



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

COS 790: Hyper-Heuristics and Combinatorial Optimization
Assignment 1: Selection Constructive Hyper-Heuristics
Due Date: 20 August 2018, 23:30

The aim of the assignment is to compare the performance of single point search and multipoint in selection constructive hyper-heuristics and requires you to:

- Implement low-level construction heuristics, first-fit, best-fit, next-fit, worse fit, for the one-dimensional bin-packing problem.
- Implement a tabu search selection constructive hyper-heuristic to solve the one-dimensional bin-packing problem.
- Implement a genetic algorithm selection constructive hyper-heuristic to solve the one-dimensional bin-packing problem.
- Compare the performance of the low-level constructive heuristics, tabu search selection construction hyper-heuristic and genetic algorithm hyper-heuristic.

The definition of the one-dimensional bin-packing problem is provided below.

The Offline One-Dimensional Bin-Packing Problem

The one-dimensional bin-packing problem involves allocating a set of items to bins so that all the items are packed using the minimum number of bins. The bins have a set capacity and usually all the bins have the same capacity. In the offline version of the problem the sizes of the items are known prior to packing while in the online version they are known at the time of packing.

The Scholl benchmark set must be used to test the genetic algorithm (<https://www2.wiwi.uni-jena.de/Entscheidung/binpp/index.htm>) . The known

optimum is specified as part of the benchmark for each of the problem instances. To test and compare the performance of the low-level heuristics and selection constructive hyper-heuristics at least 5 problems from each of the data sets, i.e. Data Set 1, Data Set 2 and Data Set 3, must be used. The EvoHyp toolkit can be used to implement the genetic algorithm hyper-heuristic (<https://sites.google.com/view/evohyp/?authuser=1>).

The report must include:

- A description of the low-level construction heuristics used.
- A description of the tabu search selection construction hyper-heuristic.
- A description of the genetic algorithm construction hyper-heuristic.
- A description of the experimental setup, i.e. parameter values used for the algorithms, problem instances used, technical specifications of the machine used to develop the program and run simulations.
- Perform a minimum of thirty runs, each with a different random number generator seed, for each problem instance for each selection constructive hyper-heuristics. List the best objective value, average objective value and deviation of the best objective value from the optimum over the 30 runs for each problem instance, average runtime.
- Compare the performance of the tabu search and genetic programming selection constructive hyper-heuristics in solving the problem instances in terms of the objective value and runtime.
- Compare the performance of both hyper-heuristics with the low-level heuristics used in solving the problem instances.

Mark breakdown:

Implementation of low-level heuristics: 10

Implementation of tabu search hyper-heuristic: 10

Implementation of genetic algorithm hyper-heuristic: 10

Report: 20

Total: 50