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This study concerns a flowshop system with uncertain processing time, similar to real situations. This study considers the flowshop system under two cases of uncertainties. Firstly, processing times are in form of a range and the objective is to find a schedule which has the minimum ranging value between the maximum makespan and the minimum makespan value. Secondly, processing times are in form of a discrete probability function and the objective is to find a schedule which has the minimum expected makespan.

For the first case, the methods of finding the best solution, called " Branch and Bound", are investigated. The first method has a lower bound from partially scheduled jobs and unscheduled jobs, and application of Ignall and Schrage, Reverse Johnson and CDS (BB_IRJCDS). Theoretically, the proposed method will reduce the number of branching nodes and computation time when compared with the complete enumeration method (ENUMAP). Because of BB_IRJCDS has the complex calculation for a lower bound and has a limitation to solve the large size problems. However, the experimental results show that BB_IRJCDS can reduce the number of branching nodes, but requires more computation time. The second method has a lower bound from partially scheduled jobs and does not account for unscheduled jobs (BB_NUJA). This method can reduce the complexity for calculating the lower bound. The experimental results show that BB_NUJA has a smaller number of branching nodes and computation times compared with BB_IRJCDS and ENUMAP. The maximum percentages of deviation of BB_IRJCDS and BB_NUJA are 1.69 and 8.33, respectively. The maximum numbers of jobs of BB_IRJCDS and BB_NUJA are 13 and 14, respectively. Moreover, to solve the large problems, GA and MNEH_GA are proposed. The results show that both methods have performed well. The percentages of deviation of GA and MNEH_GA are 2.31 and 1.29, respectively. The factor affecting the performance and computation time is the amount of reproduction in GA and MNEH_GA.

For the second case, the solution has been proposed by Barasubramanian and Grossmann. They proposed the Branch and Bound (B2002) method. This study proposed three new lower bounds (P2006, S2006, and M2006). The experimental results show that the new lower bounds require less computation time than Barasubramanian and Grossmann's lower bound.

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