Information page for written examinations at Linköping University

Examination date	2013-03-22
Room (1) If the exam is given in different rooms you have to attach an information paper for each room and mark intended place	TERE & TER3
Time	14-18
Course code	TDDD08
Exam code	TEN1
Course name **Exam name**	Logikprogrammering Skriftlig tentamen
Department	IDA
Number of questions in the examination	9
Teacher responsible/contact person during the exam time	Ulf Nilsson
Contact number during the exam time	1935/076 8601935
Visit to the examination room approx.	15
Name and contact details to the course administrator (name + phone nr + mail)	Carita Lilja, 1463, Carita Lilja@liu.se
Equipment permitted	Inga/None
Other important information	
Which type of paper should be used, cross-ruled or lined	Valfritt /Any
Number of exams in the bag	7

Exam in TDDD08 LOGIC PROGRAMMING

Friday 22 March, 2013, 14:00–18:00, Room TERE/TER3

No means of assistance (inga hjälpmedel)!
Grading will rely on the following limits (out of max 36):

Grade	3	4	5
Points	≥ 18	≥ 24	≥ 30

Ulf Nilsson can be reached on mobile 076–8601935 during the exam.
You may answer in English or in Swedish as you prefer.
REMEMBER TO GIVE MOTIVATIONS TO ALL ANSWERS!!!

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1. Determine which of the following pairs of terms that are unifiable, and provide the mgu in case there is one:

```
| ?- p(f(X),X,f(Y)) = p(Y,f(Z),Z).
| ?- p(f(X),f(Y),X) = p(Z,Z,W).
| ?- p(X1,X2,X3) = p(f(X2,X2),f(X3,X3),a).
| ?- [X,Y|X] = [f(Z),X,X].
```

(4 points)

2. Assume that the standard definition of `append/3` is given:

```
append([], Xs, Xs).
append([X|Xs], Ys, [X|Zs]) :- append(Xs, Ys, Zs).
```

Define each of the following relations using exactly one definite clause (i.e. you are not allowed to use disjunction or negation):

`last(X, List)`	`X` is the last element in `List`.
`member(X, List)`	`X` is a member in `List`.
`copies(List)`	`List` contains several occurrences of some element.
`prefix(L, List)`	`L` is a prefix of `List`.

(4 points for reasonable solutions)

3. Assume that we have an alphabet without function symbols containing the constants $\{a, b, c, d\}$ and the predicate symbols $\{p/1, q/2\}$. Let $\Im$ be the Herbrand interpretation:

$$\{p(a), p(b), q(a,a), q(a,b), q(a,c), q(a,d), q(b,b), q(c,b)\}$$

Which of the following formulas are true in $\Im$?

(4 points)

7. Every definite program P has a least Herbrand model M_P. Let $\Im$ be a Herbrand interpretation of P such that $M_P \subseteq \Im$. Is it true that $\Im$ must be a Herbrand model of P? Provide a proof or a counter-example.

(4 points)

8. Write a Prolog program that defines a predicate `between(X,Y,Z)` which holds if the arguments are integers and $\texttt{X} \leq \texttt{Y} \leq \texttt{Z}$. Given the goal `:- between(1,N,5)` the program should generate (one-by-one) all integers in the closed interval $1-5$.

(4 points for a reasonable program)

9. A Datalog program P is a definite program without any function symbols. That is, terms are either constants or variables. Show that there must be some natural number n such that

$$T_P^n(\emptyset) = T_P^{n+1}(\emptyset).$$

(4 points)