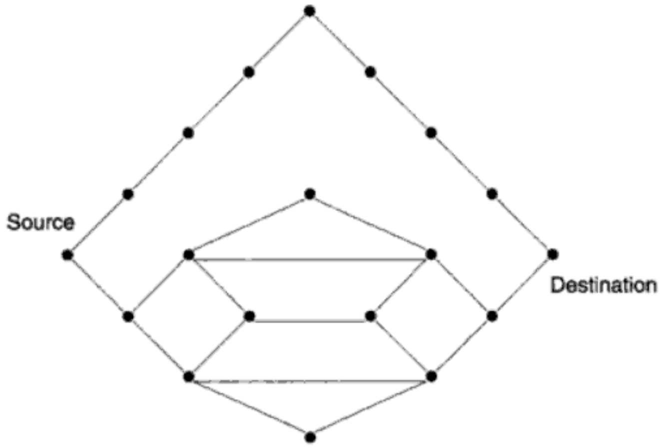
GAGP Tutorial 6 (week 8) Ant Colony Optimisation

1. Consider the following (very small) TSP:
   d(A,B) = 2, d(A,C) = 3, d(A,D) = 5, d(B,C) = 3, d(B,D) = 3, d(C,D) = 4.
   What is the optimal (shortest) tour? How many different tours are possible? How many tours are possible with a TSP containing N cities?
   How long does it take at least to solve the above problem by an ant system? Assume a convergence probability of 50% and establish an (possibly trivial) upper bound based on the assumption of a minimal pheromone level at each link of the graph.



2. The figure above shows an example from the ACO book by Dorigo and Stuetzle. What results do you expect for an ant colony algorithm that does not use taboo lists (except for inhibition of immediate return to the previous node)?
3. Assume that ants are allowed to lay pheromone on a path at every time step, so that the pheromone update rule is applied at each time step. Come up with a combination local/global updating scheme that encourages exploration and exploitation– consider what parameters influence this.
4. Discuss the application of ACO to the eight-queens puzzle. This puzzle is the problem of putting eight chess queens on an 8×8 chessboard such that none of them are able to capture any other using the standard chess queen's moves, cf. http://en.wikipedia.org/wiki/Eight_queens_puzzle.
5. How would you apply ACO to finding the cheapest way to fly from Edinburgh airport to Bora Bora airport?
6. Computer exercise: Run the standard ACO on the travelling salesperson problem with N cities. You may use code from http://www.aco-metaheuristic.org/aco-code/ or elsewhere or partially reuse your code from the 1st assignment. Start with n_{ants}=N, alpha=1, beta=2, rho=0.75. How can you influence the quality of the stationary solution. Consider the standard deviation of the tour length over the ants during one iteration.