Prolog Tutorial 3

1. Define and test the following predicates according to the specification given below:

a) mysort(L,SL)
SL is list L sorted and all duplicates removed. So, for example:

```
| ?- mysort([3,2,4,1,5,3,2], [1,2,3,4,5]).      gets the answer yes.
| ?- mysort([22, 11, 22, 10], X).               gets the answer X = [10,11,22].
```

Use *setof* and *member*. Prolog has an inbuilt predicate *sort*. Do not use it for this exercise.

b) rev(L, RevL)
RevL is list L with the order of its elements reversed. So, for example:

```
|?- rev([1,2,3],R).                 gets the answer R=[3,2,1].
|?- rev([1,pears,[],[2,3]],R).      gets the answer R=[[2,3],[],pears,1]
```

Prolog has an inbuilt predicate *reverse*. Do not use it for this exercise.

For this exercise give two different definitions for rev, one non-tail-recursive and one tail-recursive.

c) followedBy(X,Y,L)
X is followed by Y on list L. So, for example:

```
| ?- followedBy(4,6,[1,3,4,6,7]).       gets the answer yes.
| ?- followedBy(4,X,[1,3,4,6,7]).       gets the answer X = 6.
| ?- followedBy(X,Y,[1,3,4,6,7]).       gets the answers
                                        X = 1, Y = 3 ? ; X = 3, Y = 4 ? ;
                                        X = 4, Y = 6 ? ; X = 6, Y = 7 ? .
```

Here are some other queries you could try:

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| ?- followedBy(1,2,[X, Y, Z]).         gets the answers
                                        X = 1, Y = 2 ? ; Y = 1, Z = 2.
| ?- followedBy(1,2,X).                 gets the answers
                                        X = [1,2|_A] ;
                                        X = [_A,1,2|_B] ;
                                        X = [_A,_B,1,2|_C] ;
                                        X = [_A,_B,_C,1,2|_D]   etc.
```

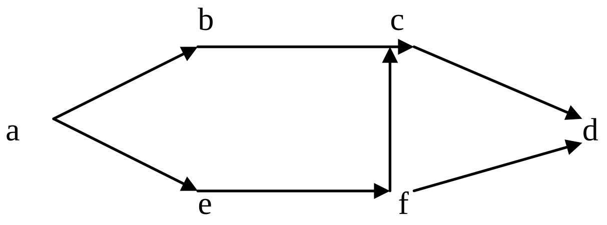
d) nextTo(X,Y,L)
X and Y are next to one another on list L. So, for example:
nextTo(3,6,[12,6,3,1,7]) and nextTo(6,3,[12,6,3,1,7]) both get the answer yes.

e) sumList(L,S)
S is the sum of all integers on list L. Assume L is a list of positive or negative integers. So, for example:

```
?- sumList([1,3,4,6], S).               gets the answers S=14.
```

f. Write Prolog clauses for the relation *last(E,L)* that finds the last element *E* of a list *L*.

2.
a) Describe the graph below by a set of Prolog facts for the relation *edge(X,Y)* stating that there is an edge from node *X* to node *Y*.



b) Using the relation *edge* write a Prolog program for the relation *path(X,Y)* that determines if there is path from node *X* to node *Y*.

c) Modify the definition of relation *path* to define a new relation path/3 such that *path(X,Y,P)* succeeds when *P* is a path from node *X* to node *Y*.

3. Write a Prolog program for the relation *max(E,L)* that determines the maximum element *E* of a list *L*.

4. Using the relation max and any other auxiliary relations you need to define, write a Prolog program for the relation *max_of_all(E, Ls)* to find the maximum element *E* of a list of lists *Ls*. So for example the query
max_of_all(E, [[1],[2,4,1], [3,45,6,4]]) succeeds with E=45. You can assume that in any call Ls is a list of elements of the same type, e.g. all numbers.