Ant Colony Algorithm to Solve Bank Problem

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**ABSTRACT**

**Keywords**

# Introduction

In today's society, optimisation problems focus on how to allocate resources more efficiently and maximise benefits. For example, in the banking problem, how to ensure that the weight of the bags of money being transported does not exceed the maximum load and the value of the bags needs to be as large as possible.

ACO is a population optimisation algorithm inspired by ants foraging for paths in nature. Ants leave Pheromone on the paths to mark the routes they have explored and choose the paths according to the pheromone concentration so that they can find the optimal route. In this report, I will use Ant Colony Optimization to design a loading scheme for a bank that allows the van to carry more value bags of money without overloading.

The structure of this paper is 1.Introduction2.Literature Review3.Method4.Description of Results5.References

# Literature Review

Regarding the origin of the colony algorithm, in the 1950s the French entomologist Pierre [1] discovered a species of termites that would respond to a certain stimulus, and that this response would produce a new stimulus to the other termites, so that a bond could be established with the other termites. Deneubourg et al. then studied the pheromones produced by ants and how ants track pheromone behaviour. In an experiment known as the ‘double bridge’ experiment, it was concluded that ants would favour the bridge with the highest pheromone concentration, and would eventually converge on the same bridge. [2]

Ant colony algorithm has global search capability in solving bank problem, which can avoid falling into local optimal solution and has a higher probability to find the global optimal solution after many iterations.

In addition to ACO algorithms, there are Dynamic Programming, Greedy Algorithm, Genetic Algorithm, Simulated Annealing.

Dynamic Programming was proposed by mathematician Richard Bellman in the 1950s. [3] Dynamic programming algorithms have high time and space complexity and suffer from memory overflow and slow operation when faced with large-scale bank problems.

Greedy Algorithm is a classical algorithm in combinatorial optimisation capable of solving minimum spanning tree problems.Greedy Algorithm is capable of making locally optimal choices but does not always have a globally optimal solution. [4] So Greedy Algorithm for the knapsack problem, it is difficult to consider the problem comprehensively and will result in a locally optimal solution.

Genetic Algorithm is a method to optimise the puzzle search tool based on the principle of genetic selection, Genetic Algorithm can find out the shortest path by path encoding. [5] But Genetic Algorithm requires more iterations to get the optimal solution with higher complexity and is slow. Also genetic algorithms are more sensitive to the choice of parameters of bank problem and the results obtained will be unsatisfactory.

Simulated Annealing is a probabilistic method proposed by Kirkpatrick, Gelett et al. that can be used to find the global minimum of a cost function that may have multiple local minima. It is inspired from the process of a solid being slowly cooled. Simulated annealing [6] is a stochastic algorithm that gradually reduces the ‘temperature’ to find the optimal solution, and in the bank problem the results may different from run to run depending on the initial temperature and the annealing process, and only approximate solutions may be obtained.

# Method

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# References

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2. Deneubourg, J.-L., Aron, S., Goss, S., & Pasteels, J.-M. (1990). The self-organizing exploratory pattern of the Argentine ant. Journal of Insect Behavior, 3(2), 159-168.
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Discussion and Further Work

Question1: Which combination of parameters produces the best results?

Question 2: What do you think is the reason for your findings in Question 1?

Question 3: How do each of the parameter settings influence the performance of the algorithm?

Question 4: Do you think that one of the algorithms in your literature review might have provided better results? Explain your answer.

1. [↑](#footnote-ref-1)