"Cut"ting out Redundancy

1) parent(sue, ted).
2) parent(john, fred).
3) parent(john, jerry).
4) parent(john, carol).
5) parent(alice, fred).
6) parent(alice, jerry).
7) parent(alice, carol).
8) parent(jerry, ted).
9) parent(carol, bob).
10) parent(jim, bob).

sib(X, Y) :- parent(Z, X), parent(Z, Y), X \(\neq\) Y.

?- sib(X, Y). --- gives 12 answers.

from solving 1\textsuperscript{st} parent goal with assertion
parent(john, fred).

then solving the 2\textsuperscript{nd} parent goal with assertion
parent(john, jerry).

and then re-solving the 2\textsuperscript{nd} parent goal with
parent(john, carol).

We get \(X=\text{fred}~Y=\text{jerry}\), and \(X=\text{fred}~Y=\text{carol}\)

2 more solving 1\textsuperscript{st} goal with parent(john, jerry) – 2 more solving 1\textsuperscript{st} goal with parent(john, carol) –

and then another 6 due to parent(alice, \_).
1) parent(sue, ted).
2) parent(john, fred).
3) parent(john, jerry).
4) parent(john, carol).
5) parent(alice, fred).
6) parent(alice, jerry).
7) parent(alice, carol).
8) parent(jerry, ted).
9) parent(carol, bob).
10) parent(jim, bob).

sib1(X,Y) :- parent(Z,X), !, parent(Z,Y), X \( \neq \) Y.
?- sib1(X,Y).  ---  fails. 1st parent goal frozen on assertion 1).

sib2(X, Y) :- parent(Z, X), findsib(Y,Z,X).
findsib(Y,Z,X) :- parent(Z,Y), !, X \( \neq \) Y.
?- sib2(X,Y).  ---  4 solutions –
two solutions each for parents john & alice

The cut is freezing the choice for Y in parent(Z,Y)
to be the very first for which Z is the parent.
Backtracking: other choices for X in parent(Z,X)
To get rid of the redundant solutions - one for each parent - use only the female parent.

\[ \text{sib3}(X,Y) : - \text{parent}(Z,X), \text{female}(Z), \text{fsib}(Y,Z,X). \]
\[ \text{fsib}(Y,Z,X) : - \text{parent}(Z,Y), !, X \neq Y. \]

?- sib3(X,Y). --- only 2 solutions
   X=jerry, Y=fred and X=carol, Y=fred

But, suppose the goal is:

?- sib3(fred, Y). --- Prolog responds NO!

Problem: The choice for 1st arg. in sib3 is now fixed as fred. But the choice for the 2nd arg. is frozen on fred also, by the cut.

Solution:

\[ \text{sib4}(X,Y) : - \text{var}(X), !, \text{sib3}(X,Y); \text{sib3}(Y,X). \]
The bagof and setof predicates

?- bagof(X/Y, sib(X,Y), L).

X = _0
Y = _1
L = [fred/jerry, fred/carol,
     jerry/fred, jerry/carol,
     carol/fred, carol/jerry,
     fred/jerry, fred/carol,
     jerry/fred, jerry/carol,
     carol/fred, carol/jerry]

?- setof(X/Y, sib(X,Y), L).

X = _0
Y = _1
L = [carol/fred, carol/jerry,
     fred/carol, fred/jerry,
     jerry/carol, jerry/fred]