CSE 341 — Prolog Discussion Questions
Difference Lists; Controlling Search — Answer Key

These questions use the Prolog rules in the lecture notes (both the basics and the ones on controlling search).

1. Write the list `[squid,clam]` as a difference list (in the most general possible way). Also draw a box-and-arrow diagram of the difference list.

   ```
   [squid,clam|T]\T
   ```

2. Consider `mymember` and also the `member_cut` rule defined in the notes on controlling search. What are all the answers that Prolog returns for the following goals?

   ```
   ?- mymember(1,[A,B,C]).
   A = 1 ;
   B = 1 ;
   C = 1 ;
   false.

   ?- member_cut(1,[A,B,C]).
   A = 1.
   ```

3. What are all the answers that Prolog returns for the following goals?

   ```
   ?- mymember(X,[1,2]), mymember(X,[0,2,2]).
   X = 2 ;
   X = 2 ;
   false.

   (Note that you get the same answer twice!)


   ?- member_cut(X,[1,2]), mymember(X,[0,2,2]).
   false.


   ?- mymember(X,[1,2]), member_cut(X,[0,2,2]).
   X = 2 ;
   false.


   ?- member_cut(X,[1,2]), member_cut(X,[0,2,2]).
   false.
   ```

4. What are all the answers that Prolog returns for the following goals?

   ```
   ?- not(mymember(1,[1,2,3])).
   false.

   ?- not(mymember(5,[1,2,3])).
   ```

```
true.


?- not(mymember(X,[1,2,3])).
false.


?- mymember(X,[1,2,3]), not(mymember(X,[1,2,4])).
X = 3 ;
false.



?- not(mymember(X,[1,2,4])), mymember(X,[1,2,3]).
false.
```

5. Consider the standard version of `append`:

```
append([],Ys,Ys).
append([X|Xs],Ys,[X|Zs]) :- append(Xs,Ys,Zs).
```

If you know that the first argument is ground (that is, fully instantiated, containing no variables), there is a more efficient version that you can write by including a cut.

(a) Define such a version.

```
append([],Ys,Ys) :- !.
append([X|Xs],Ys,[X|Zs]) :- append(Xs,Ys,Zs).
```

(b) Give an example of a query that has exactly the same behavior for both the standard version and the version with a cut.

```
append([1,2],[3,4,5],X).
```

(c) Give an example of a query that behaves differently for for the standard version and the version with a cut.

```
append(A,B,[1,2,3]).
```

(d) What restrictions do we need on the inputs for the two versions to behave exactly the same? (Is it that the first argument is ground?)

No, it's a little more general: just that the first argument not be a variable.