GLOBAL EDITION

Introduction to Materials Management

EIGHTH EDITION

Stephen N. Chapman • J. R. Tony Arnold • Ann K. Gatewood • Lloyd M. Clive

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Introduction to Materials Management

PROBLEMS

5.1. A work center consists of 3 machines each working a 16-hour day for 5 days a week. What is the weekly available time?

Answer. 240 hours per week

5.2. The work center in problem 5.1 is utilized 75% of the time. What are the hours per week actually worked?

5.3. If the efficiency of the work center in problem 5.1 is 120%, what is the rated capacity of the work center?

Answer. 216 standard hours per week

5.4. A work center consisting of 5 machines is operated 14 hours a day for a 5-day week. Utilization is 85%, and efficiency is 120%. What is the rated weekly capacity in standard hours?

Answer. 357 standard hours per week

5.5. In Mac's workshop, the standard time needed to process a job is 35 hours. How much actual time will be needed to run the order if the work center has an efficiency of 120% and a utilization of 85%?

5.6. Over a period of 4 weeks, a work center produced 40, 44, 38, and 42 standard hours of work. What is the demonstrated capacity of the work center?

Answer. 41 standard hours of work per week

5.7. A work center has 4 machines that are operated 8 hours a day for a 5-day week. What is the available time?

5.8. Over a 5-week period, a work center produced 500 standard hours of work. The scheduled hours were 540 hours, and 460 hours are actually worked. Calculate the utilization and the efficiency of the work center.

Answer. Utilization is 85%; efficiency is 108%

5.9. In one week, a work center consists of 3 machines that together produce 70 standard hours of work. The hours scheduled are 75, and 68 hours are actually worked. Calculate the utilization and efficiency of the work center. What is the weekly capacity of the work center?

5.10. ABC Machining has 2 major machines managed by 2 operators working in 2 shifts. Each operator works 8 hours a day, 5 days a week. They do not take breaks during the day, but they do allow themselves 30 minutes for lunch or dinner. In addition, they service the machines for about 30 minutes at the beginning of each shift. Since the machines are new, their efficiency is estimated at 90%. Calculate the capacity.

5.11. A work center got an order to process 130 units of casting. The setup time is 2.5 hours, and the run time is 0.3 hours per piece. What is the standard time needed to run the order?

Answer. 41.5 standard hours

5.12. How many standard hours are needed to run an order of 300 pieces if the setup time is 3.0 hours and the run time is 0.2 hours per piece? How many actual hours are needed at the work center if the efficiency is 120% and the utilization is 90%?

5.13. A work center has the following open and planned orders for week 4. Calculate the total standard time required (load).

		Order Quantity	Setup Time (hours)	Run Time (hours/piece)	Total Time (hours)
Released Orders	110	250	2.00	0.20	
	220	200	2.50	0.15	
Planned Orders	330	400	2.00	0.10	
	440	450	3.00	0.15	
Total Time (standard hours)					

Answer. Total Time = 197 standard hours

5.14. Calculate the capacity and load percentage per work center (casting and machining) for the jobs B110 and B220. Assume 50 hours is available per week for each work center.

Work Centers	Casting	Machining		
Efficiency	0.95	0.90		
Utilization	0.90	0.92		
			Production/week Week 1	Week 2
B110 (time required in hours in each work centers)	0.30	0.18	50	35
B220 (time required in hours in each work centers)	0.35	0.20	60	40

5.15. Using the following route information, open order information, and MRP planned orders, calculate the load on the work center.

Routing: Part 123: Setup time = 2 standard hours
Run time per piece = 3 standard hours per piece
Part 456: Setup time = 3 standard hours
Run time per piece = 1 standard hour per piece

Open Orders for parts

Week	1	2	3
123	12	8	5
456	15	5	5

Planned Orders for parts

1	2	3
0	5	10
0	10	15

Load report

Week		1	2	3
Released Load	123			
	456			
Planned Load	123			
	456			
Total Load				

5.16. Complete the following load report and suggest possible courses of action.

Week	18	19	20	21	Total
Released Load	160	155	100	70	485
Planned Load	0	0	70	80	150
Total Load					
Rated Capacity	150	150	150	150	600
(Over)/Under Capacity					

5.17. Back schedule the following shop order. All times are given in days. Move time between operations is 1 day, and wait time is 1 day. Due date is day 150. Assume orders start at the beginning of a day and finish at the end of a day.

Operation Number	Work Center	Operation Time (days)	Queue Time (days)	Arrival Date (a.m.)	Finish Date (p.m.)
10	111	2	4		
20	130	4	5		
30	155	1	2		
	Stores			150	

Answer. The order must arrive at work center 111 on day 126.

5.18. Back schedule the following shop order. All times are given in days. Move time between operations is 1 day, and wait time is 1 day. Due date is day 200. Assume orders start at the beginning of a day and finish at the end of a day.

Operation Number	Work Center	Operation Time (days)	Queue Time (days)	Arrival Date (a.m.)	Finish Date (p.m.)
10	110	3	2		
20	120	5	3		
30	130	3	2		
	Stores			200	

CASE STUDY 5.1

Wescott Products

Whenever Jason Roberts thought about going to work on Friday morning, he started to get a little knot in his stomach. Jason had recently accepted the job as operations manager for a small manufacturing company that specialized in a line of assemble-to-order products. When he accepted the job he was a recent graduate of a business program where he specialized in operations. He had done fairly well in his classes and had emerged as a confident, self-assured person who was sure he could handle such a job in a small company.

The company, Wescott Products, had recently experienced rapid growth from the original start in a two-car garage just five years earlier. In fact, Jason was the first person ever named as operations manager. Prior to that, the only production manager reporting to the owner, Judy Wescott, was Frank Adams, the production supervisor. While Frank was an experienced supervisor, he had been promoted to supervisor directly from his old job as a machine operator and had no formal training in planning and control. He soon found that planning was too complex and difficult for him to handle, especially since he also had full responsibility for all the Wescott workers and equipment. Randy Stockard, the sales and marketing manager, had requested and finally applauded Judy Wescott's decision to hire Jason, since he felt production was having a much more difficult time in promising and delivering customer orders. Randy was starting to spend more and more time on the phone with angry customers when they didn't get their orders at the time they expected them. The time away from developing new sales and the danger of losing established customers started to make him highly concerned about sustaining sales growth, to say nothing about his potential bonus check tied to new sales!

Once Jason was placed in the position, however, the "honeymoon" was short, and soon Jason started doubting how much he really did know. The company was still having trouble with promising customer orders and having the capacity to meet those orders. At first he thought it was the forecasting method he used, but a recent analysis told him the total actual orders were generally within 10% of what the forecast projected. In addition, production never seemed to have any significant shortages in either subassemblies or components. In fact, many felt they had far too much material, and in the last couple of staff meetings Jake Marris, the company controller, was grumbling that he thought the inventory turn ratio of just less than 3.5 was unreasonable and costing the company a lot of money. It must be something else, and he had to discover it quickly.

The first idea he thought about was to request the assembly areas to work overtime, but he soon found out that was a sensitive topic that could only be used as a last resort. The workers in that area were highly skilled and would be difficult, if not impossible, to

replace in any reasonable time. Adding more employees would also be difficult for the same reason. A year earlier they were being worked a lot of overtime but had finally had enough. Even though Wescott had no union, the workers got together and demanded better overtime control or they would all quit to move to other jobs that were plentiful for skilled workers in this area. The agreement was that they were to be asked for no more than four hours of overtime per worker per week unless it was truly an emergency situation. They were well paid and all had families, and the time with their families was worth more to them than additional overtime pay. At least the high skill level had one advantage: Each of the workers in the assembly area could skillfully assemble any of the models, and the equipment was flexible enough to handle all the models.

Friday mornings were when Jason made his master schedule for the next week and no matter how hard he tried he never seemed to be able to get it right. Since the standard lead time for all assemblies was quoted as one week, the company had felt no need to schedule farther into the future when very few orders existed there. He was sure that he had to start the process by loading the jobs that were missed in the current week into the Monday and Tuesday time blocks and then hope that production could catch up with those in addition to the new jobs that were already promised. The promises came when Randy would inform him of a customer request and ask for a promise date, which was often "as soon as possible." Jason would look at the order to see if the material to make it was in stock and if the equipment to make it was running. He would then typically promise to have it available when requested. Now that a lot of promises were not being met, however, Randy was starting to demand that Jason get control of the operation. Jason tried to respond by scheduling a lot of each model to be run every week, but he often found he had to break into the run of a lot to respond to expediting from sales. He knew this made matters worse by using extra time to set up the equipment, but what else could he do? Even Judy Wescott was asking him what she needed to do to help him improve the performance. His normal high level of self-confidence was being shaken.

Jason started pouring over his old operations book looking for something he could use. He finally realized that what he needed was a more effective system to develop master schedules from which he could promise orders, order components, and plan capacity. Unfortunately, he also recalled that when that material was covered in his class he had taken off early for spring break. Even though he knew enough to recognize the nature of the problem, he didn't know enough to set up such a schedule. Humbly, he called his former instructor to ask for advice. Once she was briefed on the problem, she told him to gather some information that he could use to develop a sample master schedule and rough-cut capacity plan. Once he had the information, she would help show him how to use it.

The following describes what she asked him to collect:

1. Pick a work center or piece of equipment that has caused some capacity problem in the recent past. List all the product models that use that work center.
2. For each of the models, list the amount of run time they use the work center per item. Also list the setup time, if any. These times can be gathered from standards or, if the standard data is suspect or does not exist, use the actual average time from recent production.
3. For each of the models, list the usual lot size. This should be the same lot size used for the master schedule.
4. For each of the models, list the current inventory, the current forecast, and the current firm customer order quantities.
5. List the current capacity (hours) available for the equipment.

The following tables summarize the data Jason collected:

WORK CENTER 12

Model	Run Time (per item, in minutes)	Setup Time (per lot)	Lot Size (minimum qty.)	On-hand*
A	3.7	90 minutes	150	10
B	5.1	40 minutes	100	0
C	4.3	60 minutes	120	0
D	8.4	200 minutes	350	22
E	11.2	120 minutes	400	153

*Most of the on-hand was really forced when the lot size exceeded orders for the week for that model. They would then assemble the rest of the lot as "plain vanilla," such that they could easily add any subassembly options once the actual customer orders came in.

Two workers are currently assigned to the work center, and only to the first shift. Even though assembly workers are very flexible, Jason cannot take workers from another assembly area, as those work centers are also behind and therefore appear to be equally overloaded.

The following is the forecast and customer orders for each of the five models assembled in work center 12:

Model	Weeks	1	2	3	4	5	6	7	8	9	10
A	Forecast	45	45	45	45	45	45	45	45	45	45
	Customer Orders	53	41	22	15	4	7	2	0	0	0
B	Forecast	35	35	35	35	35	35	35	35	35	35
	Customer Orders	66	40	31	30	17	6	2	0	0	0
C	Forecast	50	50	50	50	50	50	50	50	50	50
	Customer Orders	52	43	33	21	14	4	7	1	0	0
D	Forecast	180	180	180	180	180	180	180	180	180	180
	Customer Orders	277	190	178	132	94	51	12	7	9	2
E	Forecast	200	200	200	200	200	200	200	200	200	200
	Customer Orders	223	174	185	109	74	36	12	2	0	0

Once Jason had gathered all the data, he immediately called his instructor, only to find out that by an ironic twist of fate she would be gone for more than a week on spring break.

Assignment

This leaves you to help Jason. Specifically, you need to do the following:

1. Discuss the nature and probable sources of the problem.
2. Examine the rough-cut capacity situation using the data Jason gathered. Discuss the results and how they are linked to the problems identified in question 1.
3. Use the information and your knowledge of the situation to develop a complete plan for Jason to use in the future. Part of this plan should be to build and demonstrate the approach to master scheduling for the data given in the case.