 ISSN : 1978-774X

PROBLEM STATEMENT

Given an assembly shop and a set of N final assemblies (each final assembly consists of H_{ij} sub-assembly parts) with corresponding processing times, the problem is to find the optimal production plan in scheduling the different components for machining and assembly so as to minimize total production flow time (makespan). H_{ij} is defined as the number of components or sub-assemblies (sub-jobs) required for meeting the total demand of its direct parent.

MODEL DEVELOPMENT

As stated earlier, the objective of this study is to develop a model and a methodology for minimizing production time of jobs involving both machining and assembly operations in a production shop. In minimizing the total production flow time, technological ordering will specify the order in which each job is processed on various machines, while the solution methodology will determine the sequence of the jobs on the machines for processing.

Fundamental to this study are the assumptions on the production strategy where sub-jobs that are identical are considered as separate nodes as they occur in a bill of material (BOM). A sub-job is defined directly as a sub-assembly part or a component part. The number of sub-jobs (including the final job) is equal to the number of nodes in a BOM or product structure tree. These assumptions are the bases for the development of the mixed integer linear programming (MILP) model. Constraints for the given system are generated based on the given data and the underlying assumptions.

Required Data for Model Development

The data necessary for development of the model include the following:

- A master production schedule (MPS) covering the production period of interest exists.
- Information on the manufacturing batch size for each job and the operation sheet for each component part or sub-assembly that goes into the job. The operation sheet for each component part or sub-assembly type defines the routing and processing time per unit item on each machine in the route.
- A product structure tree or BOM for each finished product exists.

Model Characteristics

In shops that produce multiple assembled products, it is very common to find a given component or sub-assembly (sub-job) used in several end products. It is also common to find a given component or sub-job used at more than one level in a particular end product structure. In this study, when multiple end products are scheduled together for production and the end products use the same component or sub-job, the model treats each component or sub-job for each product as a separate item for scheduling. This is also true when the same component or sub-job is used at more than one level or node in the same end product. In other words, identical components or sub-jobs belonging to one or more jobs are considered as separate nodes as they occur. The objective of the model is to produce a set of sequence over all machines which will minimize total production flow time.

Assumptions

The following assumptions are made in developing the model:

- All parts necessary for manufacturing a final product are produced at the same facility. Parts or sub-assemblies purchased from outside sources are considered as components or raw materials at the target facility. For every final product, the entire demand per period is produced as a single batch