ABSTRACT

In the **Multiple-Resource Constrained Project Scheduling Problem**, a project consists of N activities numbered from a_1 to a_N, activity a_i has an integer duration $d_i \geq 0$, a set P_i of predecessor activities, and an integer requirement of $r_{ij} \geq 0$ units of the j^{th} resource type for each of the $M \geq 1$ distinct types of resources. At any moment of time, the total number of units of the j^{th} resource type allocated to all the activities taken together cannot exceed the total availability R_j of that resource type. Given d_i, P_i and (r_{ij}, $1 \leq j \leq M$) for each activity a_i, $1 \leq i \leq N$, and the pool of available resources R_j, $1 \leq j \leq M$ the problem is to determine the start time s_i, $1 \leq i \leq N$ of each activity a_i such that the total project duration (makespan) is minimized. It is generally assumed for convenience that the project has two dummy activities, a start activity (Activity a_1) and a finish activity (Activity a_N), which are of zero duration and do not require any resources.

The main focus of this work is the non-preemptive version of the Multiple Resource Constrained Project Scheduling Problem. Two new algorithms which yield exact solutions are presented. The algorithms compare favourably with the best known algorithms particularly for large tightly constrained problems i.e. those with large number of activities, resource types, and where few units of each resource is available. Computational experience has been presented on the set of problems compiled by Patterson [1984], as well as a large number of synthetically generated problems. The concepts are extended to the preemptive version.