An Introduction to Ant Colony Optimisation

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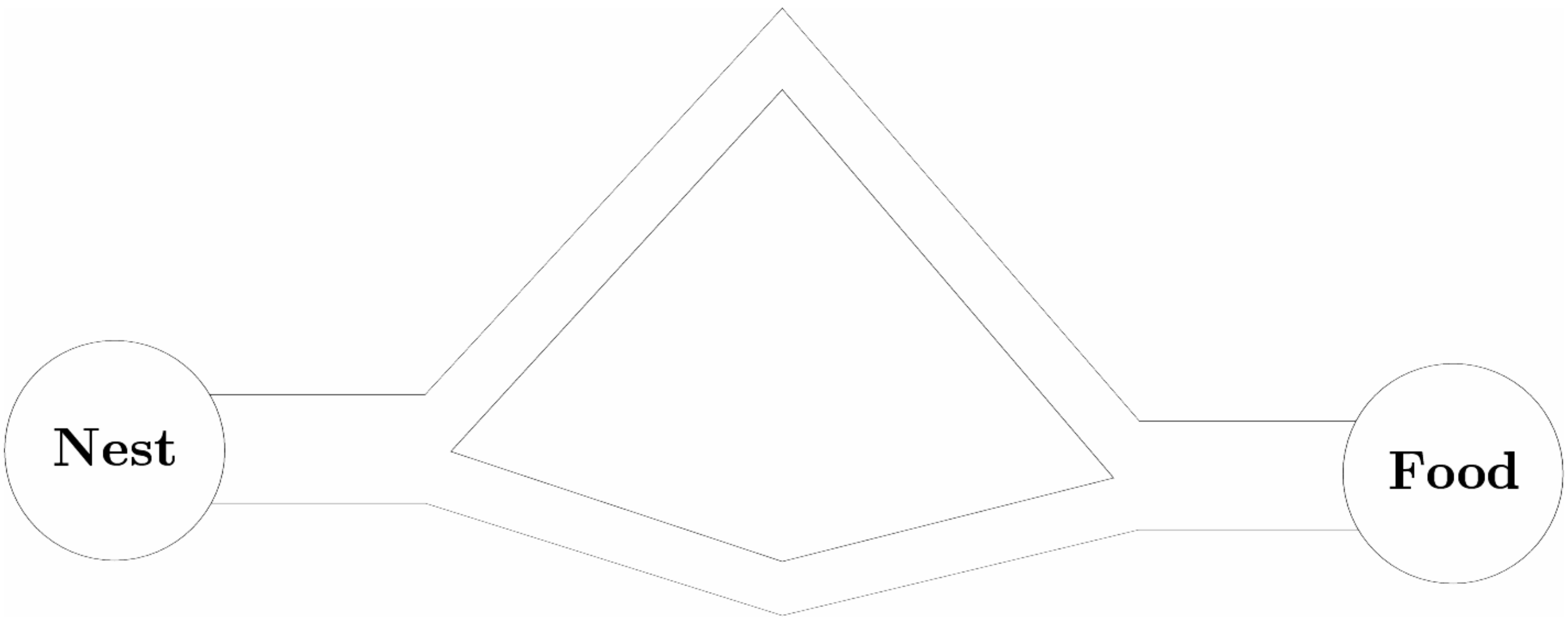
Introduction

- Introduced by Marco Dorigo as a Ph.D. thesis.
- Ideal for finding optimal paths through graphs (e.g. TSP).
- Can be applied to problems that can be reduced to path finding in graphs.

Inspiration

- Ants roam in a random pattern.
- Eventually find food and return it to the colony.
- Whenever an ant walks along a path it deposits pheromones to leave a trail.
- When they find a successful path to the food, subsequent ants will not wonder at random but will follow the pheromone trail.
- The trail evaporates over time and ants lose their attraction to it.
- Trails can evaporate faster if the path is long. The shorter the path, the less evaporation time and the pheromone density is maintained.
- Interestingly evaporation helps avoid premature convergence – even current optimal paths evaporate.

Inspiration

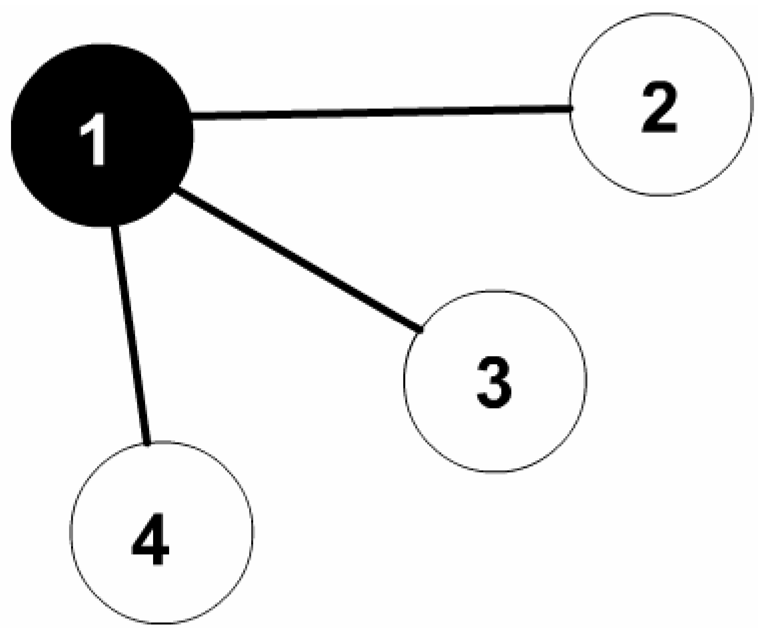


Dynamic

- Unlike GAs, ACO techniques can work on a dynamically changing graph.
- The algorithm is left running.

Implementation

- Very good, explanation can be found at :
  - http://www.codeproject.com/useritems/Ant_Colony_Optimisation.asp
  - Read it!
- Initial state:



Next Node	% chance
2	33.33333%
3	33.33333%
4	33.33333%

Table 3.1 - Pheromone table for node 1

Algorithm to Simulate Deposit and Evaopration

- Note 2 (in diagram before) is the final destination.
- It takes 1 hop to get there.
- Divide 100 by 1 hop = 100%
- Add the 100% to the current probability of note 2 (33.333%) = 133.333%.
- Add the other probabilities (33.333 and 33.333), 133.333+33.333+33.333=~200.
- Calculate the ratio for node 2 = 100/200 = 0.5.
- New probability of node is current value multiplied by ratio:
  - Node 2 = 133.333 * 0.5 = 66.666%.
  - Node 3 = 33.333 * 0.5 = 16.666%.
  - Node 4 = 33.333 * 0.5 = 16.666%.