Sequencing problem

When a number of jobs are given to be done and they require processing on two or more machines, the main concern of a manager is to find the order or sequence to perform these jobs. We shall consider the sequencing problems in respect of the jobs to be performed in a factory and study the method of their solution. Such sequencing problems can be broadly divided in two groups. In the first one, there are n jobs to be done, each of which requires processing on some or all of the k different machines. We can determine the effectiveness of each of the sequences that the technologically feasible (that is to say, those satisfying the restrictions on the order in which each job must be processed through the machines) and choose a sequence which optimizes the effectiveness. To illustrate, the timings of processing of each of the n jobs on each of the k machines, in a certain given order, may be given and the time for performing the jobs may be the measure of effectiveness. We shall select the sequences for which the total time taken in processing all the jobs on the machines would be the minimum.

In this unit we will look into solution of a sequencing problem. In this lesson the solutions of following cases will be discussed:

a) n jobs and two machines A and B, all jobs processed in the order AB.

b) n jobs and three machines A, B and C all jobs processed in the order ABC

c) Problems with n jobs and m machines.

15.1.1 Processing of n jobs through two machines

The simplest possible sequencing problem is that of n job two machine sequencing problem in which we want to determine the sequence in which n-job should be processed through two machines so as to minimize the total elapsed time T. The problem can be described as:

a) Only two machines A and B are involved;

b) Each job is processed in the order AB.

c) The exact or expected processing times A1,A2,A3, --- , An ; B1,B2,B3, --- , Bn are known and are provided in the following table

Machine

Job(s)

The problem is to find the sequence (or order) of jobs so as to minimize the total elapsed time T. The solution of the above problem is also known as Johnson's procedure which involves the following steps:

Step 1. Select the smallest processing time occurring in the list A1,A2,A3, --- , An ; B1,B2,B3, --- , Bn if there is a tie, either of the smallest processing times can be selected.

Step 2. If the least processing time is Ar , select the rth job first. If it is Bs, do the sth job last as the given order is AB

Step 3. There are now (n-1) jobs left to be ordered. Repeat steps I and II for the remaining set of processing times obtained by deleting the processing time for both the machines corresponding to the job already assigned.

Step 4. Continue in the same manner till the entire jobs have been ordered. The resulting ordering will minimize the total elapsed time T and is called the optimal sequence.

Step 5. After finding the optimal sequence as stated above find the total elapsed time and idle times on machines A and B as under:

Total elapsed time =

The time between starting the first job in the optimal sequence on machine A and completing the last job in the optimal machine B.

Idle time on machine A =

(Time when the last job in the optimal sequence on sequences is completed on machine B)- (Time when the last job in the optimal sequences is completed on machine A)

Idle time on machine B =

(Time when the first job in the optimal sequences is completed on machine A)
Utility refers to the satisfaction that each choice provides to the decision maker. Thus, utility theory assumes that any decision is made on the basis of the utility maximization principle, according to which the best choice is the one that provides the highest utility (satisfaction) to the decision maker