AI23 Coursework 1 Deadline 9am March 17 2006

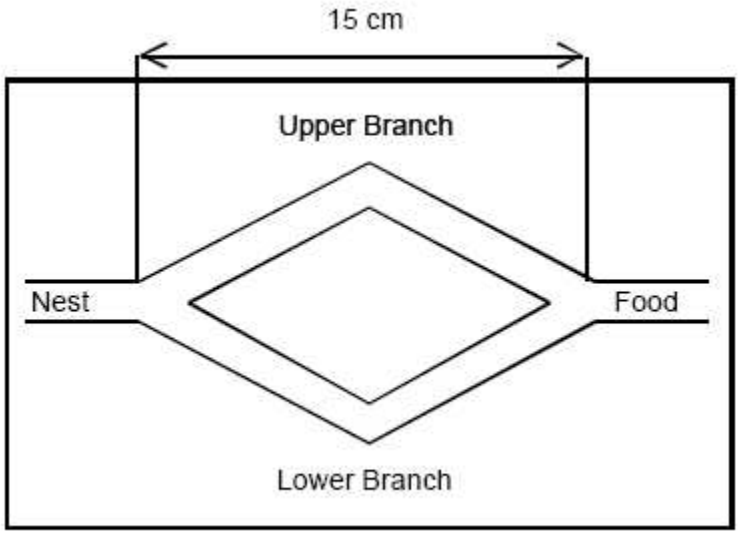
The aim of this coursework is to gain familiarity with ideas taught in the lectures on swarm intelligence, and to experiment with a simulation modelling the behaviour observed in actual ants.

In the lectures, it was discussed how ants laid pheromone trails and as a result were able to find short routes to food sources. In particular an experiment by Deneubourg and colleagues was discussed.

A review of this material can be found in the first two pages of this article:

http://citeseer.ifi.unizh.ch/cache/papers/cs/29622/http:zSzzSziridia.ulb.ac.bezSz~gdicarozSzPaperszSzalife.pdf/dorigo98ant.pdf

The task in this coursework is to simulate this experiment. The experimental set up is depicted thus:



The parameters to your simulation should be:

1. the length of each branch (15cm in the actual experiments with real ants in the above picture, but your simulation will model space discretely, i.e. each branch will consist of a sequence of cells, which may contain ants; thus the length will be the length of this sequence.
2. the number of ants leaving the nest at each time step in the simulation
3. the amount by which the pheromone in each cell evaporates at each time step.

Your simulation should take the following form:
For each time step:

- compute how many ants should leave the nest

- for each ant in the simulation, move them one cell ahead in the direction they are travelling, or if there is a choice of directions, move in the direction with the greatest pheromone; if the ant reaches the food it should reverse its direction (there is no need to model picking up food, or decreasing the amount of food at the food source).
- If an ant returns to the nest it can be deleted from the simulation.

You may either write a program from scratch to perform this simulation or use an existing tool, e.g. the Starlogo system referred to in the lectures. You may wish to implement a simple graphical interface so that you can visualise the simulation; however it is sufficient to output statistics regarding the number of ants travelling along each path and the pheromone levels (not necessarily at every time step, but at every n steps, for some suitable choice of n, depending on the path lengths).

Run your simulation on a model with two equal length paths, and with two unequal length paths. Initially it is suggested you choose no evaporation and 100% probability of choosing the strongest pheremone path.

What to hand in:

- The code of your program.
- A report describing the results of simulations and your conclusions. You may wish to experiment with varying numbers of ants, path length, pheromone evaporation rate and probability of following the strongest pheromone path. The report need not be longer than two pages, excluding any screen dumps/log files you wish to submit as appendices. Your report must be in PDF format.

You should use the SIS submit system.

This coursework is worth 15% of the module total marks. A pass mark can be obtained from a program which performs the simulation in the two scenarios (equal paths, unequal paths) and a report which describes the simulation and the results obtained and evaluates the results. Higher marks will result from experimenting with different parameter settings, and a more comprehensive evaluation.

Starlogo

If you wish to use the Starlogo system, you may download it yourself from http://education.mit.edu/starlogo/, or you can find it on the school linux systems in ~ai23/starlogo-2.2
To run the system you can just type

```
sh ~ai23/starlogo-2.2/starlogo-unix
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