

Knowledge Representation and Reasoning – exam June 4th 2020, 9-11 a.m.

IMPORTANT:

You must work individually. Please pay attention: similar solutions will not be considered at all (even if predicates, variables etc. are renamed).

The solved topics will be sent from your institutional addresses on s.unibuc.ro (or my.fmi.unibuc.ro) to my address cidota@fmi.unibuc.ro until 11.30 (take pictures of the handwritten sheets and create a pdf). Any address other than an institutional one will not be accepted (you will be ABSENT in the catalog).

If you have technical problems with creating the pdf in the required time, send me the pictures until 11.30, and afterwards you will send me the pdf when you manage to make it.

I will send you a confirmation email when I receive your paper.

SUBJECTS

I.

The following KB is given:

1. Anna is a student.
2. Students are people.
3. Paul is a student representative in the faculty council.
4. All student representatives in the faculty council are students.
5. Students consider a representative to be a friend or they do not know him/her.
6. People criticize only those who are not their friends.
7. Anna knows Paul.

8. (Question) Anna does not criticize Paul

- a) Represent 1.-7. in FOL, using a vocabulary that you will define.
- b) Prove that 8. is logically entailed from 1.-7., by applying Resolution.

II.

Using rules in production systems, solve the following problem:

We are given an array of numbers in ascending order, the length of the array and another number.

Insert the number in the initial array so that the resulting array numbers are still in ascending order ("direct insertion" procedure).

Example: the number: 4

The initial array: (1,3), (2,5), (3,9) $n=3$ (n is the length of the array)
(the pairs represent (position, value) in the array – you will represent them in the working memory in whatever format you want)

The output array: (1,3), (2,4), (3,5), (4,9) $n=4$
(obs. The order of the pairs is not important in WM– the positions and values are important).

Indicate the initial working memory, the final working memory, how the rules are applied (and conflict resolved if any) and how the working memory changes for the first 3 loops of the system operation on the example above.

III.

We are given the following rules:

1. If learning effort is high or subjects are easy then grade is high.
2. If learning effort is moderate then grade is good.
3. If learning effort is not high and subjects are difficult then grade is low.

The learning effort, subjects and the grades are represented by numbers on a 10-point scale.

Which are the base functions in this example?

Choose/draw a degree curve for each predicate in the rules (high, moderate, ...)

Given the values for learning effort and subjects, compute the grade (based on the degree curves that you choose for the vague predicates and using the three rules above).

Example: learning effort =4, subjects (difficulty) =6, grade=?

Note: Computations should be approximate; just prove that you understood the algorithm – you have to draw the degree curves and the way you combine them to get the result.