Course: **010 595 002 - ARTIFICIAL INTELLIGENCE**

Lecturer: Jan VORACEK Examination date: 31.1.2003

Notes: *a) Students can use an English dictionary and calculators. Any other tools or literature are disabled*
b) Type, please, your answers in English

Example 1

Let's have the following set of logical predicates:

```
hassize(bluebird, small)
hascovering(bird, feathers)
hascolor(bluebird, blue)
hasproperty(bird, flies)
isa(bluebird, bird)
isa (bird, vertebrate)
```

Represent such a formalized knowledge using:

a) Natural language, i.e. just as standard English sentence.
b) Semantic network.

Example 2

a) Formulate at least 2 admissible heuristics for 8-puzzle (3x3 grid containing 8 "sliding" numbers and one hole).

b) Compare these heuristics on a sample distribution of numbers (i.e. start from an arbitrary state of 8-puzzle and realize full set of subsequent moves to the depth +3 from this starting configuration) using A* searching technique and justify which one is better.

Example 3

Knowledge about lecturers and students is represented as follows:

```
lectures(jeff,611).                    studies(fred,611).
lectures(ken,621).                     studies(jack,621).
lectures(claude,641).                  studies(jill,641).
lectures(graham,642).                  studies(jill,642).
lectures(ken,643).                     studies(henry,642).
                                       studies(henry,643).

relation(Teacher,Subject,Student) :- lectures(Teacher,Subject), !, studies(Student,Subject).
```

What is the full response, i.e. the answer including all alternatives for the next two queries:

a) `relation(ken, Subject, Student).`
b) `relation(ken,Subject,henry).`

Example 4

a) Suggest and justify at least one technique how to "properly" formulate rules for a fuzzy expert system. Properly means that all input and output variables are incorporated in a reasonable way according to their significance, the state space of the problem is properly covered and the amount of designed rules is still acceptable, i.e. the whole task is understandable and easy to analyze.

b) Assign single entities from the following list as a feature of either forward or backward chaining. Use 2-column table notation:

1)	From present to future	*(this holds for forward chaining [FC] or backward chaining [BC]?)*
2)	Follows from the facts	*(FC or BC?)*
3)	Goal driven, top-down reasoning	*(FC or BC?)*
4)	Explanation is facilitated	*(FC or BC?)*
5)	From antecedent to consequent	*(FC or BC?)*
6)	Supports the hypotheses	*(FC or BC?)*

Example 5

a) Which AI technique we were talking about could be characterized with the figures below?
b) Write everything relevant what you know about this technique.