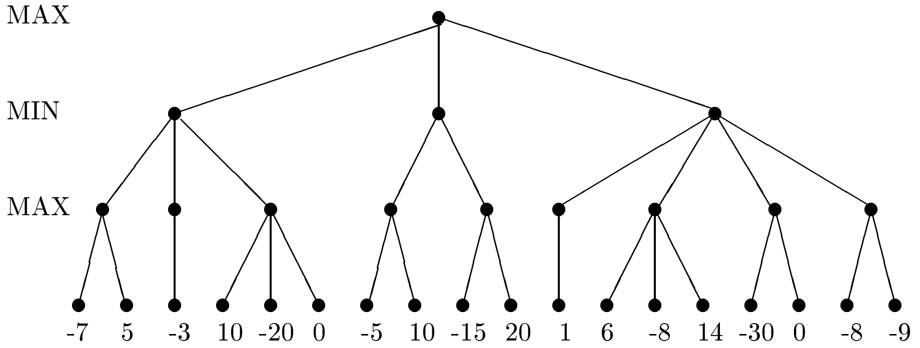
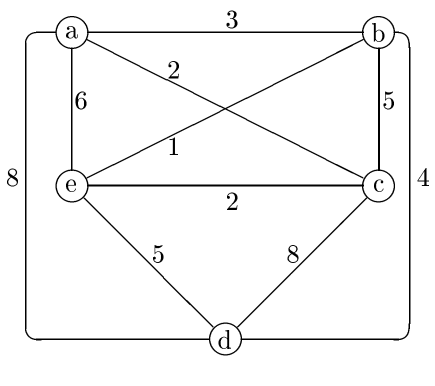
Data Structures and Algorithms 2, Fall 1998

Problem Set 4 (30 Nov – 2 Dec)

1. Determine the payoff value of the following game tree for the first player, using the $\alpha - \beta$ pruning heuristic (p. 79 of the lecture notes).



2. Simulate the behaviour of the Lin–Kernighan 2-opt heuristic (p. 83 of the lecture notes) on the TSP instance below, starting with the initial candidate route *abcde*.



3. Determine an optimal TSP route for the graph of Problem 2 using the *branch-and-bound* method presented on p. 81 of the lecture notes.

4. The NP-complete (i.e., difficult) PARTITION problem is defined as follows: given a set of $2n$ nonnegative integers $U = \{x_1, \ldots, x_{2n}\}$, is there a subset $S \subseteq U$ of size n, such that the sum of the numbers in S is exactly half the sum of all the numbers in U? The problem can be reformulated as a minimization problem by taking as the cost of a candidate solution S to be

$$c(S) = \left| \sum_{x_i \in S} x_i - \frac{1}{2} \sum_{x_i \in U} x_i \right| .$$

The original decision problem now has answer "yes" if and only if there is a subset $S \subseteq U$ such that $c(S) = 0$.

Implement, on your favorite computer system, one of the following three methods to solve this problem for a given fixed value of n: (a) iterated local search (from randomly chosen initial solutions), (b) simulated annealing, (c) some variety of genetic algorithm. Experiment with different parameter settings.