

Types and Programming Languages week1

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1 Practical session in class

Attached with zip.

2 (LPN) Exercises 2.1-2.4

2.1 Which of the following pairs of terms unify? Where relevant, give the variable instantiations that lead to successful unification.

1 bread = bread
true

2 Bread = bread
false

3 bread = bread
true

4 Bread = bread
false

5 bread = sausage
false

6 food(bread) = bread
false

7 food(bread) = X
true

8 food(X) = food(bread)
true

```

9 food(bread,X) = food(Y,sausage)
  true

10 food(bread,X,beer) = food(Y,sausage,X)
  true

11 food(bread,X,beer) = food(Y,kahuna_burger)
  false

12 food(X) = X
  false

13 meal(food(bread),drink(beer)) = meal(X,Y)
  true

14 meal(food(bread),X) = meal(X,drink(beer))
  false

```

2.2 We are working with the following knowledge base:

```

house_elf(dobby).
witch(hermione).
witch(McGonagall).
witch(rita_skeeter).
magic(X):- house_elf(X).
magic(X):- wizard(X).
magic(X):- witch(X).

```

Which of the following queries are satisfied? Where relevant, give all the variable instantiations that lead to success.

(a) ?- magic(house_elf).
false

(b) ?- wizard(harry).
false

(c) ?- magic(wizard).
false

(d) ?- magic(McGonagall).
true

(e) ?- magic(Hermione).
false

Draw the search tree for the query magic(Hermione) .

```

magic(Hermione):- house_elf(Hermione).
house_elf(Hermione) = house_elf(dobby).
false
magic(Hermione):- wizard(Hermione).
false
magic(Hermione):- witch(Hermione).
witch(hermione) = witch(Hermione).
false
witch(McGonagall) = witch(Hermione).
false
witch(rita_skeeter) = witch(Hermione).
false

```

2.3 Here is a tiny lexicon (that is, information about individual words) and a mini grammar consisting of one syntactic rule (which defines a sentence to be an entity consisting of five words in the following order: a determiner, a noun, a verb, a determiner, a noun).

```

word(determiner,a).
word(determiner,every).
word(noun,criminal).
word(noun,big kahuna burger).
word(verb,eats).
word(verb,likes).
sentence(Word1,Word2,Word3,Word4,Word5):-
    word(determiner,Word1),
    word(noun,Word2),
    word(verb,Word3),
    word(determiner,Word4),
    word(noun,Word5).

```

What query do you have to pose in order to find out which sentences the grammar can generate?
List all sentences that this grammar can generate in the order that Prolog will generate them in.

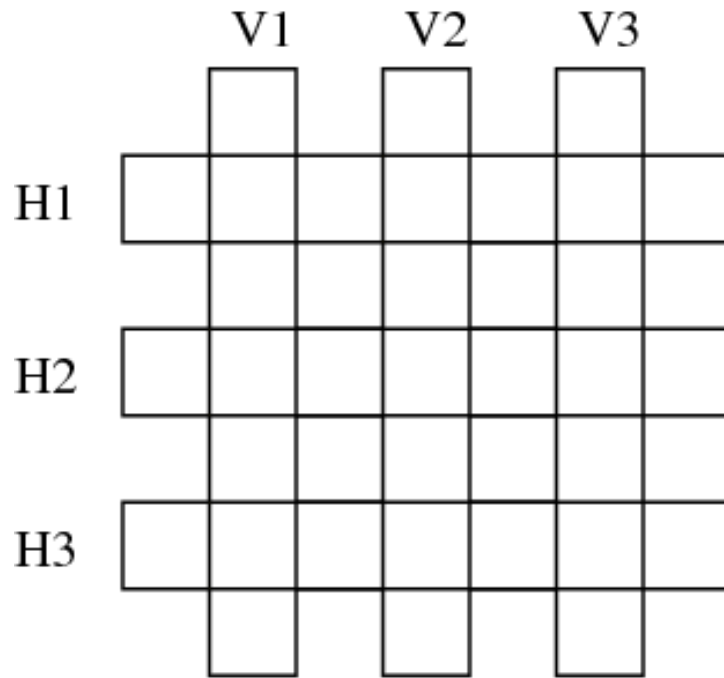
- a criminal eats a criminal
- a criminal eats a big kahuna burger
- a criminal eats every criminal
- a criminal eats every big kahuna burger
- a criminal likes a criminal
- a criminal likes a big kahuna burger

- a criminal likes every criminal
- a criminal likes every big kahuna burger
- a big kahuna burger eats a criminal
- a big kahuna burger eats a big kahuna burger
- a big kahuna burger eats every criminal
- a big kahuna burger eats every big kahuna burger
- a big kahuna burger likes a criminal
- a big kahuna burger likes a big kahuna burger
- a big kahuna burger likes every criminal
- a big kahuna burger likes every big kahuna burger
- every criminal eats a criminal
- every criminal eats a big kahuna burger
- every criminal eats every criminal
- every criminal eats every big kahuna burger
- every criminal likes a criminal
- every criminal likes a big kahuna burger
- every criminal likes every criminal
- every criminal likes every big kahuna burger
- every big kahuna burger eats a criminal
- every big kahuna burger eats a big kahuna burger
- every big kahuna burger eats every criminal
- every big kahuna burger eats every big kahuna burger
- every big kahuna burger likes a criminal
- every big kahuna burger likes a big kahuna burger
- every big kahuna burger likes every criminal
- every big kahuna burger likes every big kahuna burger

2.4 Here are six Italian words:

astante , astoria , baratto , cobalto , pistola , statale .

They are to be arranged, crossword puzzle fashion, in the following grid: The following knowledge



base represents a lexicon containing these words:

word(astante, a,s,t,a,n,t,e).

word(astoria, a,s,t,o,r,i,a).

word(baratto, b,a,r,a,t,t,o).

word(cobalto, c,o,b,a,l,t,o).

word(pistola, p,i,s,t,o,l,a).

word(statale, s,t,a,t,a,l,e).

Write a predicate crossword/6 that tells us how to fill in the grid. The first three arguments should be the vertical words from left to right, and the last three arguments the horizontal words from top to bottom.

```
crossword(V1,V2,V3,H1,H2,H3):-
    word(V1,_,A,_,B,_,C,_),
    word(V2,_,D,_,E,_,F,_),
    word(V3,_,G,_,H,_,I,_),
    word(H1,_,A,_,D,_,G,_),
    word(H2,_,B,_,E,_,H,_),
    word(H3,_,C,_,F,_,I,_).
```
