TU Clausthal

Department of Informatics

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Artificial Intelligence

– Sheet 2: Search –

Date: 13. April 2011

Points:

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Group / Tutor:

Name(s) & Matr. no.:

Exercise 1 (4 Points, Optimality of Uniform-cost - and Breadth-first search)

Prove that *uniform-cost search (with arbitrary step costs)* and *breadth-first search with constant step costs* are **optimal** when used with the `Graph-Search` algorithm.

Exercise 2 (6 Points, Comparison of search algorithms)

Consider a finite tree of depth $d+1$ and branching factor b. Suppose the shallowest goal node is at depth $g \leq d$ (g is given and fixed). What is the **minimal** and **maximal** number of nodes that might be generated by

(1) depth-first search with depth bound equal to d.

(2) breadth-first search?

(3) depth-first iterative deepening search?

Exercise 3 (6 Points, Best-first search)

We consider Best-first search with Tree-search as underlying search engine. We assume as usual a finite branching factor and that step costs are higher than a fixed constant.

(a) **Prove or disprove** the following two statements with respect to : (1) Best-first search is optimal; (2) best-first search is complete.

(b) We now consider Best-first search together with an *admissible* heuristics; i.e. $f(n) := h(n)$ where h is admissible. Reconsider the statements in (a).

Exercise 4 (4 Points, A* search)

Trace the operation of A^* search applied to the problem of getting to *Bucharest* from *Lugoj* using the *straight-line distance heuristic* (the state space and the heuristic are given in Example 2.6). That is, show in which order nodes are *expanded*, and state the costs of the actual optimal path.

Exercise 5 (3 Points, Admissibility and Graph-search)

Show that admissibility of h is insufficient to ensure that A* is optimal together with Graph-search.

Exercise 6 (6 Points, consistency and admissibility)

Let h be a heuristic function and $f(n) = g(n) + h(n)$ the evaluation function of A^* search. **Prove or disprove** the following statements (give proofs or counterexamples):

1. Admissibility of h implies consistency of h.
2. Consistency of h implies admissibility of h.

To be submitted:

27. April 2011
before class