Solutions Manual

# Chapter 18 Supplement: Capacity Requirements Planning, MRP II, ERP, and DRP

1a.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Week* | *Material Forecast (in tons)* | *Labor Needed* | *Machine Needed* | *Labor Utilization* | *Machine Utilization* |
| 1 | 60 | 60 x 6 = 360 | 60 x 4 = 240 | 360/450 = 80% | 240/300 = 80% |
| 2 | 70 | 70 x 6 = 420 | 70 x 4 = 280 | 420/450 = 93% | 280/300 = 93% |
| 3 | 50 | 50 x 6 = 300 | 50 x 4 = 200 | 300/450 = 67% | 200/300 = 67% |
| 4 | 80 | 80 x 6 = 480 | 80 x 4 = 320 | 480/450 = 107% | 320/300 = 107% |

1b. They will exceed capacity in Week 4. Since roofing materials can be inventoried, one solution would be to make some of Week 4’s anticipated demand during Week 3.

Cognitive Domain: Knowledge

Difficulty Level: Easy

2. Work load in hours appears in the table. Week 3 and Week 4 are calculated as the sum of the standard hours times production quantities for each of the three products for each work center.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Week* | | | | |
| *Work Center* | *1* | *2* | *3* | *4* | |
| Fabrication | .3 x 70 + .2 x 25 + .1 x 30 = 29 | .3 x 120 + .2 x 35 + .1 x 20 = 45 | 82 | | 68 |
| Assembly | .4 x 70 + .25 x 25 + .2 x 30 = 40.25 | .4 x 120 + .25 x 35 + .2 x 20 = 60.75 | 112.75 | | 95.75 |

Cognitive Domain: Knowledge

Difficulty Level: Easy

3.





There is a significant roundup in the assembly area of half a worker. It might be less expensive to hire five workers to work 10-hour days. Workers might be cross trained to fill in where needed, whether in assembly or welding.

Cognitive Domain: Knowledge

Difficulty Level: Easy

4.





Cross train workers to switch between baking and decorating.

Cognitive Domain: Knowledge

Difficulty Level: Easy

5. Total load by department for each product

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Product* | *Input* | *Monday* | *Tuesday* | *Wednesday* | *Thursday* | *Friday* | *Total* |
| **P** | Labor | 1600 | 1200 | 800 | 800 | 400 | 4800 |
| Machine | 1800 | 1350 | 900 | 900 | 450 | 5400 |
| **K** | Labor | 2200 | 550 | 1650 | 1100 | 550 | 6050 |
| Machine | 1000 | 250 | 750 | 500 | 250 | 2750 |

Total load for each of the departments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Fabrication* | | *Assembly* | | *Painting* | |
| Labor | Machine | Labor | Machine | Labor | Machine |
| 4600 | 3500 | 3400 | 2900 | 2850 | 1750 |

Cognitive Domain: Knowledge Difficulty Level: Easy

6a.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Week* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* |
| Planned order releases | 80 | 70 | 30 | 45 | 60 | 50 | 55 | 70 |
| Processing load in hours | 240 | 210 | 90 | 135 | 180 | 150 | 165 | 210 |
| Available capacity in hours | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 |

Demand exceeds capacity in 4 out of the 8 weeks in this period.

6b. Demand exceeds capacity in 4 out of the 8 weeks in this period. In aggregate, load exceeds capacity by 100 hours, so working at a constant pace with minimal overtime or backorders may be a possibility.

Cognitive Domain: Comprehension

Difficulty Level: Medium

7. The hours needed at each work center are as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Hours Needed* | *1* | *2* | *3* | *4* |
| Sanding | 40(.75) + 20(.5) + 90(.3) = 67 | 97.5 | 157 | 118 |
| Painting | 40(1) + 20(.75) + 90(.5) = 100 | 142.5 | 227.5 | 168.75 |

Capacity at Sanding = 40(.96)(.92) = 35.328 hours = Capacity at Painting. Dorian will not be able to meet demand.

Cognitive Domain: Comprehension

Difficulty Level: Medium

8.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Work Order Number* | *Number of Units* | *Setup Time (in minutes)* | *Run Time (in minutes/unit)* | *Time Needed* |
| 702 | 300 | 8 | 0.15 | 8 + 300(.15) = 53 |
| 520 | 700 | 15 | 0.1 | 15 + 700(.7) = 85 |
| 650 | 3500 | 7 | 0.3 | 7 + 3,500(.3) = 1,057 |
| 830 | 7500 | 20 | 0.2 | 20 + 7,500(.2) = 1,520 |
|  |  |  | Total demand | 53 + 85 + 1,057 + 1,520 = 2,715 |
|  |  |  | Worker 1 | 8(60)(.95) = 456 |
|  |  |  | Worker 2 | (8)(60)(.90) = 432 |
|  |  |  | Demand unmet | 2,715 – 456 – 432 = 1,827 |

There is insufficient capacity—only a third of what is needed is available. They should try working ***both*** smarter and harder.

Cognitive Domain: Comprehension

Difficulty Level: Medium

9.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Master Production Schedule* | | | | | | |
| *Week* | *1* | *2* | *3* | *4* | *5* | *6* |
| Product P | 120 | 140 | 90 | 180 | 80 | 80 |
| Q(3) | 3(120) = 360 | 420 | 270 | 540 | 240 | 240 |
| R(2) | 2(120) = 240 | 280 | 180 | 360 | 160 | 160 |
| S(4) | 4(360) = 1,440 | 1,680 | 1,080 | 2,160 | 960 | 960 |
| T(2) | 2(360) = 720 | 840 | 540 | 1,080 | 480 | 480 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Operation* | *1* | *2* | *3* | *4* | *5* | *6* |
| Lathing | 1,440 | 1,680 | 1,080 | 2,160 | 960 | 960 |
| Shearing | 360 | 420 | 270 | 540 | 240 | 240 |
| Milling | 240 | 280 | 180 | 360 | 160 | 160 |
| Drilling | 720 | 840 | 540 | 1,080 | 480 | 480 |
| Assembly | 360 | 420 | 270 | 540 | 240 | 240 |

Week 4 is the highest demand week for all work stations, but Week 5 and Week 6 have the lowest demands during the period. If some percentage, like 30% to 40%. of the demand in Week 4 could be evenly distributed between Week 5 and Week 6, the load would be more even across the six periods.

Cognitive Domain: Comprehension

Difficulty Level: Medium

10a.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Master Production Schedule* | | | | | | |
| *Week* | *1* | *2* | *3* | *4* | *5* | *6* |
| Product Z | 100 | 100 | 120 | 160 | 130 | 70 |
| J(2) | 200 | 200 | 240 | 320 | 260 | 140 |
| K | 100 | 100 | 120 | 160 | 130 | 70 |
| L(2) | 200 | 200 | 240 | 320 | 260 | 140 |
| M(4) | 1,600 | 1,600 | 1,920 | 2,560 | 2,080 | 1,120 |
| N(2) | 400 | 400 | 480 | 640 | 520 | 280 |
| O(3) | 300 | 300 | 360 | 480 | 390 | 210 |
| P | 100 | 100 | 120 | 160 | 130 | 70 |
| Q(3) | 600 | 600 | 720 | 960 | 780 | 420 |
| Heat treating | 1,360 | 1,360 | 1,632 | 2,176 | 1,768 | 952 |
| Machining | 2,510 | 2,510 | 3,012 | 4,016 | 3,263 | 1,757 |
| Assembly | 100 | 100 | 120 | 160 | 130 | 70 |

10b. Demand in Week 4 is 41% higher than average demand for the 6-week period. Shifting the demand to Periods 1, 2, and 6 from Periods 3, 4, and 5 would look as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Week* | *1* | *2* | *3* | *4* | *5* | *6* |
| Product Z | 113 | 113 | 114 | 113 | 113 | 114 |
| J(2) | 226 | 226 | 228 | 226 | 226 | 228 |
| K | 113 | 113 | 114 | 113 | 113 | 114 |
| L(2) | 226 | 226 | 228 | 226 | 226 | 228 |
| M(4) | 1,808 | 1,808 | 1,824 | 1,808 | 1,808 | 1,824 |
| N(2) | 452 | 452 | 456 | 452 | 452 | 456 |
| O(3) | 339 | 339 | 342 | 339 | 339 | 342 |
| P | 113 | 113 | 114 | 113 | 113 | 114 |
| Q(3) | 678 | 678 | 684 | 678 | 678 | 684 |
| Heat treating | 1,536.8 | 1,536.8 | 1,550.4 | 1,536.8 | 1,536.8 | 1,550.4 |
| Machining | 2,836.3 | 2,836.3 | 2,861.4 | 2,836.3 | 2,836.3 | 2,861.4 |
| Assembly | 113 | 113 | 114 | 113 | 113 | 114 |

Cognitive Domain: Application

Difficulty Level: Hard