UNIVERSITEIT VAN PRETORIA
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Engineering, Built Environment and IT
Department of Computer Science

COS314

Assignment 2

Due 13 May 2023

Background

1. The Knapsack problem is a popular optimization challenge which is similar to the 1 dimensional bin problem. It involves filling a knapsack with a collection of items, each with a weight and value, while keeping the total weight of the items in the knapsack within a given limit and maximizing the total value of the selected items. The problem can be defined as selecting a subset of **n** items with weight $\mathbf{w}_i$ and value $\mathbf{v}_i$ that fit into a knapsack of capacity **W**. The Knapsack problem is categorized as NP-hard, which implies that there is no polynomial-time algorithm that can solve it optimally for all scenarios. However, there are various efficient algorithms and meta-heuristics that can provide acceptable approximate solutions. The Knapsack problem has numerous practical applications, such as in logistics, finance, scheduling, and resource allocation.

Assignment Question- 30Marks

The purpose of this assignment is to compare the effectiveness of applying meta-heuristics to solve instances of this problem, namely a Genetic Algorithm and Ant Colony Optimisation. For the provided problem instances you are to develop a GA and an ACO algorithm to solve the given instances. The results are to be presented in the format of the table provided below.

The code of the 2 algorithms, a readme file indicating how to execute each of the programs and a report must be submitted via the course website. The algorithms must be developed in Java or C++ and must be able to execute without linking to any standard libraries.

The report should include the following

1. GA configuration description
2. ACO configuration description.
3. Experimental setup.(including table of parameters)
4. A table (exemplified below) presenting the results.
5. Statistical analysis of differences in performance need to be presented.
6. A critical analysis of the results.

Please note with respect to 1 and 2 the initial configuration values are usually obtained from literature and then used as starting points to perform parameter tuning. These sources need to be referenced and a justification of the final values used should be presented. A zipped folder containing the problem instances and the known optimums(not to be used in your implementation) accompanies this file.

Table 1: Comparison of ACO and GA on 10 knapsack problem instances

Problem Instance	**Algorithm**	**Best Solution**	**Known Optimum**	**Runtime (seconds)**
f1_ld_kp_10_269	ACO	xxx	xxx	xxx
	GA	xxx	xxx	xxx
f2_l_d_kp_20_878	ACO	xxx	xxx	xxx
	GA	xxx	xxx	xxx
Instance X	ACO	xxx	xxx	xxx
	GA	xxx	xxx	xxx
f10_l_d_kp_20_879	ACO	xxx	xxx	xxx
	GA	xxx	xxx	xxx