Assignment 2

# Problem 1

(c)

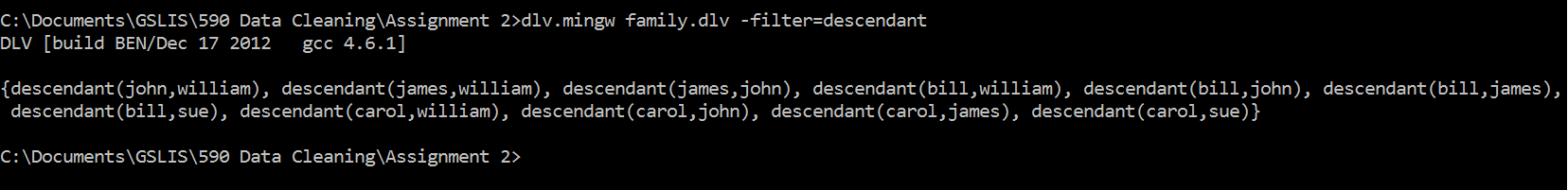
% descendant(X,Y) means X is a descendant of Y.

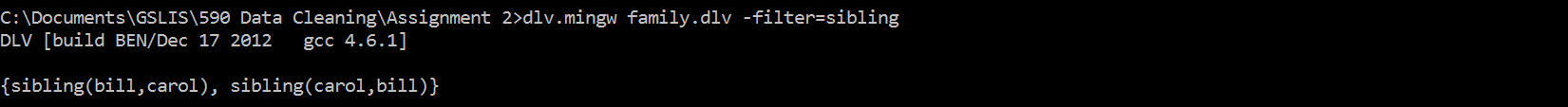
descendant(X, Y) :- ancestor(Y, X).

% sibling(X,Y) means X and Y share a parent P.

sibling(X, Y) :- parent(P, X), parent(P, Y), X != Y.

% If there is no distinction between sibling(X1,X2) and sibling(X2,X1), then we can use X<Y instead.





(d)

% ICs (Integrity Constraints) -- RULES to find "bad" (inconsistent) data

% Warm-up

% Assume the IC says: "every person must have a parent".

% How can we guarantee that?

%

% First we find persons who do NOT violate the constraint,

% that is, we find persons who have parents:

%

has\_parent(X) :- parent(\_, X).

% person(X) means X is a parent or a child.

person(X) :- parent(X,\_).

person(X) :- parent(\_,X).

% Now we can easily find persons who violate the has\_parent constraint.

% We can use a convention, e.g., "icv\_NNN" to mark [i]ntegrity [c]onstraint [v]iolations

%

icv\_no\_parent(X) :- person(X), not has\_parent(X).

% Mom & Dad

father(X, Y) :-

parent(X, Y), male(X).

mother(X, Y) :-

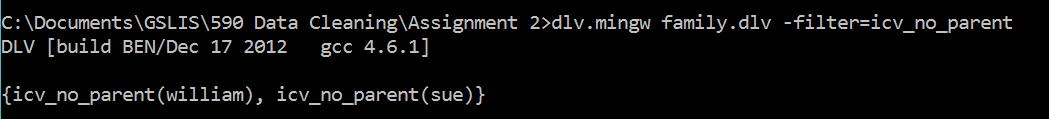
parent(X, Y), female(X).

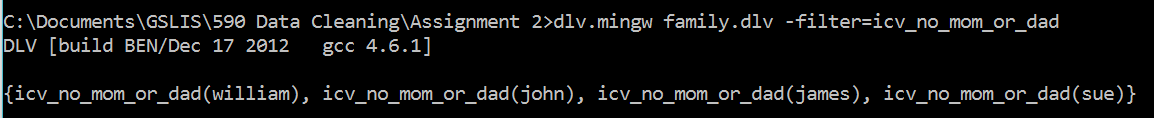
% Every person has a father and a mother.

has\_mom\_and\_dad(X) :- mother(M, X), father(F, X), M != F.

% icv\_no\_mom\_or\_dad(X) means any person who does not have a mom or dad.

icv\_no\_mom\_or\_dad(X) :- person(X), not has\_mom\_and\_dad(X).





# Problem 2

(a) (FD-1)

% Problem 2a FD-1: if a row agrees with another row on the key attribute PID,

% then it should agree on ALL other attributes.

% I suppose null value should also be reported.

icv\_fd1(author\_violation,X,Y1,Y2) :- publication(X,Y1,\_,\_,\_,\_,\_,\_,\_,\_), publication(X,Y2,\_,\_,\_,\_,\_,\_,\_,\_), Y1 < Y2.

icv\_fd1(year\_violation,X,Y1,Y2) :- publication(X,\_,Y1,\_,\_,\_,\_,\_,\_,\_), publication(X,\_,Y2,\_,\_,\_,\_,\_,\_,\_), Y1 < Y2.

icv\_fd1(title\_violation,X,Y1,Y2) :- publication(X,\_,\_,Y1,\_,\_,\_,\_,\_,\_), publication(X,\_,\_,Y2,\_,\_,\_,\_,\_,\_), Y1 < Y2.

icv\_fd1(journal\_violation,X,Y1,Y2) :- publication(X,\_,\_,\_,Y1,\_,\_,\_,\_,\_), publication(X,\_,\_,\_,Y2,\_,\_,\_,\_,\_), Y1 < Y2.

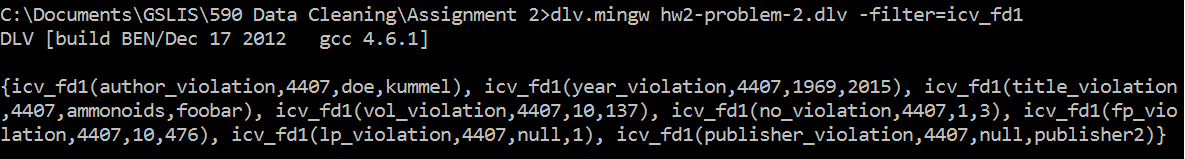
icv\_fd1(vol\_violation,X,Y1,Y2) :- publication(X,\_,\_,\_,\_,Y1,\_,\_,\_,\_), publication(X,\_,\_,\_,\_,Y2,\_,\_,\_,\_), Y1 < Y2.

icv\_fd1(no\_violation,X,Y1,Y2) :- publication(X,\_,\_,\_,\_,\_,Y1,\_,\_,\_), publication(X,\_,\_,\_,\_,\_,Y2,\_,\_,\_), Y1 < Y2.

icv\_fd1(fp\_violation,X,Y1,Y2) :- publication(X,\_,\_,\_,\_,\_,\_,Y1,\_,\_), publication(X,\_,\_,\_,\_,\_,\_,Y2,\_,\_), Y1 < Y2.

icv\_fd1(lp\_violation,X,Y1,Y2) :- publication(X,\_,\_,\_,\_,\_,\_,\_,Y1,\_), publication(X,\_,\_,\_,\_,\_,\_,\_,Y2,\_), Y1 < Y2.

icv\_fd1(publisher\_violation,X,Y1,Y2) :- publication(X,\_,\_,\_,\_,\_,\_,\_,\_,Y1), publication(X,\_,\_,\_,\_,\_,\_,\_,\_,Y2), Y1 < Y2.

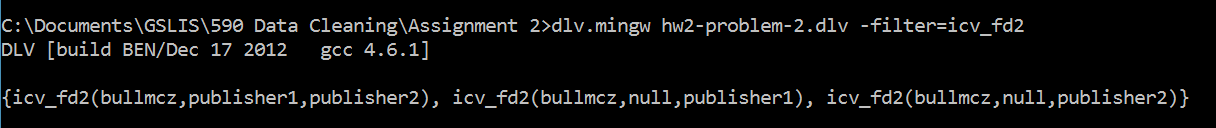


(a) (FD-2)

% Problem 2a FD-2: every journal has a single publisher

% I suppose null value should also be reported.

icv\_fd2(J,P1,P2) :- publication(\_, \_, \_, \_, J, \_, \_, \_, \_, P1), publication(\_, \_, \_, \_, J, \_, \_, \_, \_, P2), P1 < P2.

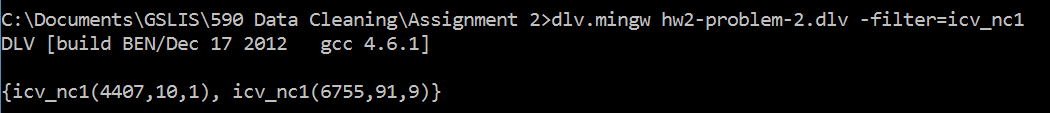


(a) (NC-1)

% Problem 2a NC-1: The last page Lp cannot be smaller than the first page Fp

% I suppose null value for a page number is not a violation.

icv\_nc1(I,F,L) :- publication(I, \_, \_, \_, \_, \_, \_, F, L, \_), F != null, L != null, F > L.



(b) (ID)

% Problem 2b ID (Inclusion Dependency):

% Every cited publication in CITES also occurs in PUBLICATION.

% Note: Publications P2 in the second column of cites(P1,P2) constitute all

% \*cited\* publications, so checking P1 isn't required!

% (If P1 is included, all \*citing\* and \*cited\* pubs are checked for inclusion

% in the Publication table. Wasn't required but is a useful check, too.)

% Auxiliary relation: Unary relation to collect just the pub-ids.

pub\_id(I) :- publication(I,\_,\_,\_,\_,\_,\_,\_,\_,\_).

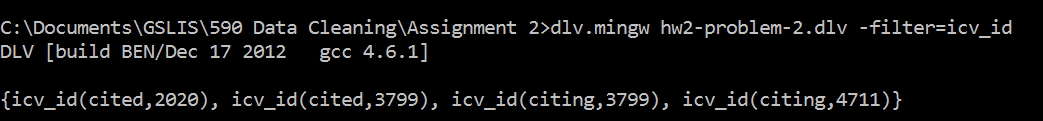
% The CITES[P2] \subseteq PUBLICATION[Pid] is violated if there is a P2

% that's not among the pubs in PUBLICATION:

icv\_id(cited,I) :- cites(\_,I), not pub\_id(I).

% If you want to check \*citing\* articles as well, use this rule:

icv\_id(citing,I) :- cites(I,\_), not pub\_id(I).



(b) (NC-2)

% Problem 2b NC-2: If P1 cites P2 then P2's year of publication

% cannot be greater than P1.

icv\_nc2(I1,I2,Y1,Y2) :-

cites(I1,I2),

publication(I1,\_,Y1,\_,\_,\_,\_,\_,\_,\_),

publication(I2,\_,Y2,\_,\_,\_,\_,\_,\_,\_),

Y1 < Y2.

