Online Instructor’s Manual
to accompany

Introduction to Materials Management

Seventh Edition

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INTRODUCTION TO MATERIALS MANAGEMENT

CHAPTER 1

ANSWERS TO PROBLEMS

1.1 Sales

<table>
<thead>
<tr>
<th></th>
<th>100%</th>
<th>100%</th>
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<tbody>
<tr>
<td>Cost of manufacturing</td>
<td>60%</td>
<td>50%</td>
</tr>
<tr>
<td>Other costs</td>
<td>30%</td>
<td>90%</td>
</tr>
<tr>
<td>Profit (percent of Sales)</td>
<td>10%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Therefore a 10% reduction in the cost of manufacturing would produce a 100% increase in profit.

1.2 Profit = Sales – (direct costs + overhead)

0.20 = Sales – (0.60 \times Sales + 0.30)

Sales = \frac{0.5}{0.4} = 1.25 = 125%

To increase profits from 10% to 20% takes a 25% increase in sales but only a 10% decrease in costs. Good materials management can have a direct impact on profit. Note the cost of overhead has been left unchanged in this problem.

1.3 a. Weekly cost of goods sold = $15,000,000 = $300,000

\frac{50}{50}

Value of 10 weeks’ WIP = 10 \times $300,000 = $3,000,000

b. Value of 7 weeks’ WIP = 7 \times $300,000 = $2,100,000

Reduction in WIP = $900,000

Annual saving = 20% \times $900,000 = $180,000

1.4 a. Weekly cost of goods sold = $40,000,000 = $800,000

\frac{50}{50}

Value of 12 weeks' WIP = 12 \times $800,000 = $9,600,000

b. Value of 5 weeks' WIP = 5 \times $800,000 = $4,000,000

Reduction in WIP = $5,600,000

Annual saving = 20% \times $5,600,000 = $1,120,000
1.5 Using $1$ million as the units:

<table>
<thead>
<tr>
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<tr>
<td>Sales</td>
<td>$10.0</td>
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<tr>
<td>Direct material</td>
<td>$3.5</td>
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<tr>
<td>Direct labor</td>
<td>2.5</td>
</tr>
<tr>
<td>Overhead</td>
<td>3.5</td>
</tr>
<tr>
<td>Profit</td>
<td>$.5</td>
</tr>
</tbody>
</table>

\[
\text{Sales} = \text{direct material} + \text{direct labor} + \text{overhead} + \text{profit (now 1M$)}
\]

\[
= .35(\text{sales}) + .25(\text{sales}) + 3.5 \text{ M$} + 1.0 \text{ M$}
\]

\[
.40 (\text{Sales}) = 4.5 \text{ M$}
\]

\[
\text{Sales} = 11.25 \text{ M$} = 11.25 \times 1,000,000 = 11,250,000
\]

Therefore there must be a $1.25$ million increase in sales.

b. To increase profit by $500,000 there must be a $500,000 reduction in cost. Therefore direct material must be reduced by $500,000. It therefore takes 2 ½ times the sales dollars to obtain the profit that would be realized in material reductions.

c. As for b. Direct labor would have to be reduced by $500,000.
MULTIPLE CHOICE QUESTIONS

1. Select the best answer to the following:
   a. traditionally the supply-production-distribution functions have reported to different departments
   b. the supply, production and distribution functions are part of a total system
   c. materials flow into an organization, are processed in some way and distributed to the consumer
   d. all the above are correct
   e. none of the above is correct

2. Manufacturing is important to the economy because:
   a. it generates wealth
   b. it supports service industries
   c. it adds value to products
   d. all of the above
   e. none of the above

3. Which of the following is the best statement about the operating environment in which operations management functions?
   a. most organizations do not need to worry about competition
   b. customers are more demanding
   c. government regulation is not important for companies
   d. price is more important than quality
   e. none of the above is true

4. Which of the following statements is best regarding order winners?
   a. they persuade a company’s customers to choose its product
   b. they are the same in every market
   c. they are the same as order qualifiers, only better
   d. they are present in every product
   e. all the above are true

5. Which of the following strategies has the shortest delivery lead time and the least customer input?
   a. engineer-to-order
   b. make-to-order
   c. assemble-to-order
   d. make-to-stock
6. Which of the following statements is best?
   a. the supply chain includes all activities and processes to provide a product or service to a customer.
   b. material in the supply chain usually flows from producer to customer.
   c. the supply chain contains only one supplier.
   d. all of the above are true.
   e. a and b only are true.

7. Companies A and B supply company C, which supplies customers D and E. Which of the following statements is best?
   a. the supply chain for company A includes B, C, D, and E.
   b. the supply chain for company B includes A, C, D and E.
   c. the supply chain for company C includes A, B, D, and E.
   d. all the above are true.

8. Which of the following statements is best?
   a. the basic elements of a supply chain are supply, production, and distribution
   b. the elements of a supply chain are interdependent
   c. design information generally flows from customer to supplier
   d. all the above are true

9. Which of the following is the best statement about the environment in which operations management functions?
   a. most organizations do not need to worry about competition
   b. world-wide competition is not significant for most companies
   c. government regulation is not important for companies
   d. customers are more demanding
   e. none of the above is true

10. If a firm wishes to maximize profit, which of the following objectives are in conflict?
    I. Maximize customer service.
    II. Minimize production costs.
    III. Minimize inventory costs.
    IV. Minimize distribution costs.
    a. all the above
    b. none of the above
    c. I and II only
    d. I and III only
    e. II and III only
11. Which of the following statements is best?
   I. The conflict between marketing, finance and production centers on customer service, disruption to production, and inventory levels.
   II. Marketing's objectives can be met with higher inventories.
   III. Finance's objectives can be met with higher inventories.
   IV. Production's objectives can be met with higher inventories.
   a. all of the above are true
   b. I and II only are true
   c. I, II and III only are true
   d. I, II and IV only are true
   e. II, III and IV only are true

12. Which of the following is normally a major activity of materials management?
   I. Manufacturing planning and control.
   II. Physical supply/distribution.
   a. both I and II
   b. neither I nor II
   c. I only
   d. II only

13. The objective of materials management is to:
   I. Provide the required level of customer service.
   II. Maximize the use of the firm's resources.
   a. I only
   b. II only
   c. I and II
   d. neither I nor II

14. Which of the following is/are primary activities of manufacturing planning and control?
   I. Production planning.
   II. Implementation and control.
   III. Inventory management.
   a. I and II only
   b. II and III only
   c. I and III only
   d. all the above are primary activities

15. Which of the following is (are) input(s) to manufacturing planning and control?
   a. product description
   b. process description
   c. available facilities
   d. quantities to be produced
   e. all the above are inputs
16. Which of the following is NOT an activity of physical supply/distribution?
   a. transportation
   b. factory inventory
   c. warehousing
   d. packaging
   e. materials handling

17. Materials management can be considered a balancing act because:
   I. There are trade-offs between customer service and the cost of providing the service.
   II. Priority and capacity must be balanced.
   a. neither I nor II
   b. I only
   c. II only
   d. I and II

18. If the cost of manufacturing (direct labor and materials) is 50% of sales and profit is 15% of sales, what would the profit percentage be if the direct costs of manufacturing was reduced from 50% to 47%?
   a. 3%
   b. 6%
   c. 12%
   d. 15%
   e. 18%

19. Which of the following are generally considered overall objectives of an organization?
   I. Providing good customer service.
   II. Maintaining low levels of inventory investment.
   III. Optimizing use of resources.
   IV. Providing sufficient return on investment.
   a. I and II only
   b. I, II and III only
   c. I, III and IV only
   d. all the above
20. The purpose of the materials management concept is:
   I. To manage materials in a production operation.
   II. To have purchasing support the needs of production.
   III. To have production support the needs of purchasing.
      a. II and III only
      b. I and II only
      c. I, II and III
      d. I and III only

21. Making a pizza at a fast-food restaurant would be considered a form of:
      a. Engineer to order
      b. Assemble to order
      c. Make to stock
      d. Make to order
      e. None of the above

22. Metrics in a supply chain are:
      a. Governed by the International Metric Commission
      b. Measurements of performance
      c. A charge passed on to customers
      d. Not used on transportation
      e. Do not apply to the supply chain

23. Performance measures in a supply:
      a. Should be objective
      b. Are viewed mostly by finance
      c. Must be measurements of one parameter only
      d. Concentrate on cost only
      e. Are not used once a process is automated

24. Which statement is best?
      a. Performance standards are set by the supplier
      b. Performance standards set the goal
      c. Performance measurements show how well you did
      d. Both b and c are correct
      e. None of the above applies to the supply chain

25. Savings in the supply chain mostly are the result of:
      a. Members in the chain sharing information
      b. Being able to ship in larger quantities
      c. Members having clout with suppliers
      d. Sticking with local competition
      e. Cutting cost after the design phase

26. Postponement is best described as:
      a. Delaying payment to a supplier until the goods have been sold
b. Delaying the removal of inventory until the last possible moment
c. Reducing inventory from RM when the parent item is produced
d. Changing the BOM after the old components have been used up

27. Postponement is best used with items that:
   a. Have a long lead time and many product configurations
   b. Are standardized and have short lead times
   c. Experience a yield that you won’t know until the product is complete
   d. Suppliers with poor delivery performance

28. A channel master in a supply chain
   a. Initiates integration of a supply chain
   b. Is the final customer in a supply chain
   c. Is the largest member of a supply chain
   d. Controls the raw material supplies in a supply chain

29. The term that describes eliminating waste throughout a company is:
   a. Kaizen
   b. Lean Production
   c. Theory of Constraints
   d. Process Control

30. If the manufacturing lead time of an item is reduced by 50% the work in process inventory:
   a. Does not change
   b. Is reduced by approximately 70%
   c. Is reduced by approximately 50%
   d. More information is needed for this problem

Answers.
1 d  2 d  3 b  4 a  5 d  6 e  7 c  8 d  9 e
10 a 11 d 12 a 13 c 14 d 15 e 16 b 17 d 18 e
19 d 20 b 21 b 22 b 23 a 24 d 25 a 26 c 27 b
28 a 29 b 30 c
ANSWERS TO PROBLEMS

2.1 Ending inventory  =  opening inventory + production – demand  
=  400 + 700 – 900 =  200 units

2.2 Total working days  =  19 + 20 + 21  =  60  
Average daily production =  500 ÷ 60  =  8.3 units

2.3 Total working days  =  22 + 21 + 20  =  63  
Average daily production =  25,000 ÷ 63 =  396.8 units

2.4 Month 1 production  =  19 × 8.3  =  157.7 units  
Month 2 production  =  20 × 8.3  =  166 units  
Month 3 production  =  21 × 8.3  =  1174.3 units

2.5 Month 1 production  =  22 × 396.8  =  8729.6 units  
Month 2 production  =  21 × 396.8  =  8332.8 units  
Month 3 production  =  20 × 396.8  =  7936 units

2.6

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<td>1600</td>
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2.7

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<td>130</td>
<td>130</td>
<td>125</td>
<td>135</td>
<td>150</td>
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</table>

Total production  =  700 + 100 – 150 =  750 units  
Period production  =  750 ÷ 6  =  125 units
2.8

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<th>Period</th>
<th>1</th>
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<th>3</th>
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<td>1200</td>
<td>800</td>
<td>600</td>
<td>800</td>
<td>900</td>
<td>5600</td>
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<td>892</td>
<td>892</td>
<td>892</td>
<td>892</td>
<td>892</td>
<td>892</td>
<td>5500</td>
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<td>450</td>
<td>42</td>
<td>-266</td>
<td>-174</td>
<td>118</td>
<td>210</td>
<td>202</td>
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Total production = 5600 + 200 –450 = 5350 units
Period production = 5350 ÷ 6 = 892 units

2.9

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<td>9</td>
<td>5</td>
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<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>32</td>
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<td>Planned inventory</td>
<td>0</td>
<td>-1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
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</table>

a. 8 units  
b. period 1, minus 1  
c. 9 units, ending inventory = 4 units

2.10 a. There is a stockout of 1 unit in period one.  
The cost will be:  
Stockout cost: 1 × $500 = $500  
Carrying cost: 3 × $50 = 150  
Total cost: = $650  
c. Total period inventory = 0 + 5 + 3 + 4 = 12 units  
The cost will be = $50 × 12 = $600  
Since there are no stockouts this will be the total cost of the plan.
2.11  
a. Total production = 530 + 130 – 100 = 560  
b. Daily production = 560/70 = 8 units  
c. The monthly production for May = 168 units  
d. The ending inventory for May = 153 units

<table>
<thead>
<tr>
<th>Month</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Total</th>
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<td>Working days</td>
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<td>19</td>
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<td>10</td>
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<td>125</td>
<td>140</td>
<td>150</td>
<td>530</td>
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<td>168</td>
<td>152</td>
<td>160</td>
<td>80</td>
<td>560</td>
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<tr>
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<td>100</td>
<td>153</td>
<td>180</td>
<td>200</td>
<td>130</td>
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2.12

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<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<td>700</td>
<td>700</td>
<td>900</td>
<td>5600</td>
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<td>961</td>
<td>874</td>
<td>874</td>
<td>787</td>
<td>830</td>
<td>5200</td>
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<td>500</td>
<td>74</td>
<td>-165</td>
<td>-91</td>
<td>83</td>
<td>170</td>
<td>100</td>
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</table>

Total production = 5600 + 100 – 500 = 5200
Daily production = 5200 ÷ 119 = 43.7 units per day
There will be a stockout of 165 units in February and 91 units in March.
2.13  Total production $= 300 + 1080 - 200 = 1180$ units
Number of weeks available for production $= 5.5$
Average weekly level production $= \frac{1180}{5.5} = 214.5$ units
The nearest quantity that can be produced is 200 units on two shifts. In the second week there is a shutdown so production in that week will be only 100 units.
Total production so far $= 5 \times 200 + 100 = 1100$ units
The balance of 80 units can be made in week four when extra help is available.
Opening inventory $= 200$ units

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<tr>
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<td>120</td>
<td>160</td>
<td>240</td>
<td>240</td>
<td>160</td>
<td>160</td>
<td>1080</td>
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<td>280</td>
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<td>220</td>
<td>180</td>
<td>220</td>
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2.14  Ending backlog $= \text{demand} + \text{opening backlog} - \text{production} = 700 + 500 - 800 = 400$ units

2.15  Total production $= \text{demand} + \text{opening backlog} - \text{ending backlog} = 3800 + 900 - 200 = 4500$ units
Weekly production $= 4500 \div 6 = 750$ units

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<td>600</td>
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<td>750</td>
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<td>750</td>
<td>550</td>
<td>500</td>
<td>350</td>
<td>100</td>
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2.16 Desired ending backlog = 1200  
Note: All weekly production amounts determined using standard rounding rules.  
\[
\text{Total production} = \text{demand} + \text{opening backlog} - \text{ending backlog} \\
= 6800 + 1100 - 1200 = 6700 \text{ units} \\
\text{Weekly production} = \frac{6700}{6} = 1117 \text{ units} \\
\]

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<th>Week</th>
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<td>1249</td>
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<td>1315</td>
<td>1198</td>
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2.17 Total production = 112,500 + 9000 – 11,250 = 110,250 \text{ units}  
\[
\text{Daily production} = \frac{110,000}{75} = 1470 \text{ units} \\
\text{Number of workers required} = \frac{1470}{15} = 98 \\
\text{Actual daily production} = 98 \times 15 = 1470 \text{ units} \\
\]

<table>
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<td>24</td>
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<td>19</td>
<td>75</td>
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<tr>
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<td>28000</td>
<td>27500</td>
<td>28500</td>
<td>28500</td>
<td>112500</td>
</tr>
<tr>
<td>Planned production</td>
<td>29400</td>
<td>35280</td>
<td>17640</td>
<td>27930</td>
<td>110250</td>
</tr>
<tr>
<td>Planned inventory</td>
<td>11250</td>
<td>12650</td>
<td>20430</td>
<td>9750</td>
<td>9180</td>
</tr>
</tbody>
</table>
Total production = 17900 + 800 – 1000 = 17700
Daily production = $\frac{17700}{117} = 151.28$ units
Number of workers required = $\frac{151.28}{9} = 16.81 \rightarrow 17$ workers
Actual daily production = $17 \times 9 = 153$ units

<table>
<thead>
<tr>
<th>Month</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working days</td>
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<td>24</td>
<td>12</td>
<td>22</td>
<td>20</td>
<td>19</td>
<td>117</td>
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<tr>
<td>Forecast demand</td>
<td>2800</td>
<td>3000</td>
<td>2700</td>
<td>3300</td>
<td>2900</td>
<td>3200</td>
<td>17900</td>
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<tr>
<td>Planned production</td>
<td>3060</td>
<td>3672</td>
<td>1836</td>
<td>3366</td>
<td>3060</td>
<td>2907</td>
<td>17901</td>
</tr>
<tr>
<td>Planned inventory</td>
<td>1000</td>
<td>1260</td>
<td>1932</td>
<td>1068</td>
<td>1134</td>
<td>1294</td>
<td>1001</td>
</tr>
</tbody>
</table>

It is not possible to meet the ending inventory target because of the extra fraction of a worker needed. The only way to do it would be to reduce the number of workers to 16 at some point.
MULTIPLE CHOICE QUESTIONS

1. The ability of manufacturing to produce goods and services is called:
   a. scheduling
   b. production planning
   c. capacity
   d. routing
   e. none of the above

2. Priority in production planning relates to:
   a. what should come first
   b. how much of what is needed and when
   c. capacity
   d. an objective of the firm
   e. none of the above

3. Which of the following is an input to the production plan?
   a. strategic business plan
   b. financial plan
   c. market plan
   d. engineering plan
   e. all of the above are inputs

4. Which of the following plans has the longest planning horizon and the least level of detail?
   a. strategic business plan
   b. production plan
   c. master production schedule
   d. all of the above have the same level of detail
   e. none of the above

5. In terms of INCREASING level of detail, which is the best sequence of activities?
   I. Material requirements planning.
   II. Master production scheduling.
   III. Production planning.
   a. I, II and III
   b. I, III, and II
   c. II, III, and I
   d. II, I, and III
   e. III, II, and I
6. Over the time span of the production plan, which of the following can usually be varied to change capacity?
   a. work force
   b. inventories
   c. plant and equipment
   d. all of the above
   e. a and b above

7. Which of the following is a characteristic of a production plan?
   a. time horizons are five years
   b. the production plan is for individual items
   c. the only objective is to have an efficient plant
   d. all of the above are characteristics of a production plan
   e. none of the above is characteristic of a production plan

8. Determining the need for labor, machines, physical resources to meet the production objectives of the firm is called:
   a. production control
   b. production planning
   c. capacity planning
   d. all of the above
   e. none of the above

9. The function of setting the limits or levels of manufacturing operations based on the market plan and resource availability is called:
   a. production planning
   b. production activity level
   c. capacity planning
   d. all of the above
   e. none of the above

10. A statement of a schedule of requirements for individual end items is called:
    a. a master production schedule
    b. a material requirements plan
    c. a production plan
    d. a capacity plan
    e. none of the above

11. Which of the following statements is most appropriate regarding production planning?
    a. a high level of detail is not needed
    b. a translation must be made from product demand to capacity demand
    c. product groups based on similarity of manufacturing process should be used in planning
    d. all of the above are true
    e. none of the above is true
12. Which of the following statements is best about sales and operations planning?
   a. it provides a means of updating the material requirements plan
   b. it includes only the marketing and production plans
   c. it is usually updated on a monthly basis
   d. it has no effect on inventory levels

13. Which of the following are characteristics of an MRPII system?
   I. It incorporates the plans of marketing, production and finance.
   II. It is a fully integrated planning and control system.
   III. It has feedback from the bottom up.
   a. I only
   b. II only
   c. III only
   d. I, II and III

14. For the purposes of production planning, product groups should be established on the basis of:
   a. market segments
   b. similarity of manufacturing process
   c. the availability of materials
   d. the availability of machinery
   e. all of the above

15. Which of the following is a basic strategy in developing a production plan?
   a. hybrid strategy
   b. production leveling
   c. chase strategy
   d. a and b above
   e. b and c above

16. A production planning strategy which turns away extra demand is called:
   a. production leveling
   b. demand matching
   c. hybrid strategy
   d. all of the above
   e. none of the above

17. Which basic production planning strategy will build inventory and avoid the costs of excess capacity?
   a. demand matching (chase)
   b. production leveling
   c. subcontracting
   d. all the above
   e. none of the above
18. Which basic production planning strategy avoids hiring and layoff costs and the costs of excess capacity?
   a. demand matching
   b. operation smoothing
   c. subcontracting
   d. all the above
   e. none of the above

19. If the opening inventory is 100 units, the sales are 500 units and the ending inventory is 200 units, then manufacturing must produce:
   a. 300 units
   b. 400 units
   c. 500 units
   d. 600 units
   e. none of the above

20. Over a 10-week period the cumulative sales are forecast at 10,000 units, the opening inventory is 200 units and the closing inventory is to be 100 units. What should be the weekly planned production for level production?
   a. 990
   b. 1000
   c. 1010
   d. 1030
   e. none of the above

21. Firms will generally make-to-stock when:
   a. demand is unpredictable
   b. there are many product options
   c. delivery lead times are long
   d. all of the above
   e. none of the above

22. Firms will generally make-to-order when:
   a. products are produced to customer specifications
   b. there are many product options
   c. product is expensive to make and store
   d. all of the above
   e. none of the above
23. Which of the following information is needed to develop a make-to-stock production plan?
   I. Forecast by time period for the production plan.
   II. Opening inventory.
   III. Opening backlog of customer orders.
   IV. Desired ending inventory.
   a. I, II and III
   b. I, II and IV
   c. I, III and IV
   d. II, III and IV
   e. none of the above

24. If the old backlog was 200 units, the forecast for the next period is 500 units, and production for the next period is 600 units, what will be the backlog at the end of the next period?
   a. 100 units
   b. 200 units
   c. 300 units
   d. 700 units
   e. 800 units

25. ____________ is concerned with long-term planning of manufacturing activity:
   a. Sales and operations planning
   b. Master production scheduling
   c. MRP
   d. Production activity control
   e. Master planning

26. Which of the following is NOT a rule of Sales and Operations Planning?
   a. Product Groups need not be decided
   b. Planning units of measure need to be decided
   c. A planning horizon must include new product development time
   d. Performance review periods to be compared should be decided

27. Which of the following is a complete closed loop planning system that develops plans for all materials and operations?
   a. Capacity requirements planning
   b. Enterprise resource planning
   c. Supply chain management
   d. Material requirements planning
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1 | c | 2 | b | 3 | e | 4 | a | 5 | e | 6 | e | 7 | e | 8 | c | 9 | a | 10 | a | 11 | d | 12 | c | 13 | d | 14 | b | 15 | e | 16 | e | 17 | b | 18 | c |
| 19 | d | 20 | a | 21 | e | 22 | d | 23 | b | 24 | a | 25 | a | 26 | a | 27 | b |