

First Exam

Logic Programming, LVA 703113

January 29, 2018

Name:

The exam consists of 5 exercises with a total of 100 points. Please fill out your name and credentials *before* you start the exam. Lecture notes, text books, or smart devices like IBM's Watson are neither allowed nor necessary.

1	2	3	4	5	Sum
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0-49:	5	50-59:	4	60-74:	3	75-89:	2	90-100:	1
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1. Consider the following type definition of natural numbers:

`is_number(0).`
`is_number(s(N)) :- is_number(N).`

– Prove that this definition is *correct* with respect to the set $M := \{s^n(0) \mid n \geq 0\}$. (10 pts)

– Prove that this definition is *complete* with respect to the set M . (10 pts)

2. Recall the following inductive definition of Boolean expressions: (i) 0, 1 und variables are Boolean expressions, if E and F are Boolean expressions, then

$$\sim(E) \quad (E \cdot F) \quad (E + F),$$

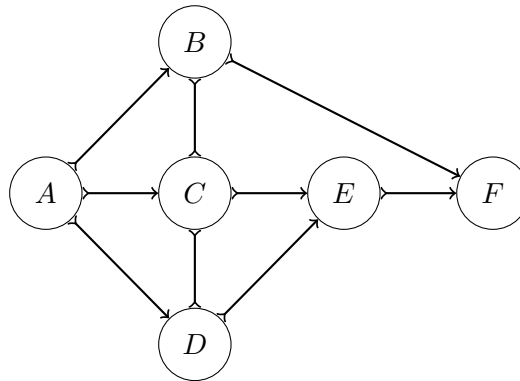
are Boolean expressions.

– Represent this definition as a (simple) context-free grammar (over the variables x_1, x_2, x_3). (5 pts)

– Write a DCG that parses a Boolean expression (over the variables x_1, x_2, x_3) and builds an expression tree for the parsed expression. (10 pts)

– Give an improved implementation that takes the following precedence into account, so that brackets can (but need not) be partially dropped: $\sim > \cdot, +$. Furthermore, allow blanks in expressions. (5 pts)

3. Consider the following dependency graph of six tasks. Here the edge between B,C and C,D denote that these two task must not be scheduled at the same time.



Implement a predicate `plan(Xs)`, succeeding, if Xs denotes a valid sequence of all task.

`:- plan(Xs), Xs = [1,2,3,2,4,5].` (20 pts)

4. Implement a simple profiler for monotone logic programs; applied to a goal G , the profiler should return the maximal depth of the proof tree of G . Here the depth of the proof tree T is the number of nodes (except those labelled with **true**) in the longest path starting in the root of T . Refrain from using cuts. (20 pts)

father (andreas , boris).

:- profile (father (_ , _) , N) , N=1.

5. Determine whether the following statements are true or false. Every correct answer is worth 2 points, every wrong answer -1 points. (The worst that can happen is that you get zero points for this exercise.) (20 pts)

statement	yes	no
An complex query is a conjunction of goals, denoted as :- A1, A2, ..., An.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Data management is handled via unification in Prolog, that is, unification is used to handle e.g. (i) assignments, (ii) parameter passing, (iii) read/write access to records.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
A proof tree represents <i>one</i> successful or unsuccessful inference in the search tree, combining <i>all</i> possible selection functions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Consider the standard implementation of append/3. Then any call to append terminates iff the second argument is a complete list.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
A Prolog clause is called <i>iterative</i> if it has one recursive call and zero or more calls to system predicates that appear before the recursive call.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
A cut fixes all choices between (and including) the moment of matching the rule's head with parent goal and the cut. If backtracking should reaches the cut, then the cut succeeds and the execution is continued with the last choice made before the clause containing the cut.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
?-op(180, xfy, [imp, =>]). asserts that the operators imp and => are binary right-associative operators.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The explicit constructor for difference structures should be removed, if time or space efficiency is an issue.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
maplist(Goal,List) is true if Goal can successfully be applied on all elements of List.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Prolog is the only language that allows the efficient manipulation of meta-interpreters.	<input type="checkbox"/>	<input checked="" type="checkbox"/>