**CS 445 Homework #6**
Due: October 26, 2020

Create Prolog predicates for the following:

1. `split/3` which has 3 arguments that are all lists. The first list is a list of integers, the second list is a list of the positive integers from the first list, and the third list is the list of the negative integers from the first list.

   For example, `split([1,-2,-3,4,5,6,-7,-8],X,Y)` should succeed binding `X` to the list `[1,4,5,6]` and `Y` to the list `[-2,-3,-7,-8]`.

2. `min_max/3` which has 3 arguments. The first argument is a list of integers, the second argument is the maximum value that is contained in the list, and the third argument is the minimum value that is contained in the list.

   For example, `min_max([8,-2,5,-6,2,3,-1,0,9,4,1],X,Y)` should succeed binding `X` to `9` and `Y` to `-6`.

3. `perfect_squares/3` which has 3 arguments. The first argument is a list of integers, the second argument is a list of the elements from the first list that are perfect squares, and the third argument is the number of perfect squares that are contained in the first list.

   For example, `perfect_squares([4,3,16,2,8,10,9,7],X,Y)` should succeed binding `X` to the list `[4,16,9]` and `Y` to the list `3`.

4. `square_cube_difference/2` which has 2 arguments. The first argument is a list of integers, and the second argument is the difference between the sum of the cubes of the list and the sum of the squares of the list.

   For example, `square_cube_difference([1,2,3],X)` should succeed binding `X` to the list `22` (since the sum of the squares of the list is $1 + 4 + 9 = 14$ and the sum of the cubes of the list is $1 + 8 + 27 = 36$).

5. `standard_deviation/2` which has 2 arguments. The first argument is a list of integers, and the second argument is the standard deviation of the list. Note that the standard deviation of a list is the square root of the variance of the list. The variance of the list is the average of the squared difference of each of the numbers from the mean. Note that you can bind `X` to the square root of `Y` with the goal `X is sqrt(Y)`.

   For example, `standard_deviation([600,470,170,430,300],X)` should succeed binding `X` to 147.32. The mean is 394. The squared difference list is `[42436,5776,50176,1296,8836]`, and its average is 21704 which is the variance. So, the standard deviation is 147.32.

6. Three friends finished first, second, and third in a programming competition. Each of the three has a different first name, likes a different sport, and has a different nationality. Michael likes basketball and did better than the American. Simon, the Israeli, did better than the tennis player. The cricket player came in first. Who is the Australian? What sport does Richard play?

```
test_puzzle(Name, Solution) :-
   structure(Name, Structure),
   clues(Name, Structure, Clues),
   queries(Name, Structure, Queries, Solution),
   solve_puzzle(puzzle(Clues, Queries, Solution), Solution).

solve_puzzle(puzzle(Clues, Queries, Solution), Solution) :-
   solve(Clues),
   solve(Queries).

solve([]).
solve([Clue|Clues]) :- Clue, solve(Clues).

structure(test, [friend(N1, C1, S1), friend(N2, C2, S2), friend(N3,
C3, S3)]).

clues(test, Friends,
[(did_better(Man1Clue1, Man2Clue1, Friends), first_name(Man1Clue1,
michael), sport(Man1Clue1, basketball), nationality(Man2Clue1, american)),
(did_better(Man1Clue2, Man2Clue2, Friends), first_name(Man1Clue2,
simon), nationality(Man1Clue2, israeli), sport(Man2Clue2, tennis)),
(first(Friends, ManClue3), sport(ManClue3, cricket))]).

queries(test, Friends,
[ member(Q1, Friends), first_name(Q1, Name), nationality(Q1, australian),
member(Q2, Friends), first_name(Q2, richard), sport(Q2, Sport) ],
[[‘The Australian is ’, Name], [‘Richard plays ’, Sport]]).

did_better(A, B, [A, B, C]).
did_better(A, C, [A, B, C]).
did_better(B, C, [A, B, C]).

first_name(friend(A, B, C), A).

nationality(friend(A, B, C), B).

sport(friend(A, B, C), C).

first([X|Xs], X).
```

Now, consider another more complex logic puzzle:

> There are five houses, each with a different color and inhabited by a person of a different nationality, with a different pet, drink, and favorite TV program.
>
> The American lives in the red house.
> The Spaniard owns the dog.
> Coffee is drunk in the green house.
> The Ukranian drinks tea.
> The green house is immediately to the right of the ivory house.
> The person who watches *Succession* owns snails.
> *Westworld* is watched in the yellow house.
> Milk is drunk in the middle house.
> The Norwegian lives in the first house on the left.
> The person who watches *ER* lives in the house next to the person with the fox.
> *Westworld* is watched in the house next to the house where the horse is kept.
> The person who watches *Breaking Bad* drinks orange juice.
> The Japanese man watches the *Game of Thrones*.
> The Norwegian lives next to the blue house.
> Who owns the zebra?
> Who drinks water?

Create the appropriate Prolog clauses to solve this puzzle using the name **homework** for your `structure`, `clues`, and `queries`.