

## Prolog Programming Assignment #2: A Favorite Pokemon KB plus Simple List Processing Exercises:

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### Abstract:

Task 1 involves establishing and interacting with a Pokemon knowledge base, and then extending the KB in a number of ways and interrogating the extended KB. Task 2 affords you an opportunity to engage in a variety of list processing exercises.

### Task 1 - Pokemon:

#### Part 1: Initial Pokemon KB:

```
1 % -----
2 %
3 % --- File: pokemon.pro
4 % --- Line: Just a few facts about pokemon
5 % -----
6
7 % -----
8 % --- cen(P) :: Pokemon P was "creatio ex nihilo"
9
10 cen(pikachu).
11 cen(bulbasaur).
12 cen(caterpie).
13 cen(charmander).
14 cen(vulpix).
15 cen(poliwag).
16 cen(squirtle).
17 cen(staryu).
18
19 % -----
20 % --- evolves(P,Q) :: Pokemon P directly evolves to pokemon Q
21
22 evolves(pikachu,raichu).
23 evolves(bulbasaur,ivysaur).
24 evolves(ivysaur,venusaur).
25 evolves(caterpie,metapod).
26 evolves(metapod,butterfree).
27 evolves(charmander,charmeleon).
28 evolves(charmeleon,charizard).
29 evolves(vulpix,ninetails).
30 evolves(poliwag,poliwhirl).
31 evolves(poliwhirl,poliwrath).
32 evolves(squirtle,wartortle).
33 evolves(wartortle,blastoise).
34 evolves(staryu,starmie).
35
36 % -----
37 % --- pokemon(name(N),T,hp(H),attach(A,D)) :: There is a pokemon with
38 % --- name N, type T, hit point value H, and attach named A that does
39 % --- damage D.
40
41 pokemon(name(pikachu), electric, hp(60), attack(gnaw, 10)).
42 pokemon(name(raichu), electric, hp(90), attack(thunder-shock, 90)).
43
44 pokemon(name(bulbasaur), grass, hp(40), attack(leech-seed, 20)).
45 pokemon(name(ivysaur), grass, hp(60), attack(vine-whip, 30)).
46 pokemon(name(venusaur), grass, hp(140), attack(poison-powder, 70)).
```

```

47
48     pokemon(name(caterpie), grass, hp(50), attack(gnaw, 20)).
49     pokemon(name(metapod), grass, hp(70), attack(stun-spore, 20)).
50     pokemon(name(butterfree), grass, hp(130), attack(whirlwind, 80)).
51
52     pokemon(name(charmander), fire, hp(50), attack(scratch, 10)).
53     pokemon(name(charmeleon), fire, hp(80), attack(slash, 50)).
54     pokemon(name(charizard), fire, hp(170), attack(royal-blaze, 100)).
55
56     pokemon(name(vulpix), fire, hp(60), attack(confuse-ray, 20)).
57     pokemon(name(ninetails), fire, hp(100), attack(fire-blast, 120)).
58
59     pokemon(name(poliwag), water, hp(60), attack(water-gun, 30)).
60     pokemon(name(poliwhirl), water, hp(80), attack(amnesia, 30)).
61     pokemon(name(poliwrath), water, hp(140), attack(dashing-punch, 50)).
62
63     pokemon(name(squirtle), water, hp(40), attack(bubble, 10)).
64     pokemon(name(wartortle), water, hp(80), attack(waterfall, 60)).
65     pokemon(name(blastoise), water, hp(140), attack(hydro-pump, 60)).
66
67     pokemon(name(staryu), water, hp(40), attack(slap, 20)).
68     pokemon(name(starmie), water, hp(60), attack(star-freeze, 20)).

```

## Part 2: Interaction demo with the Initial KB:

```

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

?- cen(pikachu).
true.

?- cen(raichu).
false.

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

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

?- evolves(squirtle,wartortle).
true.

?- evolves(wartortle,squirtle).
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), write('-->'), write(Z),nl,fail.
bulbasaur-->venusaur
caterpie-->butterfree
charmander-->charizard
poliwag-->poliwrath
squirtle-->blastoise
false.

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

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

?- pokemon(name(N),_,_,attack(posion-powder,_)).
false.

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

```

```

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

?- pokemon(name(N),_,_,attack(waterfall,_,_)).N = wartortle ,
?- pokemon(name(N),_,_,attack(poison-powder,_,_)).N = venusaur ,

?- pokemon(_,water,_,attack(N,_,_)),write(N),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, write(N), nl, fail.
raichu
venusaur
butterfree
charizard
ninetails
poliwrath
blastoise
false.

?- pokemon(_,_,_,attack(N,DMG)), DMG > 60, write(N), nl, fail.
thunder-shock
poison-powder
whirlwind
royal-blaze
fire-blast
false.

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

```

### Part 3: KB Extension:

```
display_names :- pokemon(name(Name),_,_,_),write(Name),nl,fail.
display_attacks :- pokemon(_,_,_,attack(Attack,_)),write(Attack),nl,fail.
display_cen_attacks :- pokemon(name(Name),_,_,attack(Attack,_)),cen(Name),write(Attack),nl,fail.
indicate_attack(Name) :- pokemon(name(Name),_,_,attack(Attack,_)),write(Name-->Attack),nl,fail.
indicate_attacks :- pokemon(name(Name),_,_,attack(Attack,_)),write(Name-->Attack),nl,fail.
generator(Name,Type) :- pokemon(name(Name),Type,_,_).

powerful(Name) :- pokemon(name(Name),_,_,attack(_,DMG)),DMG > 55.
awesome(Name) :- powerful(Name),tough(Name).
tough(Name) :- pokemon(name(Name),_,_,hp(HP,_)),HP > 100.
powerful_but_vulnerable(Name) :- powerful(Name),not(tough(Name)).
type(Name,Type) :- pokemon(name(Name),Type,_,_).

dump_kind(Type) :- pokemon(name(Name),Type,hp(HP),attack(Attack,DMG)),
write('pokemon (name('),write(Name),write('),'),write(Type),
write('),hp('),write(HP),write('),'),write(Attack),write(Attack),
write('),'),write(DMG),write(')'),nl,fail.

display_cen :- cen(P),write(P),nl,fail.
display_not_cen :- pokemon(name(Name),_,_,_),not(cen(Name)),write(Name),nl,fail.

family(Name) :- write(Name),write(' '),evolves(Name,Y),
write(Y),write(' '),evolves(Y,Z),write(Z).
families :- cen(Name),write(Name),write(' '),evolves(Name,Y),write(Y),write(' '),
( evolves(Y,Z)-> write(Z),nl,fail;nl,fail).

lineage(Name) :- pokemon(name(Name),Type,Hp,Attack),write(pokemon(name(Name))),write(' '),
write(Type),write(' '),write(Hp),write(' '),write(Attack),write(' '),nl,
evolves(Name,Y),pokemon(name(Y),Ytype,Yhp,Yattack),write(pokemon(name(Y))),write(' '),
write(Ytype),write(' '),write(Yhp),write(' '),write(Yattack),write(' '),nl,
evolves(Y,Z),pokemon(name(Z),Ztype,Zhp,Zattack),write(pokemon(name(Z))),write(' '),
write(Ztype),write(' '),write(Zhp),write(' '),write(Zattack),write(' '),nl.
```

### Part 4: Interaction demo with the Augmented KB:

```
?- display_cen.
pikachu
bulbasaur
caterpie
charmander
vulpix
poliwhirl
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 = poliwhirl ;
Name = poliwrath ;
Name = squirtle ;
Name = wartortle ;
Name = blastoise ;
Name = staryu ;
Name = starmie.

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

```

?- 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
poliwhag->water-gun
poliwhirl->amnesia
poliwrath->dashing-punch
squirtle->bubble
wartortle->waterfall
blastoise->hydro-pump
staryu->slap
starmie->star-freeze
true.

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

```

```

?- tough(Nam).
Nam = venusaur ;
Nam = butterfree ;
Nam = charizard ;
Nam = poliwrath ;
Nam = 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.
charmmander
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(ammnesia, 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
charmmander 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.

```

## Part 5: KB Augmented by 12 Pokemon:

```
cen(shinx) .  
cen(snivy) .  
cen(mudkip) .
```

```
evolves(torchic,combusken) .  
evolves(combusken,blaziken) .  
evolves(shinx,luxio) .  
evolves(luxio,luxray) .  
evolves(snivy,servine) .  
evolves(servine,serperior) .  
evolves(mudkip,marshtomp) .  
evolves(marshtomp,swampert) .
```

```
pokemon(name(torchic), fire, hp(45), attack(scratch, 40)).  
pokemon(name(combusken), fire, hp(60), attack(flame-charge, 50)).  
pokemon(name(blaziken), fire, hp(80), attack(flare-blitz, 120)).
```

```
pokemon(name(shinx), electric, hp(45), attack(tackle, 40)).  
pokemon(name(luxio), electric, hp(60), attack(spark, 65)).  
pokemon(name(luxray), electric, hp(80), attack(crunch, 80)).
```

```
pokemon(name(snivy), grass, hp(45), attack(vine-whip, 45)).  
pokemon(name(servine), grass, hp(60), attack(leaf-tornado, 65)).  
pokemon(name(serperior), grass, hp(75), attack(leaf-storm, 130)).
```

```
pokemon(name(mudkip), water, hp(50), attack(vwater-gun, 40)).  
pokemon(name(marshtomp), water, hp(70), attack(muddy-water, 90)).  
pokemon(name(swampert), water, hp(100), attack(hydro-pump, 110)).
```



## Part 6: Interaction demo with the KB Augmented by 12 Pokemon:

```
?- display_cen.
pikachu
bulbasaur
caterpie
charmander
vulpix
poliwag
squirtle
staryu
torchic
shinx
snivy
mudkip
false.

?- display_not_cen.
raichu
ivysaur
venusaur
metapod
butterfree
charmeleon
charizard
ninetails
poliwhirl
poliwrath
wartortle
blastoise
starmie
combusken
blaziken
luxio
luxray
servine
serperior
marshomp
swampert
false.

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

?- generator(Name,water).
Name = poliwag ;
Name = poliwhirl ;
Name = poliwrath ;
Name = squirtle ;
Name = wartortle ;
Name = blastoise ;
Name = staryu ;
Name = starmie ;
Name = mudkip ;
Name = marshomp ;
Name = swampert.

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

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

```
?- display_names.  
pikachu  
raichu  
bulbasaur  
ivysaur  
venusaur  
caterpie  
metapod  
butterfree  
charmander  
charmeleon  
charizard  
vulpix  
ninetails  
poliwhirl  
poliwrath  
squirtle  
wartortle  
blastoise  
staryu  
starmie  
torchic  
combusken  
blaziken  
shinx  
luxio  
luxray  
snivy  
servine  
serperior  
mudkip  
marshomp  
swampert  
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  
scratch  
flame-charge  
flare-blitz  
tackle  
spark  
crunch  
vine-whip  
leaf-tornado  
leaf-storm  
vwater-gun  
muddy-water  
hydro-pump  
false.
```

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

```

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

?- indicate_attack(swampert).
swampert-->hydro-pump
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
poliwhag->water-gun
poliwhirl->amnesia
poliwrath->dashing-punch
squirtle->bubble
wartortle->waterfall
blastoise->hydro-pump
staryu->slap
starmie->star-freeze
torchic->scratch
combusken->flame-charge
blaziken->flare-blitz
shinx->tackle
luxio->spark
luxray->crunch
snivy->vine-whip
servine->leaf-tornado
serperior->leaf-storm
mudkip->water-gun
marshomp->muddy-water
swampert->hydro-pump
true.

```

```

?- powerful(Name).
Name = raichu ;
Name = venusaur ;
Name = butterfree ;
Name = charizard ;
Name = ninetails ;
Name = wartortle ;
Name = blastoise ;
Name = blaziken ;
Name = luxio ;
Name = luxray ;
Name = servine ;
Name = serperior ;
Name = marshomp ;
Name = swampert.

```

```

?- 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 ;
Name = blaziken ;
Name = luxio ;
Name = luxray ;
Name = servine ;
Name = serperior ;
Name = marshomp ;
Name = swampert.

```

```

?- type(luxray,Type).
Type = electric.

```

```

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

```

```

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

?- dump_kind(water).
pokemon(name(poliwag),water,hp(60),attack(water-gun,30)).
pokemon(name(poliwhirl),water,hp(80),attack(ammnesia,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(mudkip),water,hp(50),attack(vwater-gun,40)).
pokemon(name(marshomp),water,hp(70),attack(muddy-water,90)).
pokemon(name(swampert),water,hp(100),attack(hydro-pump,110)).
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)).
pokemon(name(snivy),grass,hp(45),attack(vine-whip,45)).
pokemon(name(servine),grass,hp(60),attack(leaf-tornado,65)).
pokemon(name(serperior),grass,hp(75),attack(leaf-storm,130)).
false.

?- family(torchic).
torchic combusken blaziken
true.

?- family(marshomp).
marshomp swampert
false.

?- family(snivy).
snivy servine serperior
true.

?- families.
pikachu raichu
bulbasaur ivysaur venusaur
caterpie metapod butterfree
charmander charmeleon charizard
vulpix ninetails
poliwag poliwhirl poliwrath
squirtle wartortle blastoise
staryu starmie
torchic combusken blaziken
shinx luxio luxray
snivy servine serperior
mudkip marshomp swampert
false.

?- lineage(shinx).
pokemon(name(shinx)),electric,hp(45),attack(tackle,40))
pokemon(name(luxio)),electric,hp(60),attack(spark,65))
pokemon(name(luxray)),electric,hp(80),attack(crunch,80))
true.

?- lineage(mudkip).
pokemon(name(mudkip)),water,hp(50),attack(vwater-gun,40))
pokemon(name(marshomp)),water,hp(70),attack(muddy-water,90))
pokemon(name(swampert)),water,hp(100),attack(hydro-pump,110))
true.

?- lineage(torchic).
pokemon(name(torchic)),fire,hp(45),attack(scratch,40))
pokemon(name(combusken)),fire,hp(60),attack(flame-charge,50))
pokemon(name(blaziken)),fire,hp(80),attack(flare-blitz,120))
true.

?- lineage(snivy).
pokemon(name(snivy)),grass,hp(45),attack(vine-whip,45))
pokemon(name(servine)),grass,hp(60),attack(leaf-tornado,65))
pokemon(name(serperior)),grass,hp(75),attack(leaf-storm,130))
true.

```

## Task 2 - List Processing:

### Head/Tail Exercises:

```
?- [H|T] = [red, yellow, blue, green].
H = red,
T = [yellow, blue, green].

?- [H, T] = [red, yellow, blue, green].
false.

?- [F|_] = [red, yellow, blue, green].
F = red.

?- [_|[S|_]] = [red, yellow, blue, green].
S = yellow.

?- [F|[S|R]] = [red, yellow, blue, green].
F = red,
S = yellow,
R = [blue, green].

?- List = [this|[and, that]].
List = [this, and, that].

?- List = [this, and, that].
List = [this, and, that].

?- [a,[b, c]] = [a, b, c].
false.

?- [a|[b, c]] = [a, b, c].
true.

?- [cell(Row,Column)|Rest] = [cell(1,1), cell(3,2), cell(1,3)].
Row = Column, Column = 1,
Rest = [cell(3, 2), cell(1, 3)].

?- [X|Y] = [one(un, uno), two(dos, deux), three(trois, tres)].
X = one(un, uno),
Y = [two(dos, deux), three(trois, tres)].
```

### List Processing 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).

product([],1).
product([Head|Tail],Product) :-
product(Tail,ProductOfTail),
Product is Head * ProductOfTail.
```

```

factorial(N, X) :-
iota(N,K),
product(K,X).

make_list(0,_,[]).
make_list(N1,E1,L1) :-
K is N1 - 1,
make_list(K,E1,Lk),
add_last(E1,Lk,L1).

but_first([], []).
but_first([_|T], T).

but_last([], []).
but_last([_|], []).
but_last([H|T], [H|Result]) :-
but_last(T, Result).

is_palindrome([]).
is_palindrome([_|]).
is_palindrome([Head|Tail]) :-
but_last(Tail, Middle),
last(Tail, Last),
Head = Last,
is_palindrome(Middle).

adjectives([enormous, silly, fast, fun, cruel, gentle, sharp, charming]).
nouns([city, table, river, chair, penguin, phone, game, lion]).

noun_phrase([the|T]) :-
adjectives(AdjectiveList),
nouns(NounList),
pick(AdjectiveList, Adjective),
pick(NounList, Noun),
append([Adjective, Noun], [], T).

past_tense_verbs([walked, pushed, moved, picked, drank, ate, fell]).
sentence(L) :-
noun_phrase(FirstPhrase),
noun_phrase(SecondPhrase),
past_tense_verbs(PastTenseVerbs),
pick(PastTenseVerbs, PastTenseVerb),
make_list(1, PastTenseVerb, PastTenseVerbList),
append(FirstPhrase,PastTenseVerbList,TempList),
append(TempList,SecondPhrase,L).

```

## Demo List Processors:

```

?- 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 = peach .

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

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

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

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

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

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

?- 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] .

```

## Demo List Processing Exercises:

```

?- product([],P).
P = 1.

?- product([1,3,5,7,9],Product).
Product = 945.

?- iota(9,Iota),product(Iota,Product).
Iota = [1, 2, 3, 4, 5, 6, 7, 8, 9].
Product = 362880 .

?- make_list(7,seven,Seven).
Seven = [seven, seven, seven, seven, seven, seven, seven] .

?- make_list(8,2,List).
List = [2, 2, 2, 2, 2, 2, 2, 2] .

?- but_first([a,b,c],X).
X = [b, c].

?- but_last([a,b,c,d,e],X).
X = [a, b, c, d] .

?- is_palindrome([x]).
true .

?- is_palindrome([a,b,c]).
false.

?- is_palindrome([a,b,b,a]).
true .

?- is_palindrome([1,2,3,4,5,4,2,3,1]).
false.

?- is_palindrome([1,2,3,4,5,4,2,3,1]).
false.

?- is_palindrome([c,o,f,f,e,e,e,f,f,o,c]).
true .

?- noun_phrase(NP).
NP = [the, cruel, game] ;
false.

?- noun_phrase(NP).
NP = [the, enormous, table] ;
false.

?- noun_phrase(NP).
NP = [the, charming, lion] ;
false.

?- sentence(S).
S = [the, sharp, phone, fell, the, fast, game] .

?- sentence(S).
S = [the, sharp, phone, drank, the, enormous, city] .

?- sentence(S).
S = [the, cruel, phone, fell, the, gentle, lion] .

?- sentence(S).
S = [the, charming, lion, moved, the, enormous, table] .

?- sentence(S).
S = [the, silly, lion, drank, the, enormous, game] .

?- sentence(S).
S = [the, gentle, chair, walked, the, enormous, phone] .

?- sentence(S).
S = [the, gentle, lion, walked, the, charming, lion] .

?- sentence(S).
S = [the, enormous, chair, drank, the, enormous, game] .

?- sentence(S).
S = [the, enormous, penguin, picked, the, charming, lion] .

?- sentence(S).
S = [the, cruel, lion, ate, the, sharp, penguin] .

?- sentence(S).
S = [the, cruel, chair, drank, the, silly, lion] .

?- sentence(S).
S = [the, charming, river, ate, the, fast, penguin] .

?- sentence(S).
S = [the, charming, table, fell, the, sharp, river] .

?- sentence(S).
S = [the, fun, table, picked, the, enormous, river] .

?- sentence(S).
S = [the, enormous, game, drank, the, sharp, phone] .

?- sentence(S).
S = [the, silly, game, drank, the, charming, game] .

```