

MEMORANDUM

To: Director of Operations
From: Patricia Calchera
Date: April 04, 2005
Subject: Job Shop Scheduling Comparisons

Introduction

Per your request, a comparison has been made between the current scheduling work processes using first come, first serve (FCFS) basis to two other possibilities of the shortest processing time (SPT) and the earliest due date (EDD).

Findings

Scheduling Rule Recommendation. Using the goal of better customer service by decreasing lateness of delivery to the customer, the shortest processing time rule appears to be the best choice. The shortest processing time rule had a -6.1-day tardiness rate compared to a -1.9-day rate using the FCFS rule and -1.57-day rate using the EDD rule.

Additional considerations. The SPT method was shown to be the best choice when considering the average setup and processing of a job (flow time) when compared to the other two methods. The SPT method also provided the lowest work-in-process inventory (as shown as the average number of jobs at work center) when compared to the other two scheduling rules.

Discussion

Basis of Information. Taking information from each of the individual jobs given by the foreman who has determined each work station's setup and processing times, and how long before the jobs will be due, and how many jobs would be at the workstations at one time, calculations can then be done and compared for each of the 3 scheduling rules.

Summary of Results. Table 1 shows the results of using the 3 different scheduling rules. The average flow time reflects how long the average setup and processing time in days would be, the average tardiness shows the difference between the flow time and the actual due date, and the average number of jobs at the workstation will tell how much work-in-process inventory may be at each station using the scheduling rule¹.

¹ Stevenson, William J. (2005). *Operation management*. 8th ed. New York: McGraw-Hill.

	Average Flow Time	Average Tardiness	Average # Jobs at Work Center
FCFS	15.3 days	-1.9 days	3.9
SPT	11.1 days	-6.1 days	2.9
EDD	15.6 days	-1.57 days	4.0

Individual Scheduling Calculations. Information for the tables used come from the individual areas where the production takes place and the due date is the agreed upon date between Positrol and its individual customers. Table 2 shows the days that jobs are tardy when they are completed in the order they are received. The total number of days that the jobs are tardy is a negative number due to the completion of the six jobs was less than the total scheduled time to complete. Jobs C, E, and F were not completed before the due date. Table 3 shows the days that jobs are tardy when the jobs are arranged by the amount of job time in days it takes to complete them. Table 3 shows that although A was received first, it was not started until jobs D, E, and F were completed. The total days tardy were decreased from the FCFS method by 24.8 days total. There were still some jobs that were not completed before their due date (jobs A, C, and B), but the average number of jobs at each work center decreased from 3.9 to 2.9. Average flow time for the shortest processing time rule was approximately 11 days which is also an improvement over both the First-Come, First-Serve rule at 15.3 days and the Earliest Due Date rule at 15.6 days. Table 4 shows the Earliest Due Date rule implemented and it resulted in the worst statistics of all. The jobs were arranged using this rule by how many days until the jobs were due. Using the EDD rule, only two jobs were completed past their due date, which was job E at ½ day past due and job F at 2.8 days past the due date. But even with this improvement of job completion, the overall statistics were third ranked when compared with the FCFS rule and the SPT rule.

JOB	Job Time (days)	Flow Time (days)	Due Date (days)	Days Tardy (Flow Time-Due Date)
A	4.5	4.5	10	-5.5
B	6.0	10.5	17	-6.5
C	5.2	15.7	12	3.7
D	1.6	17.3	27	-9.7
E	2.8	20.1	18	2.1
F	3.3	23.4	19	4.4
Totals	23.4	91.5		-11.5

Average Flow Time: $91.5/6 = 15.25$ days

Average Tardiness: $-11.5/6 = -1.92$ days

Average # of Jobs at the Work Center: $91.5/23.4 = 3.91$

JOB	Job Time (days)	Flow Time (days)	Due Date (days)	Days Tardy (Flow Time-Due Date)
D	1.6	1.6	27	-25.4
E	2.8	4.4	18	-13.6
F	3.3	7.7	19	-11.3
A	4.5	12.2	10	2.2
C	5.2	17.4	12	5.4
B	6.0	23.4	17	6.4
Totals	23.4	66.7		-36.3

Average Flow Time: $66.7/6 = 11.12$ days

Average Tardiness: $-36.3/6 = -6.05$ days

Average # of Jobs at the Work Center: $66.7/23.4 = 2.85$

JOB	Job Time (days)	Flow Time (days)	Due Date (days)	Days Tardy (Flow Time-Due Date)
A	4.5	4.5	10	-5.5
C	5.2	9.7	12	-2.3
B	6.0	15.7	17	-1.3
E	2.8	18.5	18	0.5
F	3.3	21.8	19	2.8
D	1.6	23.4	27	-3.6
Totals	23.4	93.6		-9.4

Average Flow Time: $93.6/6 = 15.6$ days

Average Tardiness: $-9.4/6 = -1.57$ days

Average # Jobs at Work Center: $93.6/23.4 = 4$

Limitations. This will be a proper evaluation of the different scheduling rules and their effect on the efficiency in completion of the processes, if no jobs are cancelled once begun, no jobs arrive after the processing begins, and there are no mechanical breakdowns, accidents, or worker illnesses.² Also, the rule deemed “best” should only be considered so, if the negative tardiness does not create a conflict for shipping or the customer due to the earlier completion date.

² Stevenson, William J. (2005). *Operation management*. 8th ed. New York: McGraw-Hill.