

Title: Prolog Assignment #2: Pokemon

Abstract:

Pokemon and List Processing

Task 1:

Code:

```
% -----  
% -----  
% --- File: pokemon.pro  
% --- Line: Just a few facts about pokemon  
% -----  
  
% -----  
% --- cen(P) :: Pokemon P was "creatio ex nihilo"  
  
cen(pikachu).  
cen(bulbasaur).  
cen(caterpie).  
cen(charmander).  
cen(vulpix).  
cen(poliwag).  
cen(squirtle).  
cen(staryu).  
  
% -----  
% --- evolves(P,Q) :: Pokemon P directly evolves to pokemon Q  
  
evolves(pikachu,raichu).  
evolves(bulbasaur,ivysaur).  
evolves(ivysaur,venusaur).  
evolves(caterpie,metapod).  
evolves(metapod,butterfree).  
evolves(charmander,charmeleon).  
evolves(charmeleon,charizard).  
evolves(vulpix,ninetails).  
evolves(poliwag,poliwhirl).  
evolves(poliwhirl,poliwrath).  
evolves(squirtle,wartortle).  
evolves(wartortle,blastoise).  
evolves(staryu,starmie).  
  
% -----
```

% --- pokemon(name(N),T,hp(H),attach(A,D)) :: There is a pokemon with
% --- name N, type T, hit point value H, and attack named A that does
% --- damage D.

pokemon(name(pikachu), electric, hp(60), attack(gnaw, 10)).
pokemon(name(raichu), electric, hp(90), attack(thunder-shock, 90)).

pokemon(name(bulbasaur), grass, hp(40), attack(leech-seed, 20)).
pokemon(name(ivysaur), grass, hp(60), attack(vine-whip, 30)).
pokemon(name(venusaur), grass, hp(140), attack(poison-powder, 70)).

pokemon(name(caterpie), grass, hp(50), attack(gnaw, 20)).
pokemon(name(metapod), grass, hp(70), attack(stun-spore, 20)).
pokemon(name(butterfree), grass, hp(130), attack(whirlwind, 80)).

pokemon(name(charmander), fire, hp(50), attack(scratch, 10)).
pokemon(name(charmeleon), fire, hp(80), attack(slash, 50)).
pokemon(name(charizard), fire, hp(170), attack(royal-blaze, 100)).

pokemon(name(vulpix), fire, hp(60), attack(confuse-ray, 20)).
pokemon(name(ninetails), fire, hp(100), attack(fire-blast, 120)).

pokemon(name(poliwag), water, hp(60), attack(water-gun, 30)).
pokemon(name(poliwhirl), water, hp(80), attack(amnesia, 30)).
pokemon(name(poliwrath), water, hp(140), attack(dashing-punch, 50)).

pokemon(name(squirtle), water, hp(40), attack(bubble, 10)).
pokemon(name(wartortle), water, hp(80), attack(waterfall, 60)).
pokemon(name(blastoise), water, hp(140), attack(hydro-pump, 60)).

pokemon(name(staryu), water, hp(40), attack(slap, 20)).
pokemon(name(starmie), water, hp(60), attack(star-freeze, 20)).

Queries:

```

?- consult('pokemon.pro').
true.

?- cen(pikachu).
true.

?- cen(raichu).
false.

?- cen(CEN).
CEN = pikachu ;
CEN = bulbasaur ;
CEN = caterpie ;
CEN = charmander ;
CEN = vulpix ;
CEN = poliwag ;
CEN = squirtle ;
CEN = staryu.

?- cen(CEN),write(CEN),nl,fail.
pikachu
bulbasaur
caterpie
charmander
vulpix
poliwag
squirtle
staryu
false.

?- evolves(squirtle,wartortle).
true.

?- evovles(wartortle,squirtle).
Correct to: "evolves(wartortle,squirtle)"? yes
false.

?- evolves(squirtle,blastoise).
false.

?- evolves(X,Y), evolves(Y,Z).
X = bulbasaur,
Y = ivysaur,
Z = venusaur ;
X = caterpie,
Y = metapod,
Z = butterfree ;
X = charmander,
Y = charmeleon,
Z = charizard ;
X = poliwag,
Y = poliwhirl,
Z = poliwrath ;
X = squirtle,
Y = wartortle,
Z = blastoise ;
false.

```

```
?- evolves(X,Y),evolves(Y,Z),write(X --> Z),nl,fail.  
bulbasaur-->venusaur  
caterpie-->butterfree  
charmander-->charizard  
poliwhag-->poliwrath  
squirtle-->blastoise  
false.
```

```
?- pokemon(name(N),_,_,_),write(N),nl,fail.  
pikachu  
raichu  
bulbasaur  
ivysaur  
venusaur  
caterpie  
metapod  
butterfree  
charmander  
charmeleon  
charizard  
vulpix  
ninetails  
poliwhag  
poliwhirl  
poliwrath  
squirtle  
wartortle  
blastoise  
staryu  
starmie  
false.
```

```
?- pokemon(name(N),fire,_,_),write(N),nl,fail.  
charmander  
charmeleon  
charizard  
vulpix  
ninetails  
false.
```

```
?- pokemon(name(N),K,_,_),write('nks(name('),write(N),write('),kind('),write(K),write(')')),nl,fail.  
nks(name(pikachu),kind(electric))  
nks(name(raichu),kind(electric))  
nks(name(bulbasaur),kind(grass))  
nks(name(ivysaur),kind(grass))  
nks(name(venusaur),kind(grass))  
nks(name(caterpie),kind(grass))  
nks(name(metapod),kind(grass))  
nks(name(butterfree),kind(grass))  
nks(name(charmander),kind(fire))  
nks(name(charmeleon),kind(fire))  
nks(name(charizard),kind(fire))  
nks(name(vulpix),kind(fire))  
nks(name(ninetails),kind(fire))  
nks(name(poliwhag),kind(water))  
nks(name(poliwhirl),kind(water))  
nks(name(poliwrath),kind(water))  
nks(name(squirtle),kind(water))  
nks(name(wartortle),kind(water))  
nks(name(blastoise),kind(water))  
nks(name(staryu),kind(water))  
nks(name(starmie),kind(water))  
false.
```

```

?- pokemon(name(N),_,_,attack(waterfall,_)).
N = wartortle ;
false.

?- pokemon(name(N),_,_,attack(poison-powder,_)).
N = venusaur ;
false.

?- pokemon(_,water,_,attack(A,_)),write(A),nl,fail.
water-gun
amnesia
dashing-punch
bubble
waterfall
hydro-pump
slap
star-freeze
false.

?- pokemon(name(poliwhirl),_,hp(HP),_).
HP = 80.

?- pokemon(name(butterfree),_,hp(HP),_).
HP = 130.

?- pokemon(name(N),_,hp(HP),_), HP>85.
N = raichu,
HP = 90 ;
N = venusaur,
HP = 140 ;
N = butterfree,
HP = 130 ;
N = charizard,
HP = 170 ;
N = ninetails,
HP = 100 ;
N = poliwrath,
HP = 140 ;
N = blastoise,
HP = 140 ;
false.

?- pokemon(name(N),_,_,attack(_,D)), D>60.
N = raichu,
D = 90 ;
N = venusaur,
D = 70 ;
N = butterfree,
D = 80 ;
N = charizard,
D = 100 ;
N = ninetails,
D = 120 ;
false.

?- cen(N),pokemon(name(N),_,hp(HP),_),write(N),write(: ),write(HP),nl,fail.
pikachu:60
bulbasaur:40
caterpie:50
charmander:50
vulpix:60
poliwhirl:60
squirtle:40
staryu:40
false.

```

More Code:

```
display_cen :- cen(N),write(N),nl,fail.
```

```
display_not_cen :- evolves(X,Y),write(Y),nl,fail.
```

```
generator(N,T) :- pokemon(name(N),T,_,_).
```

```
display_names :- pokemon(name(N),_,_,_),write(N),nl,fail.
```

```
display_attacks :- pokemon(_,_,_,attack(A,_)),write(A),nl,fail.
```

```
display_cen_attacks :- cen(N), pokemon(name(N),_,_,attack(A,_)),write(A),nl,fail.
```

```
indicate_attack(N) :- pokemon(name(N),_,_,attack(A,_)),write(N -> A),nl,fail.
```

```
indicate_attacks :- pokemon(name(N),_,_,attack(A,_)),write(N -> A),nl,fail.
```

```
powerful(P) :- pokemon(name(P),_,_,attack(_,D)), D>55.
```

```
tough(P) :- pokemon(name(P),_,hp(HP),_), HP>100.
```

```
awesome(P) :- powerful(P), tough(P).
```

```
powerful_but_vulnerable(N) :- pokemon(name(N),_,hp(HP),_), powerful(N), HP<101.
```

```
type(P,T) :- pokemon(name(P),T,_,_).
```

```
dump_kind(K) :-
```

```
pokemon(name(N),K,hp(HP),attack(A,D)),write('pokemon(name('),write(N),write('),'),
```

```
write(K),write('hp('),write(HP),write('),attack('),write(A),write(','),write(D),write('))'),nl,fail.
```

```
family(X) :- write(X),write(' '), evolves(X,Y), write(Y), write(' '), evolves(Y,Z), write(Z).
```

```
families :- cen(X), write(X),write(' '), evolves(X,Y), write(Y), write(' '), evolves(Y,Z), write(Z), nl, fail.
```

```
lineage(N) :- pokemon(name(N),T,HP,A), write(pokemon(name(N))),write(','), write(T),write(','), write(HP), write(','), write(A), write(','), nl,
```

```
evolves(N,NN), pokemon(name(NN),TT,HPP,AA),  
write(pokemon(name(NN))),write(','),  
write(TT),write(','), write(HPP), write(','), write(AA), write(')'), nl,  
evolves(NN,NNN), pokemon(name(NNN),TTT,HPPP,AAA),  
write(pokemon(name(NNN))),write(','),  
write(TTT),write(','), write(HPPP), write(','), write(AAA), write(')'), nl.
```

Demo: //note, some predicate descriptions are inconsistent with the demo provided by the prof, for example in the demo, generator only shows cen for some reason, and takes only variables, not names, as a parameter. Also, spelling inconsistencies. So I just what seemed to make the most sense case by case

```

?- display_cen.
pikachu
bulbasaur
caterpie
charmander
vulpix
poliwhag
squirtle
staryu
false.

?- display_not_cen.
raichu
ivysaur
venusaur
metapod
butterfree
charmeleon
charizard
ninetails
poliwhirl
poliwrath
wartortle
blastoise
starmie
false.

?- generator(Name,fire).
Name = charmander ;
Name = charmeleon ;
Name = charizard ;
Name = vulpix ;
Name = ninetails.

?- generator(Name,water).
Name = poliwhag ;
Name = poliwhirl ;
Name = poliwrath ;
Name = squirtle ;
Name = wartortle ;
Name = blastoise ;
Name = staryu ;
Name = starmie.

?- generator(Name,grass).
Name = bulbasaur ;
Name = ivysaur ;
Name = venusaur ;
Name = caterpie ;
Name = metapod ;
Name = butterfree.

?- generator(Name,electric).
Name = pikachu ;
Name = raichu.

?- generator(pikachu,electric).
true.

?- generator(bulbasaur,electric).
false.

?- generator(bulbasaur,grass).
true.

?- display_names.
pikachu
raichu
bulbasaur
ivysaur
venusaur
caterpie
metapod
butterfree
charmander
charmeleon
charizard
vulpix
ninetails
poliwhag
poliwhirl
poliwrath
squirtle
wartortle
blastoise
staryu
starmie
false.

?- display_attacks.
gnaw
thunder-shock
leech-seed
vine-whip
poison-powder
gnaw
stun-spore
whirlwind
scratch
slash
royal-blaze
confuse-ray
fire-blast
water-gun
amnesia
dashing-punch
bubble
waterfall
hydro-pump
slap
star-freeze
false.

```

```
?- display_cen_attacks.
gnaw
leech-seed
gnaw
scratch
confuse-ray
water-gun
bubble
slap
false.

?- indicate_attack(charmander).
charmander->scratch
false.

?- indicate_attack(bulbasaur).
bulbasaur->leech-seed
false.

?- indicate_attacks.
pikachu->gnaw
raichu->thunder-shock
bulbasaur->leech-seed
ivysaur->vine-whip
venusaur->poison-powder
caterpie->gnaw
metapod->stun-spore
butterfree->whirlwind
charmander->scratch
charmeleon->slash
charizard->royal-blaze
vulpix->confuse-ray
ninetails->fire-blast
poliwag->water-gun
poliwhirl->amnesia
poliwrath->dashing-punch
squirtle->bubble
wartortle->waterfall
blastoise->hydro-pump
staryu->slap
starmie->star-freeze
false.

?- powerful(Name).
Name = raichu ;
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = ninetails ;
Name = wartortle ;
Name = blastoise ;
false.

?- tough(Name).
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = poliwrath ;
Name = blastoise ;
false.
```

```

?- awesome(Name).
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = blastoise ;
false.

?- powerful_but_vulnerable(Name).
Name = raichu ;
Name = ninetails ;
Name = wartortle ;
false.

?- type(squirtle,Type).
Type = water.

?- type(caterpie,Type).
Type = grass.

?- type(Name,fire),write(Name),nl,fail.
charmander
charmeleon
charizard
vulpix
ninetails
false.

?- dump_kind(water).
pokemon(name(poliwag),water,hp(60),attack(water-gun,30))
pokemon(name(poliwhirl),water,hp(80),attack(amnesia,30))
pokemon(name(poliwrath),water,hp(140),attack(dashing-punch,50))
pokemon(name(squirtle),water,hp(40),attack(bubble,10))
pokemon(name(wartortle),water,hp(80),attack(waterfall,60))
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60))
pokemon(name(staryu),water,hp(40),attack(slap,20))
pokemon(name(starmie),water,hp(60),attack(star-freeze,20))
false.

?- dump_kind(grass).
pokemon(name(bulbasaur),grass,hp(40),attack(leech-seed,20))
pokemon(name(ivysaur),grass,hp(60),attack(vine-whip,30))
pokemon(name(venusaur),grass,hp(140),attack(poison-powder,70))
pokemon(name(caterpie),grass,hp(50),attack(gnaw,20))
pokemon(name(metapod),grass,hp(70),attack(stun-spore,20))
pokemon(name(butterfree),grass,hp(130),attack(whirlwind,80))
false.

?- family(pikachu).
pikachu raichu
false.

?- family(bulbasaur).
bulbasaur ivysaur venusaur
true.

```

```

?- family(caterpie).
caterpie metapod butterfree
true.

?- families.
pikachu raichu bulbasaur ivysaur venusaur
caterpie metapod butterfree
charmander charmeleon charizard
vulpix ninetails poliwag poliwhirl poliwrath
squirtle wartortle blastoise
staryu starmie
false.

?- lineage(pikachu).
pokemon(name(pikachu)),electric, hp(60), attack(gnaw,10))
pokemon(name(raichu)),electric, hp(90), attack(thunder-shock,90))
false.

?- lineage(squirtle).
pokemon(name(squirtle)),water, hp(40), attack(bubble,10))
pokemon(name(wartortle)),water, hp(80), attack(waterfall,60))
pokemon(name(blastoise)),water, hp(140), attack(hydro-pump,60))
true.

?- lineage(wartortle).
pokemon(name(wartortle)),water, hp(80), attack(waterfall,60))
pokemon(name(blastoise)),water, hp(140), attack(hydro-pump,60))
false.

?- lineage(blastoise).
pokemon(name(blastoise)),water, hp(140), attack(hydro-pump,60))
false.

?- lineage(charmander).
pokemon(name(charmander)),fire, hp(50), attack(scratch,10))
pokemon(name(charmeleon)),fire, hp(80), attack(slash,50))
pokemon(name(charizard)),fire, hp(170), attack(royal-blaze,100))
true.

```

12 More Pokemon:

```

cen(asshopper).
cen(bellyfish).
cen(flame-ignon).
cen(electickle).

```

```

evolves(asshopper, circumlocust).
evolves(circumlocust, cricketeer).
evolves(bellyfish, medusadeck).
evolves(medusadeck, tentaclean).
evolves(flame-ignon, combusticles).
evolves(combusticles, californius).
evolves(electickle, electrickle).
evolves(electrickle, electoral).

```

pokemon(name(asshopper), grass, hp(70), attack(fart, 30)).
pokemon(name(circumlocust), grass, hp(90), attack(devour, 130)).
pokemon(name(cricketeer), grass, hp(110), attack(jiminy-cricket, 200)).

pokemon(name(bellyfish), water, hp(60), attack(belly-flop, 30)).
pokemon(name(medusadeck), water, hp(90), attack(flood, 40)).
pokemon(name(tentaclean), water, hp(130), attack(sting, 50)).

pokemon(name(flame-ignon), fire, hp(50), attack(grill, 10)).
pokemon(name(compusticles), fire, hp(100), attack(combustion, 60)).
pokemon(name(californius), fire, hp(140), attack(wild-fire, 160)).

pokemon(name(electickle), electric, hp(40), attack(tickle, 20)).
pokemon(name(electrickle), electric, hp(60), attack(trickle, 50)).
pokemon(name(electoral), electric, hp(80), attack(election-fraud, 70)).

Demo with new pokemon:

```

?- display_cen.
pikachu
bulbasaur
caterpie
charmander
vulpix
poliwag
squirtle
staryu
asshopper
bellyfish
flame-ignon
electickle
false.

?- display_not_cen.
raichu
ivysaur
venusaur
metapod
butterfree
charmeleon
charizard
ninetails
poliwhirl
poliwrath
wartortle
blastoise
starmie
circumlocust
cricketeer
medusadeck
tentaclean
combusticles
californius
electrickle
electoral
false.

?- generator(Name,fire).
Name = charmander ;
Name = charmeleon ;
Name = charizard ;
Name = vulpix ;
Name = ninetails ;
Name = flame-ignon ;
Name = compusticles ;
Name = californius.

?- generator(Name,water).
Name = poliwag ;
Name = poliwhirl ;
Name = poliwrath ;
Name = squirtle ;
Name = wartortle ;
Name = blastoise ;
Name = staryu ;
Name = starmie ;
Name = bellyfish ;
Name = medusadeck ;
Name = tentaclean.

?- generator(Name,grass).
Name = bulbasaur ;
Name = ivysaur ;
Name = venusaur ;
Name = caterpie ;
Name = metapod ;
Name = butterfree ;
Name = asshopper ;
Name = circumlocust ;
Name = cricketeer.

?- generator(Name,electric).
Name = pikachu ;
Name = raichu ;
Name = electickle ;
Name = electrickle ;
Name = electoral.

?- display_names.
pikachu
raichu
bulbasaur
ivysaur
venusaur
caterpie
metapod
butterfree
charmander
charmeleon
charizard
vulpix
ninetails
poliwag
poliwhirl
poliwrath
squirtle
wartortle
blastoise
staryu
starmie
asshopper
circumlocust
cricketeer
bellyfish
medusadeck
tentaclean
flame-ignon
compusticles
californius
electickle
electrickle
electoral
false.

```

?- display_attacks.

gnaw
thunder-shock
leech-seed
vine-whip
poison-powder
gnaw
stun-spore
whirlwind
scratch
slash
royal-blaze
confuse-ray
fire-blast
water-gun
amnesia
dashing-punch
bubble
waterfall
hydro-pump
slap
star-freeze
fart
devour
jimony-cricket
belly-flop
flood
sting
grill
combustion
wild-fire
tickle
trickle
election-fraud
false.

?- display_cen_attacks.

gnaw
leech-seed
gnaw
scratch
confuse-ray
water-gun
bubble
slap
fart
belly-flop
grill
tickle
false.

?- indicate_attack(bellyfish).

bellyfish->belly-flop
false.

?- indicate_attack(asshopper).

asshopper->fart
false.

?- indicate_attacks.

pikachu->gnaw
raichu->thunder-shock
bulbasaur->leech-seed
ivysaur->vine-whip
venusaur->poison-powder
caterpie->gnaw
metapod->stun-spore
butterfree->whirlwind
charmander->scratch
charmeleon->slash
charizard->royal-blaze
vulpix->confuse-ray
ninetails->fire-blast
poliwhirl->water-gun
poliwhirl->amnesia
poliwrath->dashing-punch
squirtle->bubble
wartortle->waterfall
blastoise->hydro-pump
staryu->slap
starmie->star-freeze
asshopper->fart
circumlocust->devour
cricketeer->jimony-cricket
bellyfish->belly-flop
medusadeck->flood
tentaclean->sting
flame-ignon->grill
compusticles->combustion
californius->wild-fire
electickle->tickle
electrickle->trickle
electoral->election-fraud
false.

?- powerful(N).

N = raichu ;
N = venusaur ;
N = butterfree ;
N = charizard ;
N = ninetails ;
N = wartortle ;
N = blastoise ;
N = circumlocust ;
N = cricketeer ;
N = compusticles ;
N = californius ;
N = electoral.

?- tough(N).

N = venusaur ;
N = butterfree ;
N = charizard ;
N = poliwrath ;
N = blastoise ;
N = cricketeer ;
N = tentaclean ;
N = californius ;
false.

```

?- awesome(N).
N = venusaur ;
N = butterfly ;
N = charizard ;
N = blastoise ;
N = cricketeer ;
N = californius ;
false.

?- powerful_but_vulnerable(N).
N = raichu ;
N = ninetails ;
N = wartortle ;
N = circumlocust ;
N = compusticles ;
N = electoral.

?- type(asshopper,T).
T = grass.

?- type(bellyfish,T).
T = water.

?- type(Name,fire),write(Name),nl,fail.
charmander
charmeleon
charizard
vulpix
ninetails
flame-ignnon
compusticles
californius
false.

?- dump_kind(water).
pokemon(name(poliwag),water,hp(60),attack(water-gun,30))
pokemon(name(poliwhirl),water,hp(80),attack(amnesia,30))
pokemon(name(poliwrath),water,hp(140),attack(dashing-punch,50))
pokemon(name(squirtle),water,hp(40),attack(bubble,10))
pokemon(name(wartortle),water,hp(80),attack(waterfall,60))
pokemon(name(blastoise),water,hp(140),attack(hydro-pump,60))
pokemon(name(staryu),water,hp(40),attack(slap,20))
pokemon(name(starmie),water,hp(60),attack(star-freeze,20))
pokemon(name(bellyfish),water,hp(60),attack(belly-flop,30))
pokemon(name(medusadeck),water,hp(90),attack(flood,40))
pokemon(name(tentaclean),water,hp(130),attack(sting,50))
false.

?- dump_kind(fire).
pokemon(name(charmander),fire,hp(50),attack(scratch,10))
pokemon(name(charmeleon),fire,hp(80),attack(slash,50))
pokemon(name(charizard),fire,hp(170),attack(royal-blaze,100))
pokemon(name(vulpix),fire,hp(60),attack(confuse-ray,20))
pokemon(name(ninetails),fire,hp(100),attack(fire-blast,120))
pokemon(name(flame-ignnon),fire,hp(50),attack(grill,10))
pokemon(name(compusticles),fire,hp(100),attack(combustion,60))
pokemon(name(californius),fire,hp(140),attack(wild-fire,160))
false.

```

```

?- family(asshopper).
asshopper circumlocust cricketeer
true.

?- family(bellyfish).
bellyfish medusadeck tentaclean
true.

?- family(electickle).
electickle electrickle electoral
true.

?- families.
pikachu raichu bulbasaur ivysaur venusaur
caterpie metapod butterfree
charmander charmeleon charizard
vulpix ninetails poliwag poliwhirl poliwrath
squirtle wartortle blastoise
staryu starmie assshopper circumlocust cricketeer
bellyfish medusadeck tentaclean
flame-ignon combusticles californius
electickle electrickle electoral
false.

?- lineage(electickle).
pokemon(name(electickle)),electric,hp(40),attack(tickle,20))
pokemon(name(electrickle)),electric,hp(60),attack(trickle,50))
pokemon(name(electoral)),electric,hp(80),attack(election-fraud,70))
true.

?- lineage(bellyfish).
pokemon(name(bellyfish)),water,hp(60),attack(belly-flop,30))
pokemon(name(medusadeck)),water,hp(90),attack(flood,40))
pokemon(name(tentaclean)),water,hp(130),attack(sting,50))
true.

```

Task 2:

Code:

```
first([H|_], H).
```

```
rest([_|T], T).
```

```
last([H|[]], H).
```

```
last([_|T], Result) :- last(T,Result).
```

```
nth(0,[H|_],H).
```

```
nth(N,[_|T],E) :- K is N - 1, nth(K,T,E).
```

```
writelist([]).
```

```
writelist([H|T]) :- write(H), nl, writelist(T).
```

```
sum([],0).
sum([Head|Tail],Sum) :-
sum(Tail,SumOfTail),
Sum is Head + SumOfTail.
```

```
add_first(X,L,[X|L]).
```

```
add_last(X,[],[X]).
add_last(X,[H|T],[H|TX]) :- add_last(X,T,TX).
```

```
iota(0,[]).
iota(N,IotaN) :-
K is N - 1,
iota(K,IotaK),
add_last(N,IotaK,IotaN).
```

```
pick(L,Item) :-
length(L,Length),
random(0,Length,RN),
nth(RN,L,Item).
```

```
make_set([],[]).
make_set([H|T],TS) :-
member(H,T),
make_set(T,TS).
make_set([H|T],[H|TS]) :-
make_set(T,TS).
```

Demo:

```
?- first([apple],First).
First = apple.

?- first([c,d,e,f,g,a,b],P).
P = c.

?- rest([apple],Rest).
Rest = [].

?- rest([c,d,e,f,g,a,b],Rest).
Rest = [d, e, f, g, a, b].

?- last([peach],Last).
Last = peach.

?- last([c,d,e,f,g,a,b],P).
P = b.

?- nth(0,[zero,one,two,three,four],Element).
Element = zero.

?- nth(3,[four,three,two,one,zero],Element).
Element = one.

?- writelist([red,yellow,blue,green,purple,orange]).
red
yellow
blue
green
purple
orange
true.

?- sum([],Sum).
Sum = 0.

?- sum([2,3,5,7,11],SumOfPrimes).
SumOfPrimes = 28.

?- add_first(thing,[],Result).
Result = [thing].

?- add_first(racket,[prolog,haskell,rust],Languages).
Languages = [racket, prolog, haskell, rust].

?- add_last(thing,[],Result).
Result = [thing].

?- add_last(rust,[racket,prolog,haskell],Languages).
Languages = [racket, prolog, haskell, rust].

?- iota(5,Iota5).
Iota5 = [1, 2, 3, 4, 5].

?- iota(9,Iota9).
Iota9 = [1, 2, 3, 4, 5, 6, 7, 8, 9].

?- pick([cherry,peach,apple,blueberry],Pie).
Pie = cherry.
```

```
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = cherry .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = cherry .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = apple .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = apple .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = cherry .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = blueberry .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = peach .  
  
?- pick([cherry,peach,apple,blueberry],Pie).  
Pie = cherry .  
  
?- make_set([1,1,2,1,2,3,1,2,3,4],Set).  
Set = [1, 2, 3, 4] .  
  
?- make_set([bit,bot,bet,bot,bot,bit],B).  
B = [bet, bot, bit] .
```