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WeChat: cstutorcs F. Sadri

"Family" Exercise

```
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https://tutorcs.com

Ann + Peter Laura + Boris

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Ryan + Lucy Gemma
```

- Write down facts defining who is
 - (1) female
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 (2) male and

 - (3) who is the child of whom.
- > Write a predicate that denotes the uncle relation.
- ➤ Write a predicate that denotes the *aunt* relation.

BAD Style answers to the Family-Exercise

```
% by StudentFirstName StudentLastName
% Day Month Year
female(emily).
             https://tutorcs.com
female(gemma).
child(peter, john). WeChat: cstutorcs
child(laura, emily).
female(laura). female(ann).
female(lucy).
```

```
child(laura,john).
child(ryan, ann).
male(peter).
                  Anstignmenth Project Taxama Helpmale (ryan).
male(john)
         child(peter, enhittp)s://tutorcs.com
                  , peter We Chat: cstutorcs
child(ryan
child(gemma, boris ).
uncle(X,Y):-child(Y,Z),child(Z,A),
child(X,A),X=Z,male(X).
\operatorname{aunt}(X, W) :-\operatorname{child}(W, Z), \operatorname{child}(Z, A), \operatorname{child}(X, A),
X = Z, female(X).
```

Good Style answers to the Family-Exercise

% % with thanks to Claudia Schulz

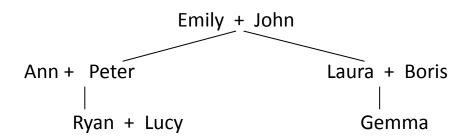
STEP 1

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- consistent use of whitespaces
- > all clauses of one predicate together torcs.com
- different predicates are separated by spaces
- > every clause begins on a new line : Cstutorcs

STEP 2

- comments to explain the predicates and their arguments
- predicates have sensible names
- document structure



% all females - orderes signment Project Exam Help

female(emily).

female(ann). https://tutorcs.com

female(laura).

female(lucy). WeChat: cstutorcs

female(gemma).

% all males - ordered depth-first

male(john).

male(peter).

male(ryan).

male(boris).

```
% is child of(Child, Parent) means that Child is the child
% of Parent
% ordered breadth-first
Assignment Project Exam Help
is_child_of(peter, emily).
is child of(peter,https://tutorcs.com
is_child_of(laura, emily).
is_child_of(laura, john).
is_child_of(ryan, ann).
is child of(ryan, peter).
is_child_of(gemma, laura).
is child of(gemma, boris).
```

Definition of the uncle and aunt relations:

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STEP 3

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- body of a rule on a new line WeChat: cstutorcs
- > every subgoal on a new line with indentation (e.g. 4 whitespaces)

```
uncle(X,Y):-
       is_child_of(Y,Z),
       is_child_of(Z,A),
is_child_of(Z,A),
Project Exam Help X
       X = Z,
                    https://tutorcs.com
       male(X).
                    WeChat: cstutorcs
aunt(X, W):-
       is_child_of (W,Z),
       is_child_of (Z,A),
       is_child_of (X,A),
       X = Z
       female(X).
```

STEP 4

➤ use meaningful variable names Assignment Project Exam Help e.g. in the uncle rule: Unc (or Uncle or U) instead of X, Person (or P) instead of Y.
Similarly in the aunt rule: Use Aun (or Aunt or A).

```
uncle(U,P):-
       is_child_of(P,PP),
                                             GP
       is_child_of(PP,GP),
       is child Assignment Project Exam Help 11
       U = PP,
                   https://tutorcs.com
       male(U).
                   WeChat: cstutorcs
aunt(A, P) :-
       is_child_of(P,PP),
       is_child_of(PP,GP),
       is_child_of(A,GP),
       A = PP,
       female(A).
```

```
uncle(U,P):-
       is_child_of(P,PP),
                                             GP
       is_child_of(PP,GP),
       is_child_skignment_Project(Exam Help U
       U = PP,
                   https://tutorcs.com
       male(U).
                   WeChat: cstutorcs
aunt(A, P) :-
       is_child_of(P,PP),
       is_child_of(PP,GP),
       is_child_of(A,GP),
                              siblings(PP,A)
       A = PP,
       female(A).
```

```
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In define auxiliary predicates:

| https://tutorcs.com |
| e.g. siblings (+comments explaining the WeChat: cstutorcs |
| weChat: cstutorcs |
| https://tutorcs.com |
| h
```

% Child1 and Child2 are siblings if they are % different children of the same parent. Assignment Project Exam Help

```
siblings(Child1, Child2) Cres.com
is_child_WeChild1; Parent),
is_child_of(Child2, Parent),
Child1 \= Child2.
```

```
uncle(U, P):-
      is child of(P, PP),
      sibling (Wighment Project Exam Help
      male(U).
                 https://tutorcs.com
aunt(A, P) :=
                WeChat: cstutorcs
      is child of(P, PP),
      siblings(A, PP),
      female(A).
```

Summary: Bad Style

```
female(emily).
                                              child(peter, emily).
female(gemma).
child(peter, john). child(ryan , peter). child(laura, emitysignment Projection)
                                     uncle(X,Y):-child(Y,Z),child(Z,A),
female(laura ).female(ann).
                      https://tutoresigoxnale(X).
female(lucy).
                      WeChat: cstyling(X, W):-
weChat: cstyling(X, W):-
weChat: cstyling(X, W):-
child(laura,john).
child(ryan, ann).
                                      X=Z,female(X).
male(peter).
        male(boris).
        child (gemma, laura).
male( ryan).
male(john).
```

To: Good Style

```
% all females - ordered breadth-
                                   \* is child of(Child, Parent) means
                                   that Child is the child % of Parent
first
female(emily).
                                   */ ordered breadth-first
               Assignment Projectilex af pette, lemily).
female(ann).
female(laura).
                                   is child of(peter, john).
                     https://tutorgschodoof(laura, emily).
female(lucy).
                                   is child of(laura, john).
female(gemma).
                     WeChat: cstutones of (ryan, ann).
% all males - ordered depth-first
                                   is_child_of(ryan, peter).
male(john).
                                   is child of(gemma, laura).
male(peter).
                                   is child of(gemma, boris).
male(ryan).
male(boris).
```

To: Good Style cntd.

```
uncle(U, P):-
         is child of(P, PP),
         siblings(U, PP),
         male(U). Assignment Project Exam Help
aunt(A, P) :-
         is_child_of(P, Phttps://tutorcs.com
         siblings(A, PP),
         female(A).
                       WeChat: cstutorcs
% Child1 and Child2 are siblings if they are different children of the same parent.
siblings(Child1, Child2):-
         is child of(Child1, Parent),
         is child of(Child2, Parent),
         Child1 \= Child2.
```

Prolog – Good Layout Style Summary

- > COMMENT your code: header, predicate-description, ...
- Use whitespaces consistently
- Each clause begins in a new line Assignment Project Exam Help
- > Rules have the form:

```
head:- https://tutorcs.com
subgoal1,
subgoal2,hat: cstutorcs
...
last_subgoal.
```

> Indentation: whitespaces

Summary cntd.

- ➤ Predicate-groups: all clauses of one predicate together
- Assignment Project Exam Help

 Vertical space between predicate-groups indicates "distance"
- Limit the length of statist (i.e. the number of subgoals) by using auxiliary predicates.

- Choose meaningful (& pronouncible?) names for variables and predicates.
- Prolog-programmes remittent to process.
 is_uncle_of instead of isUncleOf https://tutorcs.com
 Name of a predicate should indicate the meaning of its
- Name of a predicate should indicate the meaning of its arguments: WeChat: cstutorcs

```
mother(X,Y)
mother_of(X,Y)
is_mother_of(X,Y)
mother_child(X,Y)
```

Note that different predicates can have the same name if their number of arguments are different:

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```
mother(X,Y,)**
Mother(X,Y,)*
Mother(X,Y,)**
Mother(X,Y,)*
Mother(X,Y,)**
Mother(X,Y,)*
Mother(X,Y,
```

But it is better if you don't do this!

> Argument order:

For example for an accumulator-style predicate acc(Input,Intermediate,Output)

reverse Aistignment Projectate xamt Relipsed List)

> Use auxiliary predictions to the to the second between the subgoals in a clause:

head:- WeChat: cstutorcs subgoal1, subgoal2, subgoal3, subgoal4, subgoal5, subgoal6.

Package up some of the subgoals into an auxiliary definition. This helps readability and re-usability.

```
You have some options, e.g.:
head :-
      subgoal1, subgoal2, aux, subgoal6.
aux:-
      subgoal3, subgoal4, subgoal5.
Or
            Assignment Project Exam Help
head:-
      aux1, aux2.https://tutorcs.com
aux1:-
      subgoal1, sweCaltations
aux2:-
      subgoal4, subgoal5, subgoal6.
```

You decide which aux definition may be more useful/re-usable.

- Tail recursion is efficient, but don't worry about it too much.
- Assignment Project Exam Help > TEST your program!
- https://tutorcs.com

 Test your program incrementally as you are developing it. Cstutorcs
- Trace. / notrace.

Useful for debugging and for understanding the Prolog query evaluation strategy.

Useful Tips and Common Mistakes

➤ The Sicstus Manual:

Http://sicstus.sics.se/documentation.html
Assignment Project Exam Help

Available under "help" when you invoke Sicstus. https://tutorcs.com

"Coding Guidelines for Prolog" by Covington et al. (2012), Programming, Theory and Practice of Logic Programming, Volume 12 / Issue 06 / November 2012, pp 889-927. The pdf is online.

Tips and Common Mistakes: usage of comma ","

> commas are only used in the body of a rule:

```
head :- subgoal1, ..., last subgoal.
```

> You cannot signarate Pacisco Facor Holp:

Each fact begins on a new line and has a full stop (.) at the end.

- cou**MeChattanty**, teresintry (holland), country (France).
- country(britain).
- country(holland).
- country(France).

- > You cannot use commas in the head of a rule.
- wet(X), cold(X):- raining, outside(X).
 Assignment Project Exam Help
 Prolog warning:
- !Permission error: cannot redefine built-in ','/2
- The head of a Whelpalways single atomic formula.
 - wet(X) :- raining, outside(X).
 - cold(X):- raining, outside(X).

Tips and Common Mistakes: Nesting

Prolog does not allow nesting: You cannot use Assignment Project Exam Help is mother of (Mother, Child):is parent https://tutorcs.comher), Child). Correct version We Chat: cstutorcs is mother of(Mother, Child) :is parent of(Mother, Child), female(Mother).

Tips and Common Mistakes: Variables

- Remember: Variables start in the upper case and anything starting with an upper case letter is a variable.
- Think carefully before you use variables in the heads of condition-less clauses!

```
E.g. If you specifyhttps://tutorcs.com person(X).
```

Logically you have specified stutores

 $\forall X \text{ person}(X)$,

and your program will say "yes", for example to a query such as

?- person(logic_course).

➤ Variables are normally used to express dependencies:

```
is_mathagnafeMortagecChild.Help is_child_of(Child, Mother), female(Mother):
```

- If one of the wrightes doesn't matter for the dependencies, you can use an anonymous variable, i.e. underscore "_".
- ➤ If "_" appears multiple times in the same clause, the occurrences refer to *distinct* variables.

Tips and Common Mistakes: Singleton Variables

➤ A very common Prolog warning:
[..., ...] - singleton variables

Example: Assignment Project Exam Help parent(P):
is_child_of(https://tutorcs.com

[Child] - singleton variables

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- This is a warning to help you with two common mistakes:
 - Spelling mistakes in variables
 - Forgetting to use/bind a variable
- It indicates that there is one or more variable in the clause that appears only once.

Tips and Common Mistakes: Another Common Warning

Existence error in user:

```
E.g. parent(P):-child_of(Child_P)_Help
```

https://tutorcs.com Query: ?- parent(X).

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! Existence error in user:child_of/2! procedure user:child_of/2 does not exist! goal: user:child_of(_128,_129)

Prolog is expecting to find a definition for child_of/2, but cannot find it.

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You may have forgotten to define it, or you may have defined it but https://tutorcs.com

- you have used a witong thumber of arguments, or
- you have a spelling mistake, e.g. childOf or is_child_of instead of child_of.

Tips and Common Mistakes: Disjunctions

> Disjunction has to be used with parentheses:

```
subgoal1 ∧ (subgoal2 ∨ subgoal3) becomes Assignment Project Exam Help subgoal1, (subgoal2; subgoal3)
```

➤ Some people also prefer this presentation:

```
subgoal1, WeChat: cstutorcs (subgoal2; subgoal3)
```

Tips and Common Mistakes: is

The "is" predicate:

- Used to evaluate arithmetic expressions. Assignment Project Exam Help
- LHS is a variable or a constant, RHS should be https://tutorcs.com a ground expression when the predicate is called.

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Example

```
?- X=5, Y is X+3; Y is X+5.
X = 5,
Y = 8 ?;
             Assignment Project Exam Help
! Instantiation error in argument 2 of is/2! goal: 116 is
                  https://tutorcs.com
 119+5
| ?- X=5, (Y is X+3 · Y is X+5).
WeChat: cstutorcs
X = 5,
Y = 8 ?;
X = 5,
Y = 10 ?;
no
```

Tips and Common Mistakes: **Others**

Order matters:

- In recursive definitions: Assignment Project Exam Help
 - Base case first
 - https://tutorcs.com
 Then the recursive clause
- > Order of subgoals matters too.

Good info about Debugging, spy, etc

https://sicstus.sics.se/sicstus/docs/3.7.1/html/sicstus_9.html
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https://tutorcs.com

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