# A New Heuristics for the Generalized Assignment Problem

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## Abstract

The Generalized Assignment Problem(GAP) determines the minimum assignment of n tasks to m workstations such that each task is assigned to exactly one workstation, subject to the capacity of a workstation.

In this paper, we presented a new heuristic search algorithm for GAPs. Then we tested it on 4 different benchmark sample sets of random problems generated according to uniform distribution on a microcomputer.

## 1. Introduction

The Generalized Assignment Problem(GAP) determines the minimum assignment of n tasks to m workstations such that each task is assigned to exactly one workstation, subject to the capacity of a workstation. The GAP is different from the ordinarly assignment problem since a task $j$ requires an amount $a_{ij}(\geq 0)$ of the capacity of a workstion i to be assigned in the GAP.

We may formulated the GAP as follows.

$$\text{Minimize } z = \Sigma_{i \in I} \; \Sigma_{j \in J} \; c_{ij} x_{ij} \tag{1}$$

$$\text{s.t.} \quad \Sigma_{i \in I} \; x_{ij} = 1 \qquad \text{for each } j \in J \tag{2}$$

$$\Sigma_{j \in J} \; a_{ij} x_{ij} \leq b_i \qquad \text{for each } i \in I \tag{3}$$

$$x_{ij} = 0 \text{ or } 1 \qquad \text{for each } i \in I, \; j \in J \tag{4}$$

$$I = \{1, \ldots, m\}$$

$$J = \{1, \ldots, n\}$$

Where, n : number of tasks

m : number of workstaions

$a_{ij}$ : resource required by workstation i to do task $j$

$c_{ij}$ : cost of assigning task $j$ to workstion i

$b_i$ : capacity of workstation i

$x_{ij}$ : $\begin{cases} 1, & \text{if task } j \text{ is assigned to workstation i} \\ 0, & \text{otherwise} \end{cases}$

There are many applications of the generalized assignment model which is an important class of network models. Fisher and Jaikumar have developed a method for vehicle routing that is based on a generalized assignment model in which the tasks correspond to items to be delivered and the workstations to trucks. Ross and Soland(1977) have shown certain facility location problems can be converted to the GAPs. Other applications include assigning software development tasks to