UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Engineering, Built Environment and IT
Department of Computer Science

COS314

Artificial Intelligence

Assignment One

Due: 23 March 2025

Instructions

- A zipped folder containing the data for this assignment is attached.
- Only Java or C++ may be used to complete this assignment.
- The programs must be executable (JAR) and be able to run without linking to libraries via the IDE (in the case of C++). Please note the programs will not be run in IDEs but as a piece of commercial software (marks may be lost if this is not complied with).
- Read-me instructions are to be included.
- NB: Both the Report and Code need to be submitted. One will not be marked without the other.
- Submission is through ClickUP no email submissions will be allowed.
- For evaluation and replication all code must be seeded (Listing 1) and run by initially requesting the seed value and necessary filepath and parameters.

1. Question 30 Marks (Structure and quality of the report is 10 Marks)

This assignment aims to evaluate and compare the performance of two local search algorithms, Simulated Annealing[1] (SA) and Tabu Search[2], in solving instances of the Traveling Salesman Problem (TSP). The report should include the following for each algorithm.

1. Initial solution generation method.
2. Perturbation method.
3. Neighbourhood definition.
4. Acceptance criterion.
5. Stopping criteria.
6. Experimental setup. (algorithm-specific parameters)
7. A table (exemplified below) presenting the results.
8. A critical analysis of the results. An analysis of the algorithm's performance, comparing and contrasting the two algorithms as well as a summary of the findings and any insights gained.

Because of the use of stochastic elements in the algorithms, a minimum of 10 runs should be performed and the best reported. A zipped folder containing the problem instances accompanies this file. For all the problem instances use Node 1 as the start and end of the tour.

Table 1: Comparison of SA and Tabu Search on 5 TSP problem instances

Problem Instance	Algorithm	Seed value	Cost	Best Solution	Runtime
8 Cities	Tabu	xxx	xxx	xxx	xxx
	SA	xxx	xxx	xxx	xxx
12 Cities	Tabu	xxx	xxx	xxx	xxx
	SA	xxx	xxx	xxx	xxx
15 Cities	Tabu	xxx	xxx	xxx	xxx
	SA	xxx	xxx	xxx	xxx
20 Cities	Tabu	xxx	xxx	xxx	xxx
	SA	xxx	xxx	xxx	xxx
25 Cities	Tabu	xxx	xxx	xxx	xxx
	SA	xxx	xxx	xxx	xxx

Listing 1: Example Java seed Code

```
import java.util Random ;
.
.
.
long seed = System.currentTimeMillis();
Random rand = new Random(seed);
System.out.println("Seed Value" + seed);
}
```

References

1 Kirkpatrick, S., Gelatt Jr, C.D. and Vecchi, M.P., 1983. Optimization by simulated annealing. science, 220(4598), pp.671-680.

2 Glover, F., Taillard, E. and Taillard, E., 1993. A user's guide to tabu search. Annals of operations research, 41(1), pp.1-28.