Implementation of first come first served in door leaf production scheduling

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Abstract. In a production activity, optimum results can be obtained if all production activities in a good planning. Good planning can be done to make a scheduling. Scheduling as a decision-making process has an important role in various manufacturing and production systems and information processing environments. In this furniture industry each product goes through a production process with the same machine usage. The stages of processing the product using the same machine related to increase consumer demand and fluctuating indirectly causing accumulation and irregular product lead time. This condition certainly causes delivery delay of products to consumers. Therefore, a scheduling design is needed to minimize the total lead time in order to meet customer demands. The design is carried out using the First Come First Served method where the design was carried out based on the demand of consumer demand received. The results of the study using the FCFS method showsthat the makespan value is 2579,40 hours with the sequence of production product, namely job A-job B-job C-job D-job E-job F. Job sequence based on the demand in which the product first ordered will be done first.

1. Introduction

In the current era of technological progress, every company always trying to produce an effective and efficient production process. Industrial competition is very high at this time causing industrial growth affects companies to increase productivity in their production activities. In a production activity, optimum results can be obtained if all production activities in good planning. Good planning can be done to make a scheduling. Scheduling as a decision-making process has an important role in various manufacturing and production systems and information processing environments [1].

The schedule is the allocation of one or more time intervals for each job to one or more machines [2]. Scheduling is a significant process widely used in manufacturing technology, production management, computer science, etc. In a simple flow store issue, each machine center has more than one machine if at least one machine[3,4].Scheduling is a working method determined by several ways assigned to a resource that resolves the work [5,6]. The purpose of scheduling is to fulfill various production constraints and maximize/minimize the desired objective function [7]. The production consisting of complex manufacturing processes that have several types of products, each requiring a lot of stages of production process, and product parts for completion so that the production schedule is a must to do. Production scheduling is very important in producing a product for the company. Good scheduling can reduce the time spent on production units and minimize goods are in process [8]. Therefore, the right production scheduling is needed in order to reduce unproductive time and increase productive time in the production process.

This industry of doors furniture production are allocated overseas. Doors produced by the industry in accordance with the consumers wish. The industry produces door leaf which varies with 6 types of door leaf. The production system applied is a flow shop. Flow shop is an environment where machines are arranged in series and all jobs have operations performed in the same order or route [9]. In this system, each product goes through a production process with the same machine usage. The stages of processing the product using the same machine related to increase consumer demand and fluctuating indirectly causing accumulation and irregular product lead time. This certainly causes delivery delays of product to consumers. Therefore, a scheduling design is needed to minimize the total lead time in order to meet customer demands.

The handling of production scheduling can be done by several methods, one of them is the First Come First Served method. FCFS can be defined as the first received process will be served in advance. If there is a process to arrive at the same time, the services they bring through their orders in the queue [10].First come first serve easy to understand and apply. It is suitable for batch systems but is not suitable for time sharing systems. Scheduling is fair for smaller burst times but it's unfair to process larger burst time [11].FCFS method is widely used in scheduling production as in CPU scheduling [12,13], Automotive manufacturing system [14], and scheduling analysis for job sequencing in veneer lamination line [15]. However, for scheduling in the production process, the FCFS method still needs consideration to be applied because scheduling with this method is carried out based on customer demands are first received. For this reason, the application of this method is still consider to be applied.

Based on previous studies, this study uses the FCFS method in scheduling production in the furniture industry. The research was conducted by designing door leaf production scheduling based on the order of consumer demand received.

2. Methodology

The study was conducted on one of the furniture industries in the Medan city. The object examined in this study is the order of the door leaf production process. The research began with direct observation of the furniture industry. Based on the results of observations, the problem formulation will be determined according to the condition occur in the company. The formulation of the problem will determine the research objectives to be achieved. Furthermore, data collection is used as input in conducting this research. Data collection in the form of product cycle time, demand, production capacity, and the quantity of machines used. Based on these data, production scheduling analysis is carried out which is the objective in this study. Production scheduling is obtained after several stages of processing are carried out first. The stages carried out include uniformity test and data adequacy, calculation of standard time, and calculation of product lead time. The uniformity test is carried out to ensure and detect the data collection from the same system. Based on this test, it will be obtained whether the data collected is uniform or not. When the data adequacy test is done to find out which is the data obtained when making observations is sufficient to be used in overcoming this problem. Standard time calculation is done to find out the average time needed to work on the product by the capabilities and allowances consideration given to workers. The standard time produced will be one of the inputs in calculating the lead time. The product lead time will be obtained by kinsmen demand consideration, product capacity, machine setup time, and standard time with the following formula.

$$\text{Lead Time } (t_{ij}) = \text{Setup time} + \left(\frac{\text{standard time x demand}}{\text{product capacity(unit/process)}}\right) \ldots\ldots\ldots (1)$$

After the product lead time the door leaf is obtained, then door leaf production scheduling is carried out. Production scheduling is designed using the First Come First Served (FCFS) method. This method is designed based on the order of consumer demand received by the industry. The make span results are obtained from the total quantity of product lead time with the order of products have been known based on the demand of the door leaf.

3. Result and Discussion

Production scheduling will be designed by the uniformity test and the data adequacy determination, the standard time of product processing, and product lead time. Uniformity and adequacy test is done to see whether the data obtained is uniform or in the control limit and sufficient for further data processing. In this study, the data tested is the product cycle time where the quantity of observations made is 15 times with a confidence level of 95% and accuracy of 5%. The results obtained in this study indicates that the data collection during the observation is uniform and sufficient and it can be used for the next process. From these data, the calculation of standard time is based on the cycle time by the ability of the workers consideration and allowance the industry gives to workers. With this standard time, product lead time of the door leaf will be determined. Calculation of total product lead time is based on capacity, demand, and the quantity of machines used in each door leaf production process. The recapitulation of the lead time of door products for each type of door on all work stations can be seen in Table 1.

Table 1. Processing Time at Each Job of All Work Center

WC	Job Processing Time (hours)					
	Job A	Job B	Job C	Job D	Job E	Job F
1	70,92	256,80	125,38	2,82	4,49	5,83
2	107,74	411,76	209,79	5,10	7,70	9,92
3	190,67	737,23	391,09	11,19	15,04	18,72
4	92,12	311,70	142,10	3,28	4,80	6,54
5	124,00	479,99	255,32	7,26	9,70	12,11
6	24,30	93,62	49,97	1,43	1,89	2,39

Based on the total product lead time above, production scheduling will be designed using the FCFS method. The application of this method is based on the order of door leaf first received. The production scheduling design is carried out for 6 types of door leaf with work processes, namely the process of cutting, tapping, gluing, assembling, finishing, and packing. The results of the production scheduling design can be seen in Table 2.

Table 2. Makespan Value in Door Leaf Production Scheduling

Work Center		Job Order Sequence					
		Job 1	**Job 2**	**Job 3**	**Job 4**	**Job 5**	**Job 6**
	Start	0	70,92	327,73	453,11	455,93	460,42
WC I	Finish	70,92	327,73	453,11	455,93	460,42	466,25
	Start	70,92	327,73	739,49	864,86	869,97	877,67
WC II	Finish	178,66	739,49	864,86	869,97	877,67	887,59
	Start	178,66	739,49	1476,71	1867,81	1879,00	1894,03
WC III	Finish	369,33	1476,71	1867,81	1879,00	1894,03	1912,75
	Start	369,33	1476,71	1867,81	2009,91	2013,18	2017,98
WC IV	Finish	461,45	1788,41	2009,91	2013,18	2017,98	2024,53
	Start	461,45	1788,41	2268,40	2523,72	2530,98	2540,68
WC V	Finish	585,46	2268,40	2523,72	2530,98	2540,68	2552,79
	Start	585,46	2268,40	2523,72	2573,69	2575,12	2577,01
WC VI	Finish	609,76	2362,02	2573,69	2575,12	2577,01	2579,40

Based on the table above, the makespan value is 2579,40 hours with the order in which the product is made, namely job A-job B-job C-job D-job E-job F. Job sequence is based on the order in which the product is received first.

4. Conclusion

Production scheduling is needed to avoid delays in product delivery to consumers, especially for products require a long time processing. In this study, the scheduling design is carried out using the FCFS method where the makespan value was 2579,40 hours with the work order for the product namely job A-job B-job C-job D-job E-job F. This result indicates that it took around 12 days to complete all products order at the same time. Based on the table above, the makespan value of 2579,40 hours is obtained with the work order of the product, namely job A-job B-job C-job D-job E-job F. Job sequence is based on the products demand where products are first ordered will be done first.

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