CZ3005 Lab1 Trace Proof

Chen Zhiwei
U1620741J
TSP5

Example 1 Family Tree

1. spouse(X,Y). and uncle(X,myself).

spouse(X,Y).
Trace:
[trace] ?- spouse(X,Y).
   Call: (8) spouse(_3974, _3976) ? creep
   Call: (9) male(_3974) ? creep
   Exit: (9) male(yeye) ? creep
   Call: (9) female(_3976) ? creep
   Exit: (9) female(biqun) ? creep
   Call: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, xiaochun) ? creep
   Call: (9) parent_of(biqun, xiaochun) ? creep
   Fail: (9) parent_of(biqun, xiaochun) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, qiuhua) ? creep
   Call: (9) parent_of(biqun, qiuhua) ? creep
   Fail: (9) parent_of(biqun, qiuhua) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, qinhua) ? creep
   Call: (9) parent_of(biqun, qinhua) ? creep
   Fail: (9) parent_of(biqun, qinhua) ? creep
   Redo: (9) female(_3976) ? creep
   Exit: (9) female(qiuhua) ? creep
   Call: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, xiaochun) ? creep
   Call: (9) parent_of(qiuhua, xiaochun) ? creep
   Fail: (9) parent_of(qiuhua, xiaochun) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, qiuhua) ? creep
   Call: (9) parent_of(qiuhua, qiuhua) ? creep
   Fail: (9) parent_of(qiuhua, qiuhua) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, qinhua) ? creep
   Call: (9) parent_of(qiuhua, qinhua) ? creep
   Fail: (9) parent_of(qiuhua, qinhua) ? creep
   Redo: (9) female(_3976) ? creep
   Exit: (9) female(qinhua) ? creep
   Call: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, xiaochun) ? creep
   Call: (9) parent_of(qinhua, xiaochun) ? creep
   Fail: (9) parent_of(qinhua, xiaochun) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, qiuhua) ? creep
   Call: (9) parent_of(qinhua, qiuhua) ? creep
   Fail: (9) parent_of(qinhua, qiuhua) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, qinhua) ? creep
   Call: (9) parent_of(qinhua, qinhua) ? creep
   Fail: (9) parent_of(qinhua, qinhua) ? creep
   Redo: (9) female(_3976) ? creep
   Exit: (9) female(kather) ? creep
   Call: (9) parent_of(yeye, _4230) ? creep
   Exit: (9) parent_of(yeye, xiaochun) ? creep
   Call: (9) parent_of(kather, xiaochun) ? creep
   Fail: (9) parent_of(kather, xiaochun) ? creep
   Redo: (9) parent_of(yeye, _4230) ? creep

Exit: (9) parent_of(yeye, qiuhua) ? creep
Call: (9) parent_of(kather, qiuhua) ? creep
Fail: (9) parent_of(kather, qiuhua) ? creep
Redo: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, qinhua) ? creep
Call: (9) parent_of(kather, qinhua) ? creep
Fail: (9) parent_of(kather, qinhua) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(maryalice) ? creep
Call: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, xiaochun) ? creep
Call: (9) parent_of(maryalice, xiaochun) ? creep
Fail: (9) parent_of(maryalice, xiaochun) ? creep
Redo: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, qiuhua) ? creep
Call: (9) parent_of(maryalice, qiuhua) ? creep
Fail: (9) parent_of(maryalice, qiuhua) ? creep
Redo: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, qinhua) ? creep
Call: (9) parent_of(maryalice, qinhua) ? creep
Fail: (9) parent_of(maryalice, qinhua) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(ann) ? creep
Call: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, xiaochun) ? creep
Call: (9) parent_of(ann, xiaochun) ? creep
Fail: (9) parent_of(ann, xiaochun) ? creep
Redo: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, qiuhua) ? creep
Call: (9) parent_of(ann, qiuhua) ? creep
Fail: (9) parent_of(ann, qiuhua) ? creep
Redo: (9) parent_of(yeye, _4230) ? creep
Exit: (9) parent_of(yeye, qinhua) ? creep
Call: (9) parent_of(ann, qinhua) ? creep
Fail: (9) parent_of(ann, qinhua) ? creep
Redo: (9) male(_3974) ? creep
Exit: (9) male(xiaochun) ? creep
Call: (9) female(_3976) ? creep
Exit: (9) female(biqun) ? creep
Call: (9) parent_of(xiaochun, _4230) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Call: (9) parent_of(biqun, zhiwei) ? creep
Exit: (9) parent_of(biqun, zhiwei) ? creep
Exit: (8) spouse(xiaochun, biqun) ? creep
X = xiaochun,
Y = biqun ;
Redo: (9) female(_3976) ? creep
Exit: (9) female(qiuhua) ? creep
Call: (9) parent_of(xiaochun, _4230) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Call: (9) parent_of(qiuhua, zhiwei) ? creep
Fail: (9) parent_of(qiuhua, zhiwei) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(qinhua) ? creep
Call: (9) parent_of(xiaochun, _4230) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Call: (9) parent_of(qinhua, zhiwei) ? creep
Fail: (9) parent_of(qinhua, zhiwei) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(kather) ? creep

Call: (9) parent_of(xiaochun, _4230) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Call: (9) parent_of(kather, zhiwei) ? creep
Fail: (9) parent_of(kather, zhiwei) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(maryalice) ? creep
Call: (9) parent_of(xiaochun, _4230) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Call: (9) parent_of(maryalice, zhiwei) ? creep
Fail: (9) parent_of(maryalice, zhiwei) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(ann) ? creep
Call: (9) parent_of(xiaochun, _4230) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Call: (9) parent_of(ann, zhiwei) ? creep
Fail: (9) parent_of(ann, zhiwei) ? creep
Redo: (9) male(_3974) ? creep
Exit: (9) male(zhiwei) ? creep
Call: (9) female(_3976) ? creep
Exit: (9) female(biqun) ? creep
Call: (9) parent_of(zhiwei, _4230) ? creep
Fail: (9) parent_of(zhiwei, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(qiuhua) ? creep
Call: (9) parent_of(zhiwei, _4230) ? creep
Fail: (9) parent_of(zhiwei, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(qinhua) ? creep
Call: (9) parent_of(zhiwei, _4230) ? creep
Fail: (9) parent_of(zhiwei, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(kather) ? creep
Call: (9) parent_of(zhiwei, _4230) ? creep
Fail: (9) parent_of(zhiwei, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(maryalice) ? creep
Call: (9) parent_of(zhiwei, _4230) ? creep
Fail: (9) parent_of(zhiwei, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(ann) ? creep
Call: (9) parent_of(zhiwei, _4230) ? creep
Fail: (9) parent_of(zhiwei, _4230) ? creep
Redo: (9) male(_3974) ? creep
Exit: (9) male(linfeng) ? creep
Call: (9) female(_3976) ? creep
Exit: (9) female(biqun) ? creep
Call: (9) parent_of(linfeng, _4230) ? creep
Fail: (9) parent_of(linfeng, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(qiuhua) ? creep
Call: (9) parent_of(linfeng, _4230) ? creep
Fail: (9) parent_of(linfeng, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(qinhua) ? creep
Call: (9) parent_of(linfeng, _4230) ? creep
Fail: (9) parent_of(linfeng, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(kather) ? creep
Call: (9) parent_of(linfeng, _4230) ? creep
Fail: (9) parent_of(linfeng, _4230) ? creep

Redo: (9) female(_3976) ? creep
Exit: (9) female(maryalice) ? creep
Call: (9) parent_of(linfeng, _4230) ? creep
Fail: (9) parent_of(linfeng, _4230) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(ann) ? creep
Call: (9) parent_of(linfeng, _4230) ? creep
Fail: (9) parent_of(linfeng, _4230) ? creep
Redo: (9) male(_3974) ? creep
Exit: (9) male(william) ? creep
Call: (9) female(_3976) ? creep
Exit: (9) female(biqun) ? creep
Call: (9) parent_of(william, _4230) ? creep
Exit: (9) parent_of(william, zhihong) ? creep
Call: (9) parent_of(biqun, zhihong) ? creep
Fail: (9) parent_of(biqun, zhihong) ? creep
Redo: (9) female(_3976) ? creep
Exit: (9) female(qiuhua) ? creep
Call: (9) parent_of(william, _4230) ? creep
Exit: (9) parent_of(william, zhihong) ? creep
Call: (9) parent_of(qiuhua, zhihong) ? creep
Exit: (9) parent_of(qiuhua, zhihong) ? creep
Exit: (8) spouse(william, qiuhua) ? creep
X = william,
Y = qiuhua .

uncle(X,myself).
Trace:
[trace] ?- uncle(X,zhiwei).
   Call: (8) uncle(_4002, zhiwei) ? creep
   Call: (9) male(_4002) ? creep
   Exit: (9) male(yeye) ? creep
   Call: (9) sibling(yeye, _4224) ? creep
   Call: (10) parent_of(_4222, yeye) ? creep
   Fail: (10) parent_of(_4222, yeye) ? creep
   Fail: (9) sibling(yeye, _4224) ? creep
   Redo: (9) male(_4002) ? creep
   Exit: (9) male(xiaochun) ? creep
   Call: (9) sibling(xiaochun, _4224) ? creep
   Call: (10) parent_of(_4222, xiaochun) ? creep
   Exit: (10) parent_of(yeye, xiaochun) ? creep
   Call: (10) parent_of(yeye, _4224) ? creep
   Exit: (10) parent_of(yeye, xiaochun) ? creep
   Call: (10) xiaochun\=xiaochun ? creep
   Fail: (10) xiaochun\=xiaochun ? creep
   Redo: (10) parent_of(yeye, _4224) ? creep
   Exit: (10) parent_of(yeye, qiuhua) ? creep
   Call: (10) xiaochun\=qiuhua ? creep
   Exit: (10) xiaochun\=qiuhua ? creep
   Exit: (9) sibling(xiaochun, qiuhua) ? creep
   Call: (9) parent_of(qiuhua, zhiwei) ? creep
   Fail: (9) parent_of(qiuhua, zhiwei) ? creep
   Redo: (10) parent_of(yeye, _4224) ? creep
   Exit: (10) parent_of(yeye, qinhua) ? creep
   Call: (10) xiaochun\=qinhua ? creep
   Exit: (10) xiaochun\=qinhua ? creep
   Exit: (9) sibling(xiaochun, qinhua) ? creep
   Call: (9) parent_of(qinhua, zhiwei) ? creep
   Fail: (9) parent_of(qinhua, zhiwei) ? creep
   Redo: (9) male(_4002) ? creep

Exit: (9) male(zhiwei) ? creep
Call: (9) sibling(zhiwei, _4224) ? creep
Call: (10) parent_of(_4222, zhiwei) ? creep
Exit: (10) parent_of(xiaochun, zhiwei) ? creep
Call: (10) parent_of(xiaochun, _4224) ? creep
Exit: (10) parent_of(xiaochun, zhiwei) ? creep
Call: (10) zhiwei\=zhiwei ? creep
Fail: (10) zhiwei\=zhiwei ? creep
Redo: (10) parent_of(_4222, zhiwei) ? creep
Exit: (10) parent_of(biqun, zhiwei) ? creep
Call: (10) parent_of(biqun, _4224) ? creep
Exit: (10) parent_of(biqun, zhiwei) ? creep
Call: (10) zhiwei\=zhiwei ? creep
Fail: (10) zhiwei\=zhiwei ? creep
Fail: (9) sibling(zhiwei, _4224) ? creep
Redo: (9) male(_4002) ? creep
Exit: (9) male(linfeng) ? creep
Call: (9) sibling(linfeng, _4224) ? creep
Call: (10) parent_of(_4222, linfeng) ? creep
Exit: (10) parent_of(qinhua, linfeng) ? creep
Call: (10) parent_of(qinhua, _4224) ? creep
Exit: (10) parent_of(qinhua, linfeng) ? creep
Call: (10) linfeng\=linfeng ? creep
Fail: (10) linfeng\=linfeng ? creep
Fail: (9) sibling(linfeng, _4224) ? creep
Redo: (9) male(_4002) ? creep
Exit: (9) male(william) ? creep
Call: (9) sibling(william, _4224) ? creep
Call: (10) parent_of(_4222, william) ? creep
Fail: (10) parent_of(_4222, william) ? creep
Fail: (9) sibling(william, _4224) ? creep
Redo: (8) uncle(_4002, zhiwei) ? creep
Call: (9) male(_4002) ? creep
Exit: (9) male(yeye) ? creep
Call: (9) spouse(yeye, _4224) ? creep
Call: (10) male(yeye) ? creep
Exit: (10) male(yeye) ? creep
Call: (10) female(_4222) ? creep
Exit: (10) female(biqun) ? creep
Call: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, xiaochun) ? creep
Call: (10) parent_of(biqun, xiaochun) ? creep
Fail: (10) parent_of(biqun, xiaochun) ? creep
Redo: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, qiuhua) ? creep
Call: (10) parent_of(biqun, qiuhua) ? creep
Fail: (10) parent_of(biqun, qiuhua) ? creep
Redo: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, qinhua) ? creep
Call: (10) parent_of(biqun, qinhua) ? creep
Fail: (10) parent_of(biqun, qinhua) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qiuhua) ? creep
Call: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, xiaochun) ? creep
Call: (10) parent_of(qiuhua, xiaochun) ? creep
Fail: (10) parent_of(qiuhua, xiaochun) ? creep
Redo: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, qiuhua) ? creep
Call: (10) parent_of(qiuhua, qiuhua) ? creep

Fail: (10) parent_of(qiuhua, qiuhua) ? creep
Redo: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, qinhua) ? creep
Call: (10) parent_of(qiuhua, qinhua) ? creep
Fail: (10) parent_of(qiuhua, qinhua) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qinhua) ? creep
Call: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, xiaochun) ? creep
Call: (10) parent_of(qinhua, xiaochun) ? creep
Fail: (10) parent_of(qinhua, xiaochun) ? creep
Redo: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, qiuhua) ? creep
Call: (10) parent_of(qinhua, qiuhua) ? creep
Fail: (10) parent_of(qinhua, qiuhua) ? creep
Redo: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, qinhua) ? creep
Call: (10) parent_of(qinhua, qinhua) ? creep
Fail: (10) parent_of(qinhua, qinhua) ? creep
Fail: (9) spouse(yeye, _4224) ? creep
Redo: (9) male(_4002) ? creep
Exit: (9) male(xiaochun) ? creep
Call: (9) spouse(xiaochun, _4224) ? creep
Call: (10) male(xiaochun) ? creep
Exit: (10) male(xiaochun) ? creep
Call: (10) female(_4222) ? creep
Exit: (10) female(biqun) ? creep
Call: (10) parent_of(xiaochun, _4224) ? creep
Exit: (10) parent_of(xiaochun, zhiwei) ? creep
Call: (10) parent_of(biqun, zhiwei) ? creep
Exit: (10) parent_of(biqun, zhiwei) ? creep
Exit: (9) spouse(xiaochun, biqun) ? creep
Call: (9) sibling(biqun, _4224) ? creep
Call: (10) parent_of(_4222, biqun) ? creep
Fail: (10) parent_of(_4222, biqun) ? creep
Fail: (9) sibling(biqun, _4224) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qiuhua) ? creep
Call: (10) parent_of(xiaochun, _4224) ? creep
Exit: (10) parent_of(xiaochun, zhiwei) ? creep
Call: (10) parent_of(qiuhua, zhiwei) ? creep
Fail: (10) parent_of(qiuhua, zhiwei) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qinhua) ? creep
Call: (10) parent_of(xiaochun, _4224) ? creep
Exit: (10) parent_of(xiaochun, zhiwei) ? creep
Call: (10) parent_of(qinhua, zhiwei) ? creep
Fail: (10) parent_of(qinhua, zhiwei) ? creep
Fail: (9) spouse(xiaochun, _4224) ? creep
Redo: (9) male(_4002) ? creep
Exit: (9) male(zhiwei) ? creep
Call: (9) spouse(zhiwei, _4224) ? creep
Call: (10) male(zhiwei) ? creep
Exit: (10) male(zhiwei) ? creep
Call: (10) female(_4222) ? creep
Exit: (10) female(biqun) ? creep
Call: (10) parent_of(zhiwei, _4224) ? creep
Fail: (10) parent_of(zhiwei, _4224) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qiuhua) ? creep

Call: (10) parent_of(zhiwei, _4224) ? creep
Fail: (10) parent_of(zhiwei, _4224) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qinhua) ? creep
Call: (10) parent_of(zhiwei, _4224) ? creep
Fail: (10) parent_of(zhiwei, _4224) ? creep
Fail: (9) spouse(zhiwei, _4224) ? creep
Redo: (9) male(_4002) ? creep
Exit: (9) male(linfeng) ? creep
Call: (9) spouse(linfeng, _4224) ? creep
Call: (10) male(linfeng) ? creep
Exit: (10) male(linfeng) ? creep
Call: (10) female(_4222) ? creep
Exit: (10) female(biqun) ? creep
Call: (10) parent_of(linfeng, _4224) ? creep
Fail: (10) parent_of(linfeng, _4224) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qiuhua) ? creep
Call: (10) parent_of(linfeng, _4224) ? creep
Fail: (10) parent_of(linfeng, _4224) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qinhua) ? creep
Call: (10) parent_of(linfeng, _4224) ? creep
Fail: (10) parent_of(linfeng, _4224) ? creep
Fail: (9) spouse(linfeng, _4224) ? creep
Redo: (9) male(_4002) ? creep
Exit: (9) male(william) ? creep
Call: (9) spouse(william, _4224) ? creep
Call: (10) male(william) ? creep
Exit: (10) male(william) ? creep
Call: (10) female(_4222) ? creep
Exit: (10) female(biqun) ? creep
Call: (10) parent_of(william, _4224) ? creep
Exit: (10) parent_of(william, zhihong) ? creep
Call: (10) parent_of(biqun, zhihong) ? creep
Fail: (10) parent_of(biqun, zhihong) ? creep
Redo: (10) female(_4222) ? creep
Exit: (10) female(qiuhua) ? creep
Call: (10) parent_of(william, _4224) ? creep
Exit: (10) parent_of(william, zhihong) ? creep
Call: (10) parent_of(qiuhua, zhihong) ? creep
Exit: (10) parent_of(qiuhua, zhihong) ? creep
Exit: (9) spouse(william, qiuhua) ? creep
Call: (9) sibling(qiuhua, _4224) ? creep
Call: (10) parent_of(_4222, qiuhua) ? creep
Exit: (10) parent_of(yeye, qiuhua) ? creep
Call: (10) parent_of(yeye, _4224) ? creep
Exit: (10) parent_of(yeye, xiaochun) ? creep
Call: (10) qiuhua\=xiaochun ? creep
Exit: (10) qiuhua\=xiaochun ? creep
Exit: (9) sibling(qiuhua, xiaochun) ? creep
Call: (9) parent_of(xiaochun, zhiwei) ? creep
Exit: (9) parent_of(xiaochun, zhiwei) ? creep
Exit: (8) uncle(william, zhiwei) ? creep
X = william .

---

2. parent_of(X,Y) before and after rearrangement.

Before Trace:

[trace] ?- parent_of(X,Y).

```
    Call: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(yeye, xiaochun) ? creep
X = yeye,
Y = xiaochun ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(yeye, qiuhua) ? creep
X = yeye,
Y = qiuhua ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(yeye, qinhua) ? creep
X = yeye,
Y = qinhua ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(xiaochun, zhiwei) ? creep
X = xiaochun,
Y = zhiwei ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(biqun, zhiwei) ? creep
X = biqun,
Y = zhiwei ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(qinhua, linfeng) ? creep
X = qinhua,
Y = linfeng ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(qiuhua, zhihong) ? creep
X = qiuhua,
Y = zhihong ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(william, zhihong) ? creep
X = william,
Y = zhihong ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(warren, jerry) ? creep
X = warren,
Y = jerry ;
    Redo: (8) parent_of(_4368, _4370) ? creep
    Exit: (8) parent_of(maryalice, jerry) ? creep
X = maryalice,
Y = jerry.
```

After Trace:

```
[trace]  ?- parent_of(X,Y).
    Call: (8) parent_of(_3804, _3806) ? creep
    Exit: (8) parent_of(yeye, xiaochun) ? creep
X = yeye,
Y = xiaochun ;
    Redo: (8) parent_of(_3804, _3806) ? creep
    Exit: (8) parent_of(yeye, qiuhua) ? creep
X = yeye,
Y = qiuhua ;
    Redo: (8) parent_of(_3804, _3806) ? creep
    Exit: (8) parent_of(yeye, qinhua) ? creep
X = yeye,
Y = qinhua ;
    Redo: (8) parent_of(_3804, _3806) ? creep
    Exit: (8) parent_of(xiaochun, zhiwei) ? creep
X = xiaochun,
Y = zhiwei ;
    Redo: (8) parent_of(_3804, _3806) ? creep
    Exit: (8) parent_of(biqun, zhiwei) ? creep
```

X = biqun,
Y = zhiwei ;
   Redo: (8) parent_of(_3804, _3806) ? creep
   Exit: (8) parent_of(qinhua, linfeng) ? creep
X = qinhua,
Y = linfeng ;
   Redo: (8) parent_of(_3804, _3806) ? creep
   Exit: (8) parent_of(qiuhua, zhihong) ? creep
X = qiuhua,
Y = zhihong ;
   Redo: (8) parent_of(_3804, _3806) ? creep
   Exit: (8) parent_of(william, zhihong) ? creep
X = william,
Y = zhihong ;
   Redo: (8) parent_of(_3804, _3806) ? creep
   Exit: (8) parent_of(maryalice, jerry) ? creep
X = maryalice,
Y = jerry ;
   Redo: (8) parent_of(_3804, _3806) ? creep
   Exit: (8) parent_of(warren, jerry) ? creep
X = warren,
Y = jerry.

Example 2 The Smart Phone Rivalry

Trace of unethical(X):

```
[trace]  ?- unethical(X).
   Call: (8) unethical(_13078) ? creep
   Call: (9) boss(_13292, _13078) ? creep
   Exit: (9) boss(appy, stevey) ? creep
   Call: (9) steal(stevey, _13294) ? creep
   Exit: (9) steal(stevey, galacticas3) ? creep
   Call: (9) rival(appy, _13294) ? creep
   Call: (10) competitor(appy, _13294) ? creep
   Fail: (10) competitor(appy, _13294) ? creep
   Redo: (9) rival(appy, _13294) ? creep
   Call: (10) competitor(_13292, appy) ? creep
   Exit: (10) competitor(sumsum, appy) ? creep
   Exit: (9) rival(appy, sumsum) ? creep
   Call: (9) developed(sumsum, galacticas3) ? creep
   Exit: (9) developed(sumsum, galacticas3) ? creep
   Call: (9) business(galacticas3) ? creep
   Call: (10) smartphonetech(galacticas3) ? creep
   Exit: (10) smartphonetech(galacticas3) ? creep
   Exit: (9) business(galacticas3) ? creep
   Exit: (8) unethical(stevey) ? creep
X = stevey.
```

Example 3 Royal Family

---

1. Trace of old_succession(Candidates, Sorted_Candidates).

Trace:

```
[trace]  ?- old_succession([andrew,charles,edward,ann],Succession).
  Call: (8) old_succession([andrew, charles, edward, ann], _3324) ? creep
  Call: (9) quick_sort([andrew, charles, edward, ann], _3324) ? creep
  Call: (10) q_sort([andrew, charles, edward, ann], [], _3324) ? creep
  Call: (11) pivoting(andrew, [charles, edward, ann], _3578, _3580) ? creep
  Call: (12) old_rank(charles, andrew) ? creep
  Call: (13) prince(charles) ? creep
  Exit: (13) prince(charles) ? creep
  Call: (13) princess(andrew) ? creep
  Fail: (13) princess(andrew) ? creep
  Redo: (12) old_rank(charles, andrew) ? creep
  Call: (13) prince(charles) ? creep
  Exit: (13) prince(charles) ? creep
  Call: (13) prince(andrew) ? creep
  Exit: (13) prince(andrew) ? creep
  Call: (13) elder(charles, andrew) ? creep
  Call: (14) older(charles, andrew) ? creep
  Fail: (14) older(charles, andrew) ? creep
  Redo: (13) elder(charles, andrew) ? creep
  Call: (14) older(charles, _3582) ? creep
  Exit: (14) older(charles, ann) ? creep
  Call: (14) older(_3580, andrew) ? creep
  Exit: (14) older(ann, andrew) ? creep
  Exit: (13) elder(charles, andrew) ? creep
  Exit: (12) old_rank(charles, andrew) ? creep
  Call: (12) old_rank(charles, andrew) ? creep
  Call: (13) prince(charles) ? creep
  Exit: (13) prince(charles) ? creep
  Call: (13) princess(andrew) ? creep
  Fail: (13) princess(andrew) ? creep
  Redo: (12) old_rank(charles, andrew) ? creep
  Call: (13) prince(charles) ? creep
  Exit: (13) prince(charles) ? creep
  Call: (13) prince(andrew) ? creep
  Exit: (13) prince(andrew) ? creep
  Call: (13) elder(charles, andrew) ? creep
  Call: (14) older(charles, andrew) ? creep
  Fail: (14) older(charles, andrew) ? creep
  Redo: (13) elder(charles, andrew) ? creep
  Call: (14) older(charles, _3582) ? creep
  Exit: (14) older(charles, ann) ? creep
  Call: (14) older(_3580, andrew) ? creep
  Exit: (14) older(ann, andrew) ? creep
  Exit: (13) elder(charles, andrew) ? creep
  Exit: (12) old_rank(charles, andrew) ? creep
  Call: (12) pivoting(andrew, [edward, ann], _3584, _3562) ? creep
  Call: (13) old_rank(edward, andrew) ? creep
  Call: (14) prince(edward) ? creep
  Exit: (14) prince(edward) ? creep
  Call: (14) princess(andrew) ? creep
  Fail: (14) princess(andrew) ? creep
  Redo: (13) old_rank(edward, andrew) ? creep
  Call: (14) prince(edward) ? creep
  Exit: (14) prince(edward) ? creep
```

Call: (14) prince(andrew) ? creep
Exit: (14) prince(andrew) ? creep
Call: (14) elder(edward, andrew) ? creep
Call: (15) older(edward, andrew) ? creep
Fail: (15) older(edward, andrew) ? creep
Redo: (14) elder(edward, andrew) ? creep
Call: (15) older(edward, _3588) ? creep
Fail: (15) older(edward, _3588) ? creep
Fail: (14) elder(edward, andrew) ? creep
Redo: (13) old_rank(edward, andrew) ? creep
Call: (14) princess(edward) ? creep
Fail: (14) princess(edward) ? creep
Fail: (13) old_rank(edward, andrew) ? creep
Redo: (12) pivoting(andrew, [edward, ann], [edward|_3568], _3562) ? creep
Call: (13) pivoting(andrew, [ann], _3568, _3562) ? creep
Call: (14) old_rank(ann, andrew) ? creep
Call: (15) prince(ann) ? creep
Fail: (15) prince(ann) ? creep
Redo: (14) old_rank(ann, andrew) ? creep
Call: (15) prince(ann) ? creep
Fail: (15) prince(ann) ? creep
Redo: (14) old_rank(ann, andrew) ? creep
Call: (15) princess(ann) ? creep
Exit: (15) princess(ann) ? creep
Call: (15) princess(andrew) ? creep
Fail: (15) princess(andrew) ? creep
Fail: (14) old_rank(ann, andrew) ? creep
Redo: (13) pivoting(andrew, [ann], [ann|_3574], _3562) ? creep
Call: (14) pivoting(andrew, [], _3574, _3562) ? creep
Exit: (14) pivoting(andrew, [], [], []) ? creep
Exit: (13) pivoting(andrew, [ann], [ann], []) ? creep
Exit: (12) pivoting(andrew, [edward, ann], [edward, ann], []) ? creep
Exit: (11) pivoting(andrew, [charles, edward, ann], [edward, ann], [charles]) ? creep
Call: (11) q_sort([edward, ann], [], _3596) ? creep
Call: (12) pivoting(edward, [ann], _3596, _3598) ? creep
Call: (13) old_rank(ann, edward) ? creep
Call: (14) prince(ann) ? creep
Fail: (14) prince(ann) ? creep
Redo: (13) old_rank(ann, edward) ? creep
Call: (14) prince(ann) ? creep
Fail: (14) prince(ann) ? creep
Redo: (13) old_rank(ann, edward) ? creep
Call: (14) princess(ann) ? creep
Exit: (14) princess(ann) ? creep
Call: (14) princess(edward) ? creep
Fail: (14) princess(edward) ? creep
Fail: (13) old_rank(ann, edward) ? creep
Redo: (12) pivoting(edward, [ann], [ann|_3580], _3604) ? creep
Call: (13) pivoting(edward, [], _3580, _3604) ? creep
Exit: (13) pivoting(edward, [], [], []) ? creep
Exit: (12) pivoting(edward, [ann], [ann], []) ? creep
Call: (12) q_sort([ann], [], _3602) ? creep
Call: (13) pivoting(ann, [], _3602, _3604) ? creep
Exit: (13) pivoting(ann, [], [], []) ? creep
Call: (13) q_sort([], [], _3602) ? creep
Exit: (13) q_sort([], [], []) ? creep
Call: (13) q_sort([], [ann], _3608) ? creep
Exit: (13) q_sort([], [ann], [ann]) ? creep
Exit: (12) q_sort([ann], [], [ann]) ? creep
Call: (12) q_sort([], [edward, ann], _3614) ? creep

Exit: (12) q_sort([], [edward, ann], [edward, ann]) ? creep
Exit: (11) q_sort([edward, ann], [], [edward, ann]) ? creep
Call: (11) q_sort([charles], [andrew, edward, ann], _3324) ? creep
Call: (12) pivoting(charles, [], _3620, _3622) ? creep
Exit: (12) pivoting(charles, [], [], []) ? creep
Call: (12) q_sort([], [andrew, edward, ann], _3620) ? creep
Exit: (12) q_sort([], [andrew, edward, ann], [andrew, edward, ann]) ? creep
Call: (12) q_sort([], [charles, andrew, edward, ann], _3324) ? creep
Exit: (12) q_sort([], [charles, andrew, edward, ann], [charles, andrew, edward, ann]) ?
creep
Exit: (11) q_sort([charles], [andrew, edward, ann], [charles, andrew, edward, ann]) ? creep
Exit: (10) q_sort([andrew, charles, edward, ann], [], [charles, andrew, edward, ann]) ?
creep
Exit: (9) quick_sort([andrew, charles, edward, ann], [charles, andrew, edward, ann]) ?
creep
Exit: (8) old_succession([andrew, charles, edward, ann], [charles, andrew, edward, ann]) ?
creep
Succession = [charles, andrew, edward, ann] .

---

2. Trace of new_succession(Candidates, Sorted_Candidates).

Trace:

[trace] ?- new_succession([andrew,charles,edward,ann],Succession).
Call: (8) new_succession([andrew, charles, edward, ann], _3384) ? creep
Call: (9) new_quick_sort([andrew, charles, edward, ann], _3384) ? creep
Call: (10) new_q_sort([andrew, charles, edward, ann], [], _3384) ? creep
Call: (11) new_pivoting(andrew, [charles, edward, ann], _3650, _3652) ? creep
Call: (12) elder(charles, andrew) ? creep
Call: (13) older(charles, andrew) ? creep
Fail: (13) older(charles, andrew) ? creep
Redo: (12) elder(charles, andrew) ? creep
Call: (13) older(charles, _3654) ? creep
Exit: (13) older(charles, ann) ? creep
Call: (13) older(_3652, andrew) ? creep
Exit: (13) older(ann, andrew) ? creep
Exit: (12) elder(charles, andrew) ? creep
Call: (12) elder(charles, andrew) ? creep
Call: (13) older(charles, andrew) ? creep
Fail: (13) older(charles, andrew) ? creep
Redo: (12) elder(charles, andrew) ? creep
Call: (13) older(charles, _3654) ? creep
Exit: (13) older(charles, ann) ? creep
Call: (13) older(_3652, andrew) ? creep
Exit: (13) older(ann, andrew) ? creep
Exit: (12) elder(charles, andrew) ? creep
Call: (12) new_pivoting(andrew, [edward, ann], _3656, _3634) ? creep
Call: (13) elder(edward, andrew) ? creep
Call: (14) older(edward, andrew) ? creep
Fail: (14) older(edward, andrew) ? creep
Redo: (13) elder(edward, andrew) ? creep
Call: (14) older(edward, _3660) ? creep
Fail: (14) older(edward, _3660) ? creep
Fail: (13) elder(edward, andrew) ? creep
Redo: (12) new_pivoting(andrew, [edward, ann], [edward|_3640], _3634) ? creep
Call: (13) new_pivoting(andrew, [ann], _3640, _3634) ? creep
Call: (14) elder(ann, andrew) ? creep
Call: (15) older(ann, andrew) ? creep
Exit: (15) older(ann, andrew) ? creep
Exit: (14) elder(ann, andrew) ? creep
Call: (14) elder(ann, andrew) ? creep

Call: (15) older(ann, andrew) ? creep
Exit: (15) older(ann, andrew) ? creep
Exit: (14) elder(ann, andrew) ? creep
Call: (14) new_pivoting(andrew, [], _3640, _3646) ? creep
Exit: (14) new_pivoting(andrew, [], [], []) ? creep
Exit: (13) new_pivoting(andrew, [ann], [], [ann]) ? creep
Exit: (12) new_pivoting(andrew, [edward, ann], [edward], [ann]) ? creep
Exit: (11) new_pivoting(andrew, [charles, edward, ann], [edward], [charles, ann]) ? creep
Call: (11) new_q_sort([edward], [], _3668) ? creep
Call: (12) new_pivoting(edward, [], _3668, _3670) ? creep
Exit: (12) new_pivoting(edward, [], [], []) ? creep
Call: (12) new_q_sort([], [], _3668) ? creep
Exit: (12) new_q_sort([], [], []) ? creep
Call: (12) new_q_sort([], [edward], _3674) ? creep
Exit: (12) new_q_sort([], [edward], [edward]) ? creep
Exit: (11) new_q_sort([edward], [], [edward]) ? creep
Call: (11) new_q_sort([charles, ann], [andrew, edward], _3384) ? creep
Call: (12) new_pivoting(charles, [ann], _3680, _3682) ? creep
Call: (13) elder(ann, charles) ? creep
Call: (14) older(ann, charles) ? creep
Fail: (14) older(ann, charles) ? creep
Redo: (13) elder(ann, charles) ? creep
Call: (14) older(ann, _3684) ? creep
Exit: (14) older(ann, andrew) ? creep
Call: (14) older(_3682, charles) ? creep
Fail: (14) older(_3682, charles) ? creep
Fail: (13) elder(ann, charles) ? creep
Redo: (12) new_pivoting(charles, [ann], [ann|_3664], _3688) ? creep
Call: (13) new_pivoting(charles, [], _3664, _3688) ? creep
Exit: (13) new_pivoting(charles, [], [], []) ? creep
Exit: (12) new_pivoting(charles, [ann], [ann], []) ? creep
Call: (12) new_q_sort([ann], [andrew, edward], _3686) ? creep
Call: (13) new_pivoting(ann, [], _3686, _3688) ? creep
Exit: (13) new_pivoting(ann, [], [], []) ? creep
Call: (13) new_q_sort([], [andrew, edward], _3686) ? creep
Exit: (13) new_q_sort([], [andrew, edward], [andrew, edward]) ? creep
Call: (13) new_q_sort([], [ann, andrew, edward], _3692) ? creep
Exit: (13) new_q_sort([], [ann, andrew, edward], [ann, andrew, edward]) ? creep
Exit: (12) new_q_sort([ann], [andrew, edward], [ann, andrew, edward]) ? creep
Call: (12) new_q_sort([], [charles, ann, andrew, edward], _3384) ? creep
Exit: (12) new_q_sort([], [charles, ann, andrew, edward], [charles, ann, andrew, edward]) ? creep
Exit: (11) new_q_sort([charles, ann], [andrew, edward], [charles, ann, andrew, edward]) ? creep
Exit: (10) new_q_sort([andrew, charles, edward, ann], [], [charles, ann, andrew, edward]) ? creep
Exit: (9) new_quick_sort([andrew, charles, edward, ann], [charles, ann, andrew, edward]) ? creep
Exit: (8) new_succession([andrew, charles, edward, ann], [charles, ann, andrew, edward]) ? creep