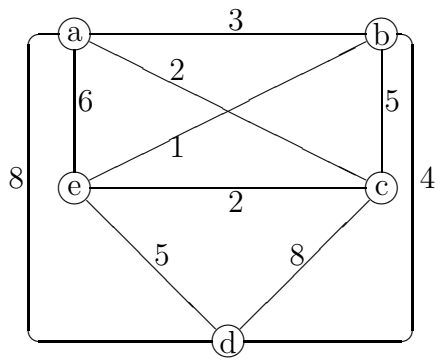
T-79.4201 **Autumn 2006**
Search Problems and Algorithms
Tutorial 4, 12 October
Problems

1. Simulate the behaviour of the Lin–Kernighan 2-opt heuristic on the TSP instance below (this is the same instance as used in Problem 1 of last week's tutorial), starting with the initial candidate route *abcde*.



2. Consider the MAX CUT optimisation problem discussed in Problem 2 of last week's tutorial. Write down in pseudocode a Simulated Annealing method for optimising the objective function of this problem. Indicate in particular what is the neighbourhood relation you are using for the candidate solutions. Note also that MAX CUT is a maximisation problem, not minimisation as assumed in the general presentation of Simulated Annealing given at the lectures.

3. Consider the simulated annealing approach to solving the MAX CUT problem, as discussed above. What kind of cooling schedules would the simulated annealing convergence theorem presented at this week's lecture suggest in the case of a 3-regular input graph with n nodes? (3-regular $\equiv$ every node has exactly 3 neighbours.)

4. Draw the search space corresponding to the 3-SAT formula

   $$(x_1 \vee x_2 \vee x_3) \wedge (\bar{x}_1 \vee x_2 \vee x_3) \wedge (x_1 \vee \bar{x}_2 \vee x_3) \wedge (x_1 \vee x_2 \vee \bar{x}_3) \wedge (\bar{x}_1 \vee \bar{x}_2 \vee x_3)$$

   as a cube, and mark down at the corners of this cube the values of the objective function indicating the number of unsatisfied clauses at each point (= truth assignment). Trace the progress of a WalkSAT search with $p = 0$ along the corners of the cube, starting at initial point $(x_1, x_2, x_3) = (0, 0, 0)$.