Test 3

NAME:_____ STUDENT NO:_____

1. (25%) Given the following family database:

```
parent(X,Y) :- mother(X,Y).
parent(X,Y) :- father(X,Y).

mother(jane,bob).      mother(lucy,john).
mother(mary,david).    mother(lucy,mary).
father(bob,eric).      father(bill,john).      father(mike,mary).

male(bob).        male(john).          male(david).
male(eric).       male(bill).          male(mike).
female(mary).     female(lucy).        female(jane).
```

   (a) (5%) Write down a query for "who is the grandmother of mary?".

   (b) (5%) Write down a query for "who has two fathers?".

   (c) (5%) Write down a query for "which couples are married with children?".

   (d) (10%) Write a predicate "`descendant(X,Y)`" which is true when `X` is a descendant of `Y`.

2. (25%) Given the following predicate "`concat(X,Y,Z)`" which holds if `Z` is the list concatenation of lists `X` and `Y`.

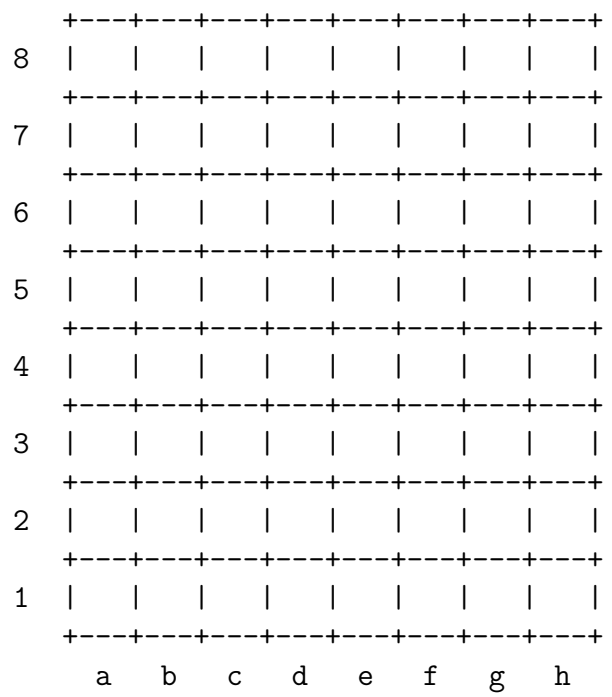
```
concat( [], Y, Y ).
concat( [H|X], Y, [H|Z] ) :- concat( X, Y, Z ).
```

   (a) (10%) What are (all) the answers for the query:

```
?- concat( _, [H|_], [1,2,3] ).
```

   (b) (15%) Using `concat` only, write a predicate "`sublist(X,Y)`" which is true if `X` is a sublist of `Y`, i.e., the elements of `X` appears consecutively inside `Y`.

3. (25%) "On a 8x8 chess board, a pawn can move one square forward or forward diagonally, but not backward. Initially, while a pawn at row 2 can move two squares forward. A pawn can capture any other chess pieces one square forward diagonally." Assume there is a predicate `next(X,Y)` which holds if `X` and `Y` are adjacent coordinates, e.g., `next(1,2). next(2,3). ... next(a,b). next(b,c). ...`



   (a) (15%) Write down a predicate `move( (X1,Y1) (X2,Y2) )` which is true if a pawn can move the position `(X1,Y1)` to position `(X2,Y2)` in one step.

(b) (10%) Write down a predicate `capture( (X1,Y1) (X2,Y2) )` which is true if a pawn in position `(X1,Y1)` can capture another piece in position `(X2,Y2)` in one step.

4. (25%)

(a) (10%) What is a *logical (deduction) inference* step? Explain using the family database in Question 1 as an example.

(b) (15%) What is *unification*? Explain using part 1 of Question 2 as an example.