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Homework 3

1.Write a Prolog program named outside so that outside(I,J,K) is true iff K is an integer K< I and K> J .

outside(I,J,K) :- K < I; K > J.

2.Write a Prolog program named min so that max(L,M) is true if M is the largest element in the list L.

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max([H|T],M) :- member(M,[H|T]), greaterThan(T,M).
max([X],X).

greaterThan([H|T], M) :- M >= H, greaterThan(T,M).
greaterThan([],X).
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3.Write a Prolog program such that p(X) is true if X is a list consisting of n a's followed by n+1 b's, for any n >= 1.

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p(X) :- aList(X,0).

aList([X,Y|T],NA1) :- X == 'a', Y == 'a', NA2 is NA1 - 1, aList([Y|T],NA2).
aList([X,Y|T],NA1) :- X == 'a', Y == 'b', NA2 is NA1 - 1, bList([Y|T],NA2).

bList([X,Y|T],NB1) :- X == 'b', Y == 'b', NB2 is NB1 + 1, bList([Y|T],NB2).
bList(['b'],0).
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4.Here are some genealogical facts about George Washington.
Construct Prolog rules defining the following kinship relations and test out with George Washington's family database.

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mother(X,Y) :- parent(X,Y), female(X).
father(X,Y) :- parent(X,Y), male(X).
son(X,Y) :- parent(Y,X), male(X).
daughter(X,Y) :- parent(Y,X), female(X).
grandparent(X,Y) :- grandfather(X,Y); grandmother(X,Y).
grandfather(X,Y) :- parent(X,Z), parent(Z,Y), male(X).
grandmother(X,Y) :- parent(X,Z), parent(Z,Y), female(X).
aunt(X,Y) :- parent(G,X), parent(Z,Y), parent(G,Z), female(X).
uncle(X,Y) :- parent(G,X), parent(Z,Y), parent(G,Z), male(X).
niece(X,Y) :- parent(G,Y), grandparent(G,X), female(X).
nephew(X,Y) :- parent(G,Y), grandparent(G,X), male(X).
cousin(X,Y) :- grandparent(G,X), grandparent(G,Y), X/=Y.

parent('Augustine Washington', 'George Washington').
parent('Mary Ball Washington', 'George Washington').
parent('Lawrence Washington', 'Augustine Washington').
parent('Mildred Warner Washington', 'Augustine Washington').
parent('Joseph Ball' ,'Mary Ball Washington').
parent('Mary Johnson Ball', 'Mary Ball Washington').
```

parent (‘John Dandridge’,’Martha Washington’).).
parent (‘Frances Jones Dandridge’,’Martha Washington’).
male(‘George Washington’).
male(‘Lawrence Washington’)
male(‘Augustine Washington’).
male(‘Joseph Ball’).
male(‘John Dandridge’).
female(‘Mary Ball Washington’).
female(‘Mildred Warner Washington’).
female(‘Mary Johnson Ball’).
female(‘Martha Washington’).
female(‘Frances Jones Dandridge’).

5.Write a Prolog program that when given a list of names from above, determines if any of the names in the list is the mother of any other name in the list.

mother(X,Y) :- parent(X,Y), female(X).
father(X,Y) :- parent(X,Y), male(X).
son(X,Y) :- parent(Y,X), male(X).
daughter(X,Y) :- parent(Y,X), female(X).
grandparent(X,Y) :- grandfather(X,Y); grandmother(X,Y).
grandfather(X,Y) :- parent(X,Z), parent(Z,Y), male(X).
grandmother(X,Y) :- parent(X,Z), parent(Z,Y), female(X).
aunt(X,Y) :- parent(G,X), parent(Z,Y), parent(G,Z), female(X).
uncle(X,Y) :- parent(G,X), parent(Z,Y), parent(G,Z), male(X).
niece(X,Y) :- parent(G,Y), grandparent(G,X), female(X).
nephew(X,Y) :- parent(G,Y), grandparent(G,X), male(X).
cousin(X,Y) :- grandparent(G,X), grandparent(G,Y), X/=Y.
motherOf(X,Y,TheList) :- member(X,TheList), member(Y,TheList), mother(X,Y). /*X is in TheList and Y is in TheList and X is the mother of Y */

parent(‘Augustine Washington’, ‘George Washington’).
parent(‘Mary Ball Washington’, ‘George Washington’).
parent(‘Lawrence Washington’, ‘Augustine Washington’).
parent(‘Mildred Warner Washington’, ‘Augustine Washington’).
parent(‘Joseph Ball’ ,’Mary Ball Washington’).
parent(‘Mary Johnson Ball’, ‘Mary Ball Washington’).
parent (‘John Dandridge’,’Martha Washington’).).
parent (‘Frances Jones Dandridge’,’Martha Washington’).
male(‘George Washington’).
male(‘Lawrence Washington’)
male(‘Augustine Washington’).
male(‘Joseph Ball’).
male(‘John Dandridge’).
female(‘Mary Ball Washington’).
female(‘Mildred Warner Washington’).
female(‘Mary Johnson Ball’).
female(‘Martha Washington’).
female(‘Frances Jones Dandridge’).