Prolog Programming Assignment #1: Various Computations

Abstract

Task 1 involves establishing and interacting with the knowledge base detailed in Prolog Lesson 1, a very simple KB pertaining to colors. Task 2 involves establishing and interacting with a very simple KB which is structurally just like the given KB of Task 1, but which you are asked to piece together yourself, one pertaining to food. Task 3, based on Prolog Lesson 3, is all about solving a map coloring problem. Task 4 involves establishing and interacting with a given KB of a bit more complexity than that featured in the first task. This is the KB about floating shapes, inspired by Terry Winograd's blocks world, that was presented in Prolog Lesson 4. Collectively, these tasks afford an opportunity to get acquainted with the basics of Prolog programming.

Task 1 - Colors KB

Colors KB Code

```
%
-------------------------------------------------------------------
-------
% File: colors.pro
% Line: Six color facts, structured into primaries and
secondaries
%
-------------------------------------------------------------------
-------
% primary(P) :: P is a primary color
primary(blue).
primary(red).
primary(yellow).
%
-------------------------------------------------------------------
-------
% secondary(S) :: S is a secondary color
secondary(green).
```

```
secondary(orange).
secondary(purple).
%
-------------------------------------------------------------------
-------
% color(C) :: C is a color
color(C) :- primary(C).
color(C) :- secondary(C).
```

Colors KB Interactions

```
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?- primary(blue).
ERROR: Unknown procedure: primary/1 (DWIM could not correct goal)
?- consult('Desktop/colors.pl').
true.

?- primary(blue).
true.

?- primary(red).
true.

?- primary(green).
false.

?- secondary(green).
true.

?- secondary(purple).
true.

?- secondary(yellow).
false.
```

```
?- color(blue).
true .

?- color(purple).
true.

?- primary(P).
P = blue ;
P = red ;
P = yellow.

?- secondary(S).
S = green ;
S = orange ;
S = purple.

?- color(C).
C = blue ;
C = red ;
C = yellow ;
C = green ;
C = orange ;
C = purple.
```

```
?- listing(primary).
primary(blue).
primary(red).
primary(yellow).

true.

?- listing(secondary).
secondary(green).
secondary(orange).
secondary(purple).

true.

?- listing(color).
color(C) :-
    primary(C).
color(C) :-
    secondary(C).

true.

?- secondary(A).
A = green .

?-
```

Task 2 - Food KB

Food KB Code

```
%-----------------------------------------------------------------
% File: food.pl
%-----------------------------------------------------------------
%fruit(F) :: F is a fruit
fruit(gratefruit).
fruit(avocado).
fruit(date).
%-----------------------------------------------------------------
%vegetable(V) :: V is a vegetable
vegetable(asperagus).
vegetable(broccoli).
vegetable(carrot).
%-----------------------------------------------------------------
% Food(F) :: F is food
food(F) :- fruit(F).
food(F) :- vegetable(F).
```

Food KB Interactions

```
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?- fruit(gratefruit).
ERROR: Unknown procedure: fruit/1 (DWIM could not correct goal)
?- consult('Desktop/food.pl').
true.

?- fruit(gratefruit).
true.

?- fruit(avocado).
true.

?- fruit(carrot).
false.

?- fruit(date).
true.

?- vegetable(asperagus).
true.

?- vegetable(broccoli).
true.

?- vegetable(carrot).
true.
```
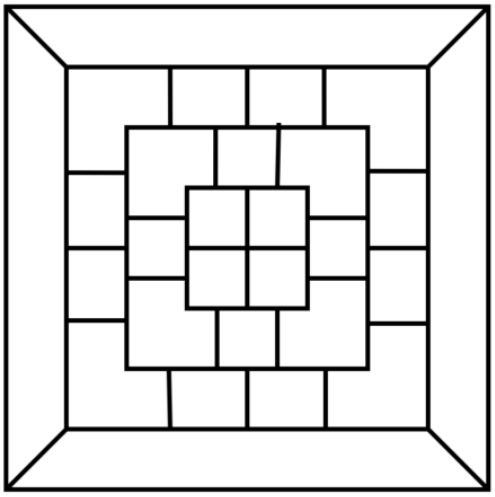

```
?- food(carrot).
true.

?- food(broccoli).
true.

?- fruit(F).
F = gratefruit ;
F = avocado ;
F = date.

?- vegetable(V).
V = asperagus ;
V = broccoli ;
V = carrot.

?- food(F).
F = gratefruit ;
F = avocado ;
F = date ;
F = asperagus ;
F = broccoli ;
F = carrot.

?- listing(fruit).
fruit(gratefruit).
fruit(avocado).
fruit(date).

true.
```

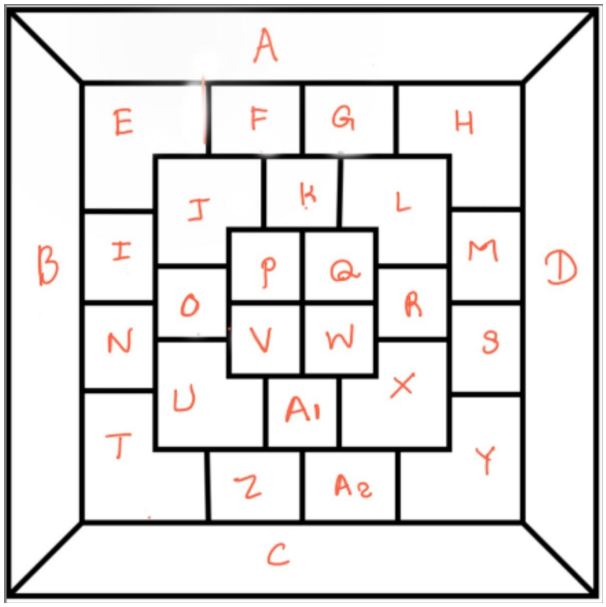
```
?- listing(vegetable).
vegetable(asperagus).
vegetable(broccoli).
vegetable(carrot).

true.

?- listing(food).
food(F) :-
    fruit(F).
food(F) :-
    vegetable(F).

true.

?-
```

Task 3 - Map Coloring

The Given Map



The Labeled Map



Code for Coloring the Map

```
% File: map_coloring.pl
% Line: Program to find a 4-color map rendering for the square
map.
% More: The colors used will be red, blue, green orange.
% More: The letters are used to represent the areas.

% different(X,Y) :: X is not equal to Y

different(red,blue).
different(red,green).
different(red,orange).
different(green,blue).
different(green,orange).
different(green,red).
different(blue,green).
different(blue,orange).
different(blue,red).
different(orange,blue).
different(orange,green).
different(orange,red).


%
coloring(A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z,A1,
A2)

coloring(A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z,A1,
A2) :-
  different(A,B),
  different(A,D),
  different(A,E),
  different(A,F),
  different(A,G),
  different(A,H),
```

```
different(B,A),
different(B,C),
different(B,E),
different(B,I),
different(B,N),
different(B,T),
different(C,B),
different(C,D),
different(C,T),
different(C,Z),
different(C,A2),
different(C,Y),
different(D,A),
different(D,C),
different(D,H),
different(D,M),
different(D,S),
different(D,Y),
different(E,A),
different(E,B),
different(E,I),
different(E,J),
different(E,F),
different(F,A),
different(F,E),
different(F,G),
different(F,J),
different(F,K),
different(G,A),
different(G,F),
different(G,H),
different(G,L),
different(G,K),
different(H,A),
different(H,G),
different(H,D),
different(H,M),
different(H,L),
```

```
different(I,B),
different(I,E),
different(I,J),
different(I,N),
different(I,O),
different(J,E),
different(J,I),
different(J,F),
different(J,K),
different(J,O),
different(J,P),
different(K,F),
different(K,G),
different(K,J),
different(K,L),
different(K,P),
different(K,Q),
different(L,G),
different(L,H),
different(L,K),
different(L,M),
different(L,Q),
different(L,R),
different(M,D),
different(M,H),
different(M,S),
different(M,L),
different(M,R),
different(N,B),
different(N,I),
different(N,T),
different(N,O),
different(N,U),
different(O,J),
different(O,I),
different(O,N),
different(O,U),
different(O,P),
```

```
different(O,V),
different(P,K),
different(P,J),
different(P,O),
different(P,Q),
different(P,V),
different(P,W),
different(Q,P),
different(Q,K),
different(Q,L),
different(Q,V),
different(Q,W),
different(Q,R),
different(R,Q),
different(R,L),
different(R,M),
different(R,W),
different(R,X),
different(R,S),
different(S,D),
different(S,M),
different(S,R),
different(S,X),
different(S,Y),
different(T,B),
different(T,N),
different(T,U),
different(T,Z),
different(T,C),
different(U,T),
different(U,N),
different(U,O),
different(U,V),
different(U,A1),
different(U,Z),
different(V,P),
different(V,O),
different(V,U),
```

```
different(V,Q),
different(V,W),
different(V,A1),
different(W,Q),
different(W,P),
different(W,V),
different(W,A1),
different(W,X),
different(W,R),
different(X,R),
different(X,W),
different(X,A1),
different(X,A2),
different(X,Y),
different(X,S),
different(Y,D),
different(Y,S),
different(Y,X),
different(Y,A2),
different(Y,C),
different(Z,C),
different(Z,T),
different(Z,U),
different(Z,A1),
different(Z,A2),
different(A1,U),
different(A1,V),
different(A1,W),
different(A1,X),
different(A1,Z),
different(A1,A2),
different(A2,Z),
different(A2,A1),
different(A2,X),
different(A2,Y),
different(A2,C).
```

Map Coloring Interaction

```
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?- consult('Desktop/map.pl').
true.

?- coloring(A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z,A1,A2).
A = J, J = L, L = S, S = U, U = W, W = A2, A2 = red,
B = D, D = F, F = O, O = Q, Q = X, X = Z, Z = blue,
C = E, E = G, G = M, M = N, N = P, P = A1, A1 = green,
H = I, I = K, K = R, R = T, T = V, V = Y, Y = orange
```
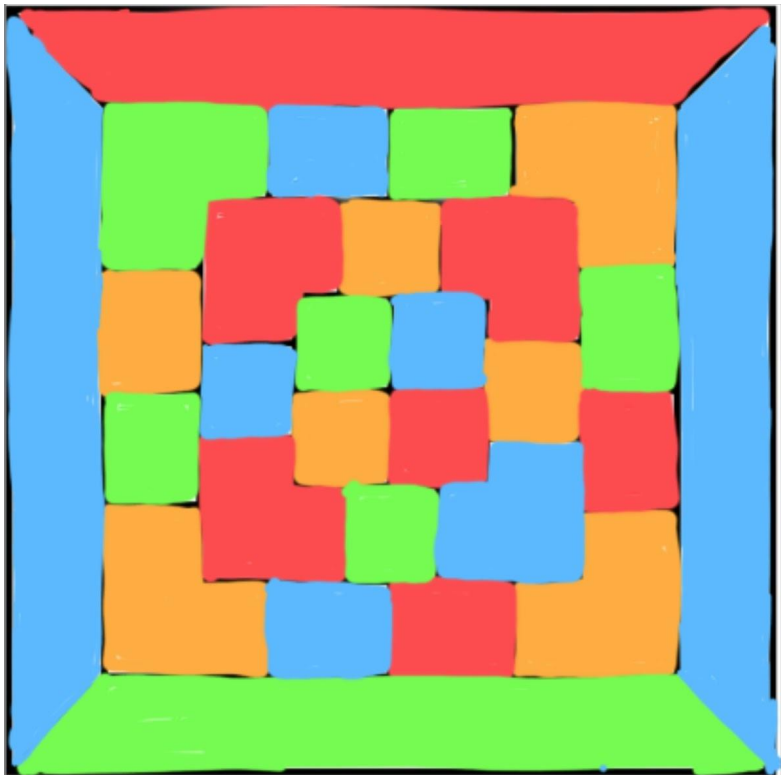
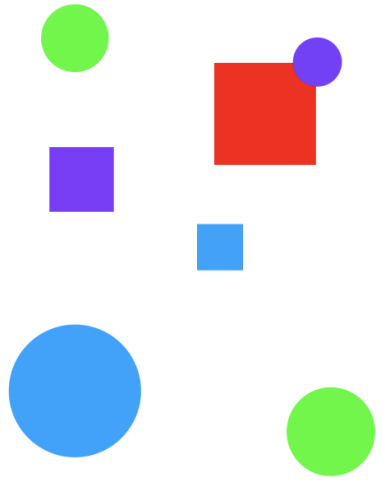

The Colored Map



Task 4 - Floating Shapes World KB

Floating Shapes World Image



Floating Shapes World KB Code

```
%
------------------------------------------------------------------
------
%
------------------------------------------------------------------
------
% --- File: shapes_world_1.pl
% --- Line: Loosely represented 2-D shapes world (simple take on
SHRDLU)
%
------------------------------------------------------------------
------

%
------------------------------------------------------------------
------
% --- Facts …
```

```
%
------------------------------------------------------------------
------
%
------------------------------------------------------------------
------
% --- square(N,side(L),color(C)) :: N is the name of a square
with side L
% --- and color C

  square(sera,side(7),color(purple)).
  square(sara,side(5),color(blue)).
  square(sarah,side(11),color(red)).

% --- circle(N,radius(R),color(C)) :: N is the name of a circle
with
% --- radius R and color C

    circle(carla,radius(4),color(green)).
    circle(cora,radius(7),color(blue)).
    circle(connie,radius(3),color(purple)).
    circle(claire,radius(5),color(green)).

%
------------------------------------------------------------------
------
% Rules ...
%
------------------------------------------------------------------
------

%
------------------------------------------------------------------
------
% --- circles :: list the names of all of the circles

  circles :- circle(Name,_,_), write(Name),nl,fail.
  Circles.
```

```
%
------------------------------------------------------------------
------
% --- squares :: list the names of all of the squares

  squares :- square(Name,_,_), write(Name),nl,fail.
  squares.

%
------------------------------------------------------------------
------
% --- squares :: list the names of all of the shapes

  shapes :- circles,squares.

%
------------------------------------------------------------------
------
% --- blue(Name) :: Name is a blue shape

  blue(Name) :- square(Name,_,color(blue)).
  blue(Name) :- circle(Name,_,color(blue)).

%
------------------------------------------------------------------
------
% --- large(Name) :: Name is a large shape

  large(Name) :- area(Name,A), A >= 100.

%
------------------------------------------------------------------
------
% --- small(Name) :: Name is a small shape

  small(Name) :- area(Name,A), A < 100.
```

```
%
------------------------------------------------------------------
------
% --- area(Name,A) :: A is the area of the shape with name Name

  area(Name,A) :- circle(Name,radius(R),_), A is 3.14 * R * R.
  area(Name,A) :- square(Name,side(S),_), A is S * S.
```

Floating Shapes World KB Interaction

```
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?- consult('Desktop/shapes_world_1.pl').
true.

?- listing(squares).
squares :-
    square(Name, _, _),
    write(Name),
    nl,
    fail.
squares.

true.

?- squares.
sera
sara
sarah
true.

?- listing(circles).
circles :-
    circle(Name, _, _),
    write(Name),
    nl,
    fail.
circles.

true.
```

```
?- circles.
carla
cora
connie
claire
true.

?- listing(shapes).
shapes :-
    circles,
    squares.

true.

?- shapes.
carla
cora
connie
claire
sera
sara
sarah
true.

?- blue(Shape).
Shape = sara ;
Shape = cora.

?- large(Name),write(Name),nl,fail.
cora
sarah
false.

?- small(Name),write(Name),nl,fail.
carla
connie
claire
sera
sara
false.
```

```
?- area(cora,A).
A = 153.86 .

?- area(carla,A).
A = 50.24
```