ABSTRACT

AN OPTIMAL SEQUENCENING PROBLEM FOR A TWO-STAGE FLOW SHOP WITH ALTERNATIVE JOB ASSIGNMENTS

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A set of n items, $N=\{1,2,\ldots,i,\ldots,n\}$ is given and each item is processed by machines M_1 and M_2 in this order. Each item i, $i\varepsilon N$, goes through three operations, namely $<a_i>$, $<b_i>$, and $<p_i>$. The operation $<p_i>$ can be assigned to either M_1 or M_2, while operations $<a_i>$ and $<b_i>$ are assinged to M_1 and M_2 respectively. Item i is said to be of I-type job, i^I, when $<p_i>$ is assigned to M_1, and of II-type job, i^{II}, when assigned to M_2.

This paper deals with a problem of finding an optimal schedule, i.e., determining the job type of each item and the processing sequence of all the items, which minimizes makespan.

The assignment of $<p_i>$, $i\varepsilon N$, is specified by a set λ, where $\lambda=\{i|i^I, i\varepsilon N\}$, and an optimal sequence corresponding to a given λ, which is denoted by S_λ, can be obtained by Johnson's condition. Thus an optimal schedule, $S_{\lambda*}$, exists among the 2^n optimal sequences corresponding to the 2^n possible S_λ's. One item k is chosen from among the II-type jobs, and its job type is reversed from k^{II} to k^I. For this new set of job types, an optimal sequence is obtained. To describe this process towards an optimal schedule, a network structure can be constructed encompassing all of the solutions which are obtained only by an operation of "one-way change" of the job type from k^{II} to k^I.

The summary of this paper is as follows:

(1) It is shown that the makespan on an arbitrary path from S_ϕ to $S_{\lambda*}$ is strictly monotone decreasing.

(2) The lower-bound of the makespan is obtained for the set of all the schedules generated from an arbitrary S_λ.

(3) An algorithm is developed to solve for an optimal solution for this problem.