TU Clausthal

Department of Informatics

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Artificial Intelligence

– Sheet 3: Advanced Search and Learning –

Date: 26. April 2011

Points:

_____ of 24

Group / Tutor:

Name(s) & Matr. no.:

Exercise 1 (2 Points, Optimality of Uniform-cost - and Breadth-first-search)

Show a state space with constant step costs in which *Graph-search* using Iterative-deepening-search finds a **suboptimal** solution.

Exercise 2 (4 Points, Optimality of A* using Graph-search)

Prove Theorem 2.12 formally: A* is optimal using *Graph-search*, if the heuristic function h is consistent.

Exercise 3 (2 Points, Admissibility and Graph-search)

Show that admissibility of h is **does not ensure** that A* is optimal together with Graph-search.

Exercise 4 (8 Points, Decision list)

Consider the following two definitions:

(Canonic DL) A decision list is called *canonic* if, and only if, each test consists of a *disjunction* of attributes (or a single attribute, or $\perp$) and the answers of the tests are *alternating* (where the first answer is *no*).

(Monotonic DL) A decision list is called *monotone* if, and only if, each test consists of a single attribute.

(a) Consider the following decision list:

$$(y_1 \vee y_4; no) \rightarrow (y_2 \vee y_9; yes) \rightarrow (y_5 \vee y_{10} \vee y_{11}; no) \rightarrow (y_8; yes) \rightarrow no$$

1. (1 points) Is this list canonic? Why or why not?
2. (1 points) Transform the list into an equivalent monotone list!

(b) Assume that n attributes are available and prove the following:

1. (3 points) Every *canonic* decision list can be transformed into a *monotone* decision list **with at most n tests**.
2. (3 points) Every *monotone* decision list can be transformed into a *canonic* decision list **with at most $n+1$ tests**.

To be submitted:

11. May 2011
before class

Exercise 5 (8 Points, Decision-tree-learning)

Consider the following examples:

Number	Burger	French fries	Coke	Sick
1	No	Yes	No	Yes
2	No	Yes	Yes	Yes
3	No	Yes	No	Yes
4	Yes	Yes	Yes	Yes
5	Yes	Yes	No	No
6	No	No	Yes	No
7	Yes	No	No	No
8	No	No	Yes	No

(a) (4 points) Which attribute is **the best** to start with and why? Use information theory!

(b) (3 points) Build the decision tree starting with the best attribute! Assign all the examples to their respective leaf nodes and classify them.

(c) (3 points) Build a decision tree starting with a *first* attribute **that is different** from the one chosen in (b). (That is, *french fries* if the tree in (b) starts with *burger* and *burger* if the tree starts with *french fries* or *coke*.)

Assign all the examples to their respective leaf nodes and classify them.

(d) (2 points) Consider the following menues: Menu 1 (Burger and Coke) and Menu 2 (the "empty" menu).

Which of these menues would you recommend according to the tree constructed in (a) (respectively, in (b))? Explain why!

(e) (2 points) Assume that a decision tree is constructed only from these examples which cause illness. Is the resulting tree useful? Why or why not?