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CSI2120 Programming Paradigms

MIDTERM EXAM

Length of Examination: 75 minutes

February 11, 2014, 13:00

Professor: Jochen Lang

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Family Name: _____

Other Names: _____

Student Number: _____

Signature _____

You are allowed one single-sided letter-sized sheet of notes.

At the end of the exam, when time is up: Stop working and close your exam booklet. Remain silent.

Question	Marks	Out of
1		2
2		3
3		2
4		4
5		5
6		2
7		6
Total		24

_____

Question 1 [2 marks]

Given the following program:

```
postIt([]).
postIt([c|R]):- postIt(R), !, nl.
postIt([X|R]):- postIt(R), write(X).
```

What will be printed as response to the following query?

```
?- postIt([a,b,c,d,e]).
```

```
ed
ba
true.
```

_____

Question 2 [3 marks]

Complete the predicate negCount below such that it counts the negative numbers in a list, e.g.,

```
?- negCount([0,4,-3,-1,6,-7], N).
N = 3
```

Note: You are not allowed to change the order of the following rules.

```
negCount([],0).




negCount([X|L],N) :- X<0, negatif(L,N1), N is N1+1.

negCount([X|L],N) :- X>=0, negCount(L,N).


```

_____

Question 3 [2 marks]

The following predicate q3 below is designed to operate on binary trees:

```
q3(t(V, nul, nul), 0).
q3(t(V, Q, nul), 1).
q3(t(V, nul, Q), 1).
q3(t(V, Q1, Q2), T) :- q3(Q1, T1), q3(Q2, T2), T is 1+T1+T2.
```

What value for T is obtained with the following query?

```
?- q3(t(4,
            t(2,
                nul,
                t(3, t(1,nul,nul), t(9,nul,nul))),
            t(7, t(5, nul, t(6, nul, nul)),
                t(9, t(1,nul,nul), t(9,nul,nul)))),T).
```

T=5

_____

Question 4 [4 marks]

The following facts describe which license or permit is held by whom. The list includes driving licenses, fishing permits and licensed weapons.

```
permitted(robert,fishing).
permitted(jochen,driving).
permitted(paul,fishing).
permitted(jean,weapons).
permitted(jean,driving).
permitted(sam,weapons).
permitted(sam,fishing).
```

a) Give a query which finds a person who is **not** permitted to drive.

```
?- permitted(P,_),\+permitted(P,conduire).
```

b) List in order **all solutions** found by the following query.

```
?- permitted(X,Y),permitted(X,Z),Y\==Z.
```

X = jean,
Y = weapons,
Z = driving ;
X = jean,
Y = driving,
Z = weapons ;
X = sam,
Y = waepons,
Z = fishing ;
X = sam,
Y = fishing,
Z = weapons ;
false.

_____

Question 5 [5 marks]

a) Given the following Prolog program

```
p(X) :- b(X), c(Y).
p(X) :- a(X).
c(X) :- d(X).
a(1).
a(2).
a(3).
b(4).
b(5).
d(6).
d(7).
```

Draw the complete Prolog search tree for the following query (clearly mark the solutions found and the **order** in which they are found).

```
?- p(X).
```

```
X = 4 ;
X = 4 ;
X = 5 ;
X = 5 ;
X = 1 ;
X = 2 ;
X = 3.
```

_____

Question 5 (continued)

b) List the solutions which are found by the same query when a Cut is added as below:

```
p(X) :- b(X), !, c(Y).
p(X) :- a(X).
c(X) :- d(X).
a(1).
a(2).
a(3).
b(4).
b(5).
d(6).
d(7).
```

```
X = 4 ;
X = 4.
```

c) List the solutions which are found by the same query when a Cut is added as below:

```
p(X) :- b(X), c(Y).
p(X) :- a(X).
c(X) :- d(X).
a(1).
a(2):- !.
a(3).
b(4).
b(5).
d(6).
d(7).
```

```
X = 4 ;
X = 4 ;
X = 5 ;
X = 5 ;
X = 1 ;
X = 2.
```

_____

Question 6 [2 marks]

Which of the predicates below works correctly? The predicate is to substitute all elements of the list equal the first argument with the second argument. For example:

```
?- subElement(apple, orange, [apple, celery, pear, pear, apple, raisin],L).
     L = [orange, celery, pear, pear, orange, raisin]
```

a)	b)
subElement(_,_,[],[]).	subElement(_,_,[],[]).
subElement(X,Y,[X|R],[Y|R]) :-	subElement(X,Y,[X|R],[Y|R1]) :-
subElement(X,Y,R,R).	subElement(X,Y,R,R1).
subElement(X,Y,[Z|R],[Z|R]) :- X\==Z,	subElement(X,Y,[Z|R],[Z|R1]) :- X==Z,
subElement(X,Y,R,R).	subElement(X,Y,R,R1).
c)	**d)**
subElement(_,_,[],[]).	subElement(_,_,[],[]).
subElement(X,Y,[Z|R],[Z|R1]) :-	subElement(X,Y,[X|R],[Y|R1]) :-
subElement(X,Y,R,R1).	subElement(X,Y,R,R1).
subElement(X,Y,[X|R],[Y|R1]) :- X==Z,	subElement(X,Y,[Z|R],[Z|R1]) :- X\==Z,
subElement(X,Y,R,R1).	subElement(X,Y,R,R1).
e)	**f)**
subElement(_,_,[],[]).	subElement(_,_,[],[]).
subElement(X,Y,[Z|R],[Z|R1]) :-	subElement(X,Y,[X|R],[X|R1]) :-
subElement(X,Y,R,R1).	subElement(X,Y,R,R1).
subElement(X,Y,[X|R],[Y|R1]) :- X\==Z,	subElement(X,Y,[Z|R],[Z|R1]) :- X\==Z,
subElement(X,Y,R,R1).	subElement(X,Y,R,R1).

_____

Question 7 [6 marks]

Given the following database:

```
prerequisite(csi2520,csi2510).
prerequisite(csi2520,csi2610).
prerequisite(csi2510,iti1521).
prerequisite(csi2510,mat1748).
prerequisite(csi2510,csi2772).
```

What is the value of L obtained by each of the following queries (if multiple solutions are possible, list only the first solution that will be found)?

```
?- bagof(X,Y^prerequisite(X,Y),L).
```

```
L=[csi2520, csi2520, csi2510, csi2510, csi2510].
```

```
?- setof(X,Y^prerequisite(X,Y),L).
```

```
L= [csi2510, csi2520].
```

```
?- setof(Y,prerequisite(X,Y),L)
```

```
X = csi2510,
L = [csi2772, iti1521, mat1748]
```