4.5 Precipitation(A) :- Raining(A) ; Snowing(A).
Snowing(A,B) :- (Freezing(A), Precipitation(B)).
Raining(A,B) :- (not(Freezing(A)), Precipitation(B)).
Precipitation(Snowing).

?- Freezing(A)

no

?- Raining(A)

no

The only fact that it is Snowing can be deduced therefore Freezing & Raining are false. The clauses can't be rearranged for better answers.

4.7

```
gcd(u,v,w) :- min(u,v,x), divisor(u,v,x,w)
min(u,v,u) :- u<v.
min(u,v,v) :- u>=v.
divisor(u,v,x,x) :- divides(u,x), divides(v,x), !.
divisor(u,v,x,w) :- y is x-1, divisor(u,v,y,w).
divides(u,x) :- y is u mod x, y=0.
```

Euclid's efficiency is $O(\log(\min(a,b)))$ whereas this is less efficient at $O(w)$

4.19 member(X, [X|_]).
member(X, [_|L]) :- member(X, L).

?- member(X, [2,3])
if X==2 or X==3 return true

member(2, L) → if 2 ∈ L & return result

[2 ∉ L] false
[2 ∈ L] true

member(X, [2,3])
|X∈2| |X=2|
|X≠3| |X!=3|
false true

4.29 Sort is a built in list operation that would throw an error if overloaded. The predicate must avoid names of current built in predicates in order to implement.