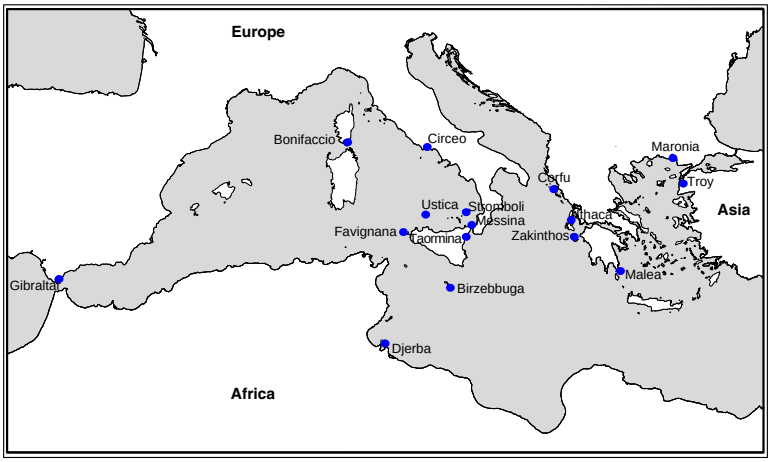
This assignment covers Modules 1–2. It is due on Tue, 1 Feb 2005 at the beginning of class.

Problem 1 (Problem solving; 2+2+2+3=9 marks)

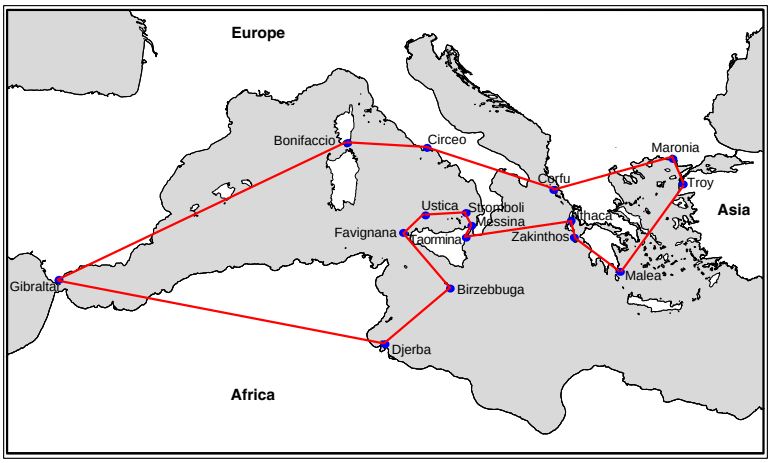
(a) Consider the following Euclidean TSP instance (for the purpose of this problem we revert to the ancient belief that the surface of the earth is perfectly planar):



Specify a result obtained from the Nearest Neighbour Heuristic on this instance.

(b) Given an arbitrary TSP instance G, does the Nearest Neighbour Heuristic (as defined in Section 1.4 of SLS:FA) always return the same solution, that is, does G have a uniquely defined nearest neighbour tour? (Justify your answer.)

(c) Show a 2-exchange neighbour of the following candidate solution of the TSP instance from part (a):



(d) For a TSP instance with n vertices and a complete edge relation (*i.e.*, there is an edge between any pair of vertices), how many 2-exchange neighbours are there for any round trip? (Justify your answer.)

Problem 2 (Problem solving; 3 marks)

Show formally that Iterative Improvement and Randomised Iterative Improvement can be seen as special cases of Probabilistic Iterative Improvement.

Problem 3 (Knowledge test; 1+1+1+1 marks)

Briefly explain the difference between:

(a) Randomised Iterative Improvement and Probabilistic Iterative Improvement;

(b) Variable Depth Search and Variable Neighbourhood Descent;

(c) Dynasearch and Dynamic Local Search;

(d) evaluation functions and objective functions.

(Focus on the key differences. Your answers should comprise at most two sentences for each part.)

Bonus Problem (Problem solving; no marks, just good karma)

(a) Assume that you have a procedure that solves the decision variant of the Graph Colouring Problem (GCP). Show how this procedure can be used for efficiently solving the search variant of GCP (*i.e.*, for finding a valid colouring of the given graph). Your argument should be as precise as possible.

(b) What does the solution to part (a) prove about the complexity of the search variant of GCP?