# Multiobjective Evolutionary Algorithm Approach for Solving Integer Based Optimization Problems

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## Abstract

Multiobjective Evolutionary algorithms (MOEAs) are often well-suited for complex combinatorial Multiobjective optimization problems (MOPs). Integer based MOPs are prevalent in real world applications where there exist a discrete amount of a component or quantity of an item. Presented here is the application of a building block based MOEA, the MOMGA-II, to a NP Complete problem and real-world application. Excellent results are obtained.

## 1 INTRODUCTION

Over the last few years we have shown the efficiency and effectiveness of our Multiobjective Messy Genetic Algorithm (MOMGA) and MOMGA-II as applied to various unconstrained MOPs [1]. We expand our MOP test suite to include integer based, constrained MOPs. The MOMGA-II is applied to the NP Complete (NPC) knapsack problem and a real-world logistics problem. This algorithm is unique in its explicit manipulation of Building Blocks (BBs) and variable string lengths to find the solution to complex MOPs as compared to other MOEAs.

## 2 INTEGER OPTIMIZATION

Integer optimization problems are a class of real-world problems encountered in industry, science, engineering, and government. In the first MOP utilized, the 0/1 knapsack problem, one has a knapsack to place items of value in, where each item has a particular weight and value associated with it. There is a constraint that the knapsack has a maximum capacity and that only whole items may be placed within the knapsack. The multiobjective formulation of this problem includes an arbitrary number of knapsacks that the overall profit is to be maximized.

The second MOP analyzed here is the advanced logistics problem (MOP-ALP) which is concerned with allocating appropriate resources for use in various tasks. It is a real-world optimization problem with strict equality constraints. This MOP formulation consists of three objective functions to minimize.

## 3 CONCLUSIONS

The results of the MOMGA-II when applied to a NPC and a real-world highly constrained optimization problem illustrate that the MOMGA-II is capable of solving integer based problems, constrained integer based problems and highly constrained integer based problems with strict equality constraints. The MOMGA-II obtains results that are favorable when compared with other well-known MOEAs for the knapsack problem. Having success with the NPC multiple knapsack problem, and the real world MOP-ALP, the MOMGA-II can be applied to other multiobjective versions of NPC problems and real-world problems that map to them.

## References

[1] Jesse B. Zydallis and Gary Lamont. Solving of Discrete Multiobjective Problems using an Evolutionary Algorithm with a Repair Mechanism. In *Proceedings of the 44th IEEE 2001 Midwest Symposium on Circuits and Systems (MWSCAS 2001)*, volume 1, pages 470–473, Dayton, OH, August 2001.

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