 23000 = 73000$

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.

- ○

| 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.**
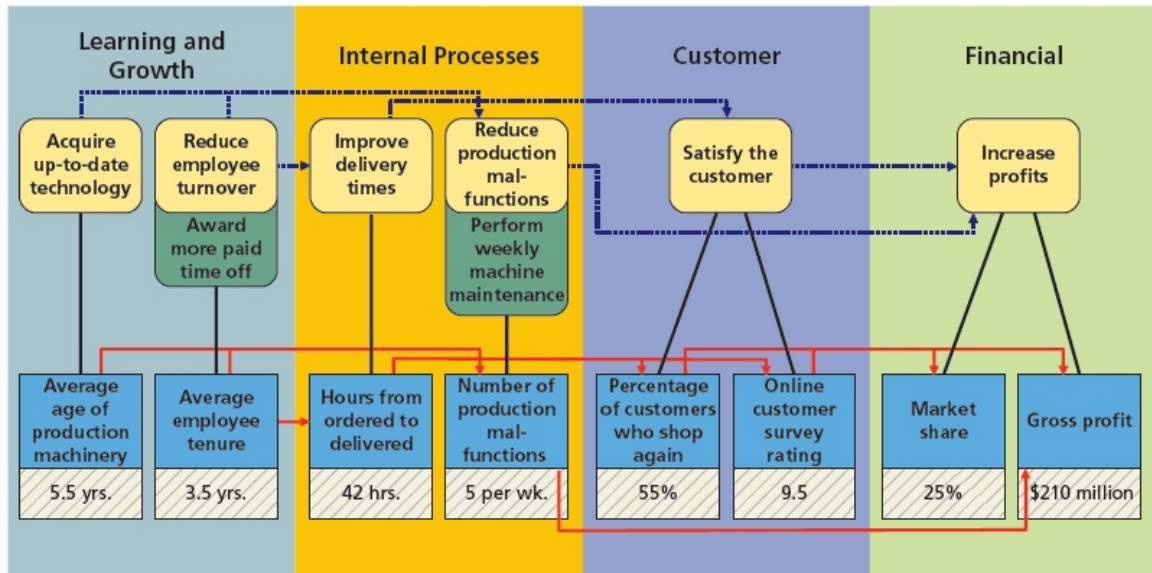
6.  1. Using the given balanced scorecard, identify the strategic objectives of the company.

    - **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 × $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 the 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.*

- 

|  | 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.*

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

# Homework Exercises