circ.pl

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Contents

1 Circuit

for more info on this, see Bratko, chpt20. Qualitative Reasoning. common sense, qualitative reasoning and nave physics AND http://menzies.us/pdf/01lesstalk.pdf */

```
:- ensure_loaded([randoms,memo]).

circuit(   switch=[XS1, Sw1,  VSw1, C1],
           bulb  =[XB1,   B1,   L1,   VB1, C1],
           switch=[XS2, Sw2,  VSw2, C2],
           bulb  =[XB2,   B2,   L2,   VB2, C2],
           switch=[XS3, Sw3,  VSw3, CSw3],
           bulb  =[XB3,   B3,   L3,   VB3, CB3],
       Shine) :-
   VSw3 = VB3,              %  2
   sum(VSw1, VB1, V1),      %  3
   sum(V1,VB3,+),           %  4
   sum(VSw2,VB2,VB3),       %  5
   switch(XS1,Sw1,VSw1,C1),     %  6
   bulb(XB1,B1,L1,VB1,C1),      %  7
   switch(XS2,Sw2,VSw2,C2),     %  8
   bulb(XB2,B2,L2,VB2,C2),      %  9
   switch(XS3,Sw3,VSw3,CSw3),   % 10
   bulb(XB3,B3,L3,VB3,CB3),     % 11
   sum(CSw3,CB3,C3),        % 12
   sum(C2,C3,C1),           % 13
   num(L1,N1),
   num(L2,N2),
   num(L3,N3),
   Shine is N1+N2+N3.

sum(X,Y,Z) :- any(sum1(X,Y,Z)).

sum1(+,+,+).
sum1(+,0,+).
sum1(+,-,_Any).
sum1(0,+,+).
sum1(0,0,0).
sum1(0,-,-).
sum1(-,+,_Any).
sum1(-,0,-).
sum1(-,-,-).

bulb(X,A,B,C,D) :- memo(any(bulb1(A,B,C,D)),
                        [X/state=A,X/light=B,X/volt=C,X/curr=D]).

bulb1(blown,dark, _Any, 0).
bulb1(ok,   light,+,  +).
bulb1(ok,   light,-,  -).
bulb1(ok,   dark, 0,  0).
```

```
switch(X,A,B,C) :- memo(any(switch1(A,B,C)),
                        [X/sw=A,X/volt=B,X/curr=C]).

switch1(on,    0,    _Any).
switch1(off,   _Any,  0).

num(light,1).
num(dark,0).

value(X,Sw,    switch, switch=[X,_,Sw,_,_]).
value(X,Light, bulb,   bulb=[X,_,_,Light,_,_]).

inf(Inf,bulb=[_,_,Shine,_,_],switch=[_,Pos,_,_]) :-
   inf1(Inf,Shine,Pos).

inf1(Inf,Shine,Pos) :- any(inf2(Inf,Shine,Pos)).

inf2(+,dark,off).
inf2(+,light,on).
inf2(-,dark,on).
inf2(-,light,off).

def(bulb,[name,status,shine,volts,amps]).

bulb0(Name,B) :- bulb0(Name,_,B).
bulb0(Name) --> in bulb, the name=Name.

def(switch,[name,state,volts,amps]).

switch0(Name,S) :- switch0(Name,_,S).
switch0(Name) --> in switch, the name=Name.

run(Shine) :- reset, once(circuit(Shine)).

circuit(Shine) :-
   bulb0(bulb1a,B1a),    bulb0(bulb2a,B2a), bulb0(bulb3a,B3a),
   bulb0(bulb1b,B1b),    bulb0(bulb2b,B2b), bulb0(bulb3b,B3b),
   bulb0(bulb1c,B1c),    bulb0(bulb2c,B2c), bulb0(bulb3c,B3c),
   switch0(switch1a,Sw1a),switch0(switch2a,Sw2a),switch0(switch3a,Sw3a),
   switch0(switch1b,Sw1b),switch0(switch2b,Sw2b),switch0(switch3b,Sw3b),
   switch0(switch1c,Sw1c),switch0(switch2c,Sw2c),switch0(switch3c,Sw3c),

   at(in bulb with the shine := light,B1a,B1a),
%    value(bulb1a, light,bulb,B1a), % K1
   %value(switch3c,on,switch,Sw3c), % K2
   %value(switch1c,on,switch,Sw1c), % K3
   %value(switch2c,off,switch,Sw2c), % K4
   %B3c= bulb(bulb3c,ok,_,_,_),
   %value(bulb2a, dark,bulb,B2a),
   %value(switch3a, off,switch,Sw3a),
```

```
    circuit(Sw1a,B1a,Sw2a,B2a,Sw3a,B3a,Shine1),
    inf(+,B1a,Sw1b),
    inf(-,B2a,Sw3b),
    circuit(Sw1b,B1b,Sw2b,B2b,Sw3b,B3b,Shine2),
    inf(-,B3b,Sw2c),
    inf(+,B2b,Sw3c),
    circuit(Sw1c,B1c,Sw2c,B2c,Sw3c,B3c,Shine3),
    inf(-,B2c,Sw1d),
    inf(+,B3c,Sw3d),
    inf(+,B1a,Sw1d),
    inf(+,B1b,Sw2d),
    circuit(Sw1d,B1d,Sw2d,B2d,Sw3d,B3d,Shine4),
    Shine is Shine1+Shine2+Shine3+Shine4.
```

% sformat(_String,'~p,~p,~p,~p,~p,~p,~p,~p,~p,~p,~p,~p,~%,~%,~%,~%,~%,~%,~%,~%,~%,~%,~%,~%,~p\n', % [Sw1a,Sw2a,Sw3a,Sw1b,Sw2b,Sw3b,Sw1c,Sw2c,Sw3c, Sw1d,Sw2d,Sw3d, % B1a,B2a,B3a,B1b,B2b,B3b,B1c,B2c,B3c, B1d,B2d,B3d, % Shine]). % true.

% datas(Max) :- % flag(n,_,0), % repeat, % circuit, % flag(n,N,N+1), % N > Max, % !.

```
:- format_predicate('%',bulbIs(_,_)).

bulbIs(_,bulb=[_,X,_,_,_]) :- var(X) -> write('?') | write(X).

%portray(X) :- value(Z,Y,_,X), write(Z/Y).

data :- tell('circ.data'),forall(datas(1000000),true), told.

/*K1:
35228 cases
initial conditions
  0:                                [     0 -  0%]
  1:~~~~~~~~~~~~~~~                 [  7920 - 22%]
  2:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [ 15125 - 43%]
  3:~~~~~~~~~~~~~~                  [  7493 - 21%]
  4:~~~~                            [  2248 -  6%]
  5:~~~~                            [  2151 -  6%]
  6:                                [   241 -  1%]
  7:                                [    50 -  0%]
  8:                                [     0 -  0%]
  9:                                [     0 -  0%]
guessing: initial + some...

Worth=3.621769
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[
       switch2c=off]

              0:                                [     0 -  0%]
              1:                                [     0 -  0%]
              2:                                [     0 -  0%]
              3:                                [     0 -  0%]
```

```
              4:~~~~~~~~~~~~~~~~~~~~~~~~~~~    [  1526 - 47%]
              5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [  1582 - 48%]
              6:~~                             [   106 -  3%]
              7:                               [    50 -  2%]
              8:                               [     0 -  0%]
              9:                               [     0 -  0%]

Worth=6.029714
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[
       switch3c=on]

              0:                               [     0 -  0%]
              1:                               [     0 -  0%]
              2:                               [     0 -  0%]
              3:                               [     0 -  0%]
              4:~~~~~~~~~                      [    28 - 15%]
              5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [    88 - 46%]
              6:~~~~~~~~~~~~~~~~~~~~~~         [    68 - 35%]
              7:~~                             [     8 -  4%]
              8:                               [     0 -  0%]
              9:                               [     0 -  0%]

actual: initial +  swith2c=off

Worth=1.000000
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[No Treatment]

             0:                               [     0 -  0%]
             1:                               [     0 -  0%]
             2:                               [     0 -  0%]
             3:                               [     0 -  0%]
             4:~~~~~~~~~~~~~~~~~~~~~~~~~~~    [  1526 - 47%]
             5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [  1582 - 48%]
             6:~~                             [   106 -  3%]
             7:                               [    50 -  2%]
             8:                               [     0 -  0%]
             9:                               [     0 -  0%]

Worth=1.000000
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[No Treatment]

             0:                               [     0 -  0%]
             1:                               [     0 -  0%]
             2:                               [     0 -  0%]
             3:                               [     0 -  0%]
             4:~~~~~~~~~~~~~~~~~~~~~~~~~~~    [  1526 - 47%]
             5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [  1582 - 48%]
             6:~~                             [   106 -  3%]
```

```
            7:                                  [    50 -  2%]
            8:                                  [     0 -  0%]
            9:                                  [     0 -  0%]

actual with K1 + switch2=off & switch1c=on

Worth=1.320921
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[
       switch1c=on]

             0:                                 [     0 -  0%]
             1:                                 [     0 -  0%]
             2:                                 [     0 -  0%]
             3:                                 [     0 -  0%]
             4:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~   [   266 - 41%]
             5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [   274 - 42%]
             6:~~~~~~                           [    58 -  9%]
             7:~~~~~                            [    50 -  8%]
             8:                                 [     0 -  0%]
             9:                                 [     0 -  0%]

Worth=1.333333
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[
       bulb3a=ok]

             0:                                 [     0 -  0%]
             1:                                 [     0 -  0%]
             2:                                 [     0 -  0%]
             3:                                 [     0 -  0%]
             4:                                 [     0 -  0%]
             5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [  1526 - 94%]
             6:~                                [    56 -  3%]
             7:                                 [    50 -  3%]
             8:                                 [     0 -  0%]
             9:                                 [     0 -  0%]

Worth=1.433829
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[
       bulb3c=ok]

             0:                                 [     0 -  0%]
             1:                                 [     0 -  0%]
             2:                                 [     0 -  0%]
             3:                                 [     0 -  0%]
             4:~~~~~~~~~~~~~~~~~~~~~~~~~        [   196 - 36%]
             5:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [   224 - 41%]
             6:~~~~~~~~~                        [    74 - 14%]
             7:~~~~~~                           [    46 -  9%]
             8:                                 [     0 -  0%]
             9:                                 [     0 -  0%]
```

```
Worth=1.997824
Granularity=2 Promising=-1000.000000 Useful=1.000000 nChanges=1
Treatment:[
       switch3c=on]

              0:                                [     0 -  0%]
              1:                                [     0 -  0%]
              2:                                [     0 -  0%]
              3:                                [     0 -  0%]
              4:                                [     0 -  0%]
              5:~~~~~~~~~~~~~~~~~~~~~~~~~       [    56 - 44%]
              6:~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  [    64 - 50%]
              7:~~~                             [     8 -  6%]
              8:                                [     0 -  0%]
              9:                                [     0 -  0%] */
```