### OUTPUT FROM CONMAN, THE CONSTRAINT MANAGER

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Script started on Fri Oct 30 02:09:35 198 moon(1)-> prolog

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#### | ?- [load].

Building the ConMan constraint management system...

[driver consulted 0.517 sec 2,668 bytes]
[select consulted 0.184 sec 820 bytes]
[tighten consulted 1.783 sec 7,752 bytes]
[algebra consulted 1.283 sec 5,608 bytes]
[util consulted 1.100 sec 4,832 bytes]
[genutil consulted 3.116 sec 13,848 bytes]
[data consulted 0.667 sec 3,984 bytes]

[load consulted 9.217 sec 40,656 bytes]

yes

```
l ?- conman.
VALUES:
     c0
                = [0,1]
     c1
                = [0,1]
     c2
                = [0,1]
     c3
                = [0,1]
     c4
                = \lceil 0, 1 \rceil
     c5
                = [0,1]
     d
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     e
                = [0,1,2,3,4,5,6,7,8,9]
     m
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     s
                = [0,1,2,3,4,5,6,7,8,9]
     У
CONSTRAINTS:
     c0=0
     c4=[m,10*c5]
     c5=0
     [c0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     [c3,s,m]=[o,10*c4]
     [9000*m, 900*o, 90*n, y] = [1000*s, 91*e, d, 10*r]
     m = 0
     s\==0
DEMONS:
     c1:
                  c1=0->[d,e]<10
     c1 :
                  c1=1->[d,e]>9
                  c2=0->[n,r]<10
     c2 :
     c2 :
                  c2=1->[n,r]>9
                 c3=0->[e,o]<10
     c3 :
                  c3=1->[e,o]>9
     c3 :
                  c4=0->[s,m]<10
     c4:
                  c4=1->[s,m]>9
     c4 :
```

```
Selected constraint: c0=0
Tightening possibilities for: c0
Solving c0=0 for c0
c0=[0.0*1]
Constraint gives possibilities: [0]
Old possibilities were:
                                [0,1]
New possibilities are:
                                 [0]
Values have changed. Checking demons
______
VALUES:
                = [0]
     c0
     c1
                = [0,1]
     c2
                = \lceil 0, 1 \rceil
     c3
                = [0,1]
     c4
                = \lceil 0,1 \rceil
     c5
                = [0,1]
     d
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     e
                = [0,1,2,3,4,5,6,7,8,9]
     m
                = [0,1,2,3,4,5,6,7,8,9]
     n
                = [0,1,2,3,4,5,6,7,8,9]
     0
                = [0,1,2,3,4,5,6,7,8,9]
     r
     S
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     У
CONSTRAINTS:
     c4=[m,10*c5]
     c5=0
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     \lceil c2, e, o \rceil = \lceil n, 10 * c3 \rceil
     [c3,s,m]=[o,10*c4]
     [9000*m,900*o,90*n,y]=[1000*s,91*e,d,10*r]
     m = 0
     s\==0
DEMONS:
     c4:
                 c4=1->[s,m]>9
                 c4=0->\lceil s,m\rceil<10
     c4:
     c3 :
                 c3=1->[e,o]>9
     c3 :
                 c3=0->[e,o]<10
     c2 :
                 c2=1->[n,r]>9
     c2 :
                c2=0->[n,r]<10
     c1 :
                c1=1->[d,e]>9
                 c1=0->\lceil d,e\rceil<10
     c1 :
```

```
Selected constraint: c5=0
Tightening possibilities for: c5
Solving c5=0 for c5
c5=[0.0*1]
Constraint gives possibilities: [0]
Old possibilities were:
                               [0,1]
New possibilities are:
                                [0]
Values have changed. Checking demons
______
VALUES:
    c0
                = [0]
    c1
                = [0,1]
     c2
                = \lceil 0, 1 \rceil
     c3
                = [0,1]
     c4
                = \lceil 0,1 \rceil
     c5
                = [0]
     d
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     e
                = [0,1,2,3,4,5,6,7,8,9]
    m
                = [0,1,2,3,4,5,6,7,8,9]
    n
                = [0,1,2,3,4,5,6,7,8,9]
    0
                = [0,1,2,3,4,5,6,7,8,9]
     r
    S
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
    У
CONSTRAINTS:
    c4=[m,10*0]
    [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     \lceil c3, s, m \rceil = \lceil o, 10*c4 \rceil
     [9000*m,900*o,90*n,y]=[1000*s,91*e,d,10*r]
    m = 0
    s\==0
DEMONS:
    c1 :
                 c1=0->[d,e]<10
    c1 :
                 c1=1->[d,e]>9
    c2 :
                 c2=0->[n,r]<10
    c2 :
                c2=1->[n,r]>9
    c3 :
                c3=0->[e,o]<10
    c3 :
                c3=1->[e,o]>9
    c4 :
                c4=0->[s,m]<10
    c4 :
                c4=1->[s,m]>9
```

```
Selected constraint: m\==0
Tightening possibilities for: m
Solving m = 0 for m
m = [0.0*1]
Constraint gives possibilities: [0]
Old possibilities were: [0,1,2,3,4,5,6,7,8,9]
New possibilities are:
                          [1,2,3,4,5,6,7,8,9]
Values have changed. Checking demons
-----
VALUES:
     c0
                = [0]
     c1
                = [0,1]
     c2
                = \lceil 0, 1 \rceil
     c3
                = [0,1]
     c4
                = \lceil 0,1 \rceil
     c5
                = [0]
     d
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     e
                = [1,2,3,4,5,6,7,8,9]
     m
                = [0,1,2,3,4,5,6,7,8,9]
     n
                = [0,1,2,3,4,5,6,7,8,9]
     0
                = [0,1,2,3,4,5,6,7,8,9]
     r
     S
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     У
CONSTRAINTS:
     c4=[m,10*0]
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     \lceil c3, s, m \rceil = \lceil o, 10*c4 \rceil
     [9000*m, 900*o, 90*n, y] = [1000*s, 91*e, d, 10*r]
     s\==0
DEMONS:
                 c4=1->\lceil s,m\rceil>9
     c4:
     c4 :
                 c4=0->[s,m]<10
                 c3=1->[e,o]>9
     c3 :
     c3 :
                 c3=0\rightarrow [e,o]<10
     c2 :
                c2=1->[n,r]>9
     c2 :
                c2=0->[n,r]<10
     c1 :
                 c1=1->[d,e]>9
     c1 :
                 c1=0->[d,e]<10
```

```
Selected constraint: s\==0
Tightening possibilities for: s
Solving s = 0 for s
s\==[0.0*1]
Constraint gives possibilities: [0]
Old possibilities were: [0,1,2,3,4,5,6,7,8,9]
New possibilities are: [1,2,3,4,5,6,7,8,9]
Values have changed. Checking demons
VALUES:
     c0
                = [0]
     c1
                = [0,1]
     c2
                = \lceil 0, 1 \rceil
     c3
                = [0,1]
     c4
                = \lceil 0,1 \rceil
     c5
                = [0]
     d
                = [0,1,2,3,4,5,6,7,8,9]
                = [0,1,2,3,4,5,6,7,8,9]
     e
               = [1,2,3,4,5,6,7,8,9]
     m
                = [0,1,2,3,4,5,6,7,8,9]
     n
                = [0,1,2,3,4,5,6,7,8,9]
     0
              = [0,1,2,3,4,5,6,7,8,9]
     r
               = [1,2,3,4,5,6,7,8,9]
     S
                = [0,1,2,3,4,5,6,7,8,9]
     У
CONSTRAINTS:
     c4=[m,10*0]
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     \lceil c3, s, m \rceil = \lceil o, 10*c4 \rceil
     [9000*m, 900*o, 90*n, y] = [1000*s, 91*e, d, 10*r]
DEMONS:
     c1 :
                 c1=0->[d,e]<10
     c1 :
                 c1=1->\lceil d,e\rceil>9
     c2 :
                 c2=0->[n,r]<10
                c2=1->[n,r]>9
     c2 :
     c3 :
               c3=0>[e,o]<10
                c3=1->[e,o]>9
     c3 :
                c4=0->[s,m]<10
     c4 :
     c4:
                c4=1->[s,m]>9
```

```
Selected constraint: c4=\lceil m,10*0 \rceil
Tightening possibilities for: c4
Solving c4=[m,10*0] for c4
C4=[1.0*m,0.0*1]
Constraint gives possibilities: [1,2,3,4,5,6,7,8,9]
Old possibilities were:
                           [0,1]
New possibilities are:
                                [1]
Values have changed. Checking demons
Moving demon to constraint list: 1=0->[s,m]<10
Moving demon to constraint list: 1=1->[s,m]>9
Tightening possibilities for: m
Solving c4=[m,10*0] for m
m = [0.0*1, 1.0*c4]
Constraint gives possibilities: [1]
Old possibilities were: [1,2,3,4,5,6,7,8,9]
New possibilities are:
                                [1]
m is now unique. Removing its value 1 from others
Values have changed. Checking demons
VALUES:
               = [0,2,3,4,5,6,7,8,9]
    У
    S
              = [2,3,4,5,6,7,8,9]
              = [0,2,3,4,5,6,7,8,9]
              = [0,2,3,4,5,6,7,8,9]
    0
              = [0,2,3,4,5,6,7,8,9]
    n
               = [1]
    m
               = [0,2,3,4,5,6,7,8,9]
    e
     d
              = [0,2,3,4,5,6,7,8,9]
              = [0]
    c5
    c4
               = [1]
    c3
               = \lceil 0, 1 \rceil
     c2
              = [0,1]
     c1
               = [0,1]
     c0
               = [0]
CONSTRAINTS:
    1=1->[s,1]>9
     1=0 \to [s, 1] < 10
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     [c3, s, 1] = [o, 10*1]
     [9000*1,900*0,90*n,y]=[1000*s,91*e,d,10*r]
DEMONS:
                c1=0->[d,e]<10
    c1 :
                c1=1->[d,e]>9
    c1 :
                c2=0->[n,r]<10
    c2 :
```

c2 : c2=1->[n,r]>9c3 : c3=0->[e,o]<10c3 : c3=1->[e,o]>9

```
Selected constraint: 1=1->[s,1]>9
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: s
Solving [s,1]>9 for s
s > [8.0*1]
Constraint gives possibilities: [8]
Old possibilities were: [2,3,4,5,6,7,8,9]
New possibilities are:
                                 [9]
s is now unique. Removing its value 9 from others
Values have changed. Checking demons
VALUES:
     с0
               = [0]
                = [0,1]
     c1
                = [0,1]
     c2
     c3
                = \lceil 0, 1 \rceil
                = [1]
     c4
     c5
                = [0]
                = [0,2,3,4,5,6,7,8]
     d
                = [0,2,3,4,5,6,7,8]
     e
     m
               = [1]
     n
              = [0,2,3,4,5,6,7,8]
     0
              = [0,2,3,4,5,6,7,8]
              = [0,2,3,4,5,6,7,8]
     r
     S
               = [9]
              = [0,2,3,4,5,6,7,8]
CONSTRAINTS:
     1=0 \rightarrow [9,1]<10
     \lceil 0, d, e \rceil = \lceil y, 10 * c 1 \rceil
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     [c3,9,1]=[o,10*1]
     [9000*1,900*o,90*n,y]=[1000*9,91*e,d,10*r]
DEMONS:
     c3 :
                 c3=1->[e,o]>9
               c3=0->[e,o]<10
     c3 :
     c2 :
                c2=1->[n,r]>9
     c2 :
                c2=0->[n,r]<10
     c1 :
                c1=1->[d,e]>9
     c1 : c1=1->[a,e]>9
c1 : c1=0->[d,e]<10
```

```
Selected constraint: 1=0->[9,1]<10
Evaluating equation: 1=0
Evaluates false
VALUES:
     c0
              = [0]
     c1
              = [0,1]
     c2
              = [0,1]
     c3
               = [0,1]
     c4
                = [1]
     c5
                = [0]
     d
                = [0,2,3,4,5,6,7,8]
               = [0,2,3,4,5,6,7,8]
              = [1]
              = [0,2,3,4,5,6,7,8]
             = [0,2,3,4,5,6,7,8]= [0,2,3,4,5,6,7,8]= [9]
     S
            = [0,2,3,4,5,6,7,8]
     У
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,o]=[n,10*c3]
     [c3,9,1]=[o,10*1]
     [9000*1,900*o,90*n,y]=[1000*9,91*e,d,10*r]
DEMONS:
    c3 :
                c3=1->[e,o]>9
     c3 :
                c3=0 \rightarrow [e,o]<10
              c2=1->[n,r]>9
c2=0->[n,r]<10
     c2 :
     c2 :
     c1 :
               c1=1->[d,e]>9
    c1 : c1=0->[d,e]<10
```

```
Selected constraint: [c3,9,1]=[o,10*1]
Tightening possibilities for: c3
Solving [c3,9,1]=[0,10*1] for c3
c3=[1.0*0,0.0*1]
Constraint gives possibilities: [0,2,3,4,5,6,7,8]
Old possibilities were: [0,1]
New possibilities are:
                               [0]
Values have changed. Checking demons
Moving demon to constraint list: 0=1->[e,o]>9
Moving demon to constraint list: 0=0->[e,o]<10
Tightening possibilities for: o
Solving [c3,9,1]=[0,10*1] for o
o=[0.0*1,1.0*c3]
Constraint gives possibilities: [0]
Old possibilities were: [0,2,3,4,5,6,7,8]
New possibilities are:
                               ۲0٦
o is now unique. Removing its value 0 from others
Values have changed. Checking demons
VALUES:
              = [2,3,4,5,6,7,8]
    y
    S
             = [9]
             = [2,3,4,5,6,7,8]
    0
              = [0]
              = [2,3,4,5,6,7,8]
    n
              = [1]
    m
             = [2,3,4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
              = [0]
    c5
    c4
               = [1]
    c3
               = [0]
    c2
              = [0,1]
    c1
               = [0,1]
    c0
               = [0]
CONSTRAINTS:
    0=0->[e,0]<10
    0=1->[e,0]>9
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [c2,e,0]=[n,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
DEMONS:
    c2 :
                c2=1->\lceil n,r \rceil > 9
    c2 :
                c2=0->[n,r]<10
               c1=1->[d,e]>9
    c1 :
               c1=0->\lceil d,e\rceil<10
    c1 :
```

```
Selected constraint: 0=0->[e,0]<10
```

Evaluating equation: 0=0

Evaluates true

Tightening possibilities for: e

Solving [e,0]<10 for e

e<[10.0\*1]

Constraint gives possibilities: [10]

Old possibilities were: [2,3,4,5,6,7,8] New possibilities are: [2,3,4,5,6,7,8]

### VALUES:

```
= [2,3,4,5,6,7,8]
= [9]
У
```

S

= [2,3,4,5,6,7,8] = [0] r

= [2,3,4,5,6,7,8]

= [1]

= [2,3,4,5,6,7,8]e

d = [2,3,4,5,6,7,8]

c5 = [0]

= [1] c4

c3

c2

= [0] = [0,1] = [0,1] = [0] c1

c0

#### CONSTRAINTS:

$$0=1->[e,0]>9$$

$$[0,d,e]=[y,10*c1]$$

[c1,n,r]=[e,10\*c2]

 $\lceil c2, e, 0 \rceil = \lceil n, 10*0 \rceil$ 

[9000\*1,900\*0,90\*n,y]=[1000\*9,91\*e,d,10\*r]

### DEMONS:

c2 : c2=1->[n,r]>9 c2 : c2=0->[n,r]<10 c1 : c1=1->[d,e]>9 c1 : c1=0->[d,e]<10

```
Selected constraint: 0=1->[e,0]>9
```

Evaluating equation: 0=1

Evaluates false

-----

```
VALUES:

y = [2,3,4,5,6,7,8]

s = [9]

r = [2,3,4,5,6,7,8]

o = [0]

n = [2,3,4,5,6,7,8]

m = [1]
```

e = 
$$\begin{bmatrix} 2,3,4,5,6,7,8 \end{bmatrix}$$
  
d =  $\begin{bmatrix} 2,3,4,5,6,7,8 \end{bmatrix}$ 

$$\begin{array}{lll} c5 & = [0] \\ c4 & = [1] \\ c3 & = [0] \\ c2 & = [0,1] \\ c1 & = [0,1] \\ c0 & = [0] \end{array}$$

#### CONSTRAINTS:

```
[0,d,e]=[y,10*c1]

[c1,n,r]=[e,10*c2]

[c2,e,0]=[n,10*0]

[9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
```

### **DEMONS:**

```
Selected constraint: [c2,e,0]=[n,10*0]
Tightening possibilities for: c2
Solving \lceil c2, e, 0 \rceil = \lceil n, 10*0 \rceil for c2
c2=[1.0*n,0.0*1,-1.0*e]
Constraint gives possibilities: [-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6]
Old possibilities were:
                                   [0,1]
New possibilities are:
                                   [0,1]
Tightening possibilities for: e
Solving [c2,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1,-1.0*c2]
Constraint gives possibilities: [1,2,3,4,5,6,7,8]
Old possibilities were:
                                   [2,3,4,5,6,7,8]
New possibilities are:
                                   [2,3,4,5,6,7,8]
Tightening possibilities for: n
Solving \lceil c2,e,0 \rceil = \lceil n,10*0 \rceil for n
n=[0.0*1,1.0*c2,1.0*e]
Constraint gives possibilities: [2,3,4,5,6,7,8,9]
Old possibilities were:
                                   [2,3,4,5,6,7,8]
New possibilities are:
                                   [2,3,4,5,6,7,8]
Constraint: [c2,e,0]=[n,10*0] caused no change. Making conditionals
Solving [0,e,0]=[n,10*0] for 0
Made new conditional constraint: c2=0->[-1*n,0*1,1*e]=0
Solving [1,e,0]=[n,10*0] for 0
Made new conditional constraint: c2=1->[-1*n,1*1,1*e]=0
Made new demons:
[[c2, [c2, e, 0]=[n, 10*0]], [e, [c2, e, 0]=[n, 10*0]], [n, [c2, e, 0]=[n, 10*0]]]
VALUES:
                 = [2,3,4,5,6,7,8]
     У
                 = [9]
     S
                 = [2,3,4,5,6,7,8]
     r
                 = [0]
     0
                 = [2,3,4,5,6,7,8]
     n
                 = [1]
     m
                 = [2,3,4,5,6,7,8]
     e
     d
                 = [2,3,4,5,6,7,8]
     c5
                 = [0]
                 = [1]
     c4
                 = [0]
     c3
                 = \lceil 0, 1 \rceil
     c2
                 = [0,1]
     c1
     c0
                 = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     c2=0 \rightarrow [-1*n, 0*1, 1*e]=0
```

```
c2=1->[-1*n,1*1,1*e]=0
```

\_\_\_\_\_\_

```
Selected constraint: c2=0 \rightarrow \Gamma-1*n, 0*1, 1*e = 0
Tightening possibilities for: c2
Solving c2=0 for c2
c2=[0.0*1]
Constraint gives possibilities: [0]
Old possibilities were:
                             [0,1]
New possibilities are:
                                  [0]
Values have changed. Checking demons
Moving demon to constraint list: 0=1->[n,r]>9
Moving demon to constraint list: 0=0->[n,r]<10
Moving demon to constraint list: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving \lceil -1*n,0*1,1*e \rceil = 0 for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [2,3,4,5,6,7,8]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are: [2,3,4,5,6,7,8]
Tightening possibilities for: n
Solving [-1*n,0*1,1*e]=0 for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [2,3,4,5,6,7,8]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are: [2,3,4,5,6,7,8]
VALUES:
              = [2,3,4,5,6,7,8]
     У
               = [9]
     S
              = [2,3,4,5,6,7,8]
               = [0]
     0
               = [2,3,4,5,6,7,8]
     n
               = [1]
     m
               = [2,3,4,5,6,7,8]
     e
     d
               = [2,3,4,5,6,7,8]
     c5
               = [0]
     c4
                = [1]
     c3
               = [0]
     c2
                = [0]
     c1
               = [0,1]
                = [0]
     с0
CONSTRAINTS:
     [0,e,0]=[n,10*0]
     0=0->[n,r]<10
     0=1->[n,r]>9
     \lceil 0, d, e \rceil = \lceil y, 10 * c 1 \rceil
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     0=1->[-1*n,1*1,1*e]=0
```

n: [0,e,0]=[n,10\*0]e: [0,e,0]=[n,10\*0]c1: c1=0->[d,e]<10c1: c1=1->[d,e]>9

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [2,3,4,5,6,7,8]
Old possibilities were:
                                [2,3,4,5,6,7,8]
New possibilities are:
                                 [2,3,4,5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [2,3,4,5,6,7,8]
Old possibilities were:
                               [2,3,4,5,6,7,8]
New possibilities are:
                                [2,3,4,5,6,7,8]
Constraint: [0,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 0,2,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=2->[-1*n,2*1]=0
Solving [0,3,0]=[n,10*0] for 0
Made new conditional constraint: e=3->[-1*n,3*1]=0
Solving [0,4,0]=[n,10*0] for 0
Made new conditional constraint: e=4->[-1*n,4*1]=0
Solving [0,5,0]=[n,10*0] for 0
Made new conditional constraint: e=5->[-1*n,5*1]=0
Solving [0,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,6*1]=0
Solving [0,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,7*1]=0
Solving [0,8,0]=[n,10*0] for 0
Made new conditional constraint: e=8->[-1*n,8*1]=0
Made new demons: [[e,[0,e,0]=[n,10*0]],[n,[0,e,0]=[n,10*0]]]
VALUES:
                = [2,3,4,5,6,7,8]
     У
     S
                = [9]
                = [2,3,4,5,6,7,8]
                = [0]
     0
                = [2,3,4,5,6,7,8]
                = [1]
     m
     e
                = [2,3,4,5,6,7,8]
     d
                = [2,3,4,5,6,7,8]
     c5
                = [0]
                = Γ17
     c4
     c3
                = [0]
     c2
                = [0]
                = [0,1]
     c1
     c0
                = [0]
CONSTRAINTS:
```

0=0->[n,r]<10

```
0=1->[n,r]>9
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    0=1->[-1*n,1*1,1*e]=0
     e=2->[-1*n,2*1]=0
     e=3->[-1*n,3*1]=0
     e=4->[-1*n,4*1]=0
     e=5->[-1*n,5*1]=0
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
    c1 :
                 c1=0->[d,e]<10
                 c1=1->[d,e]>9
     c1 :
                 [0,e,0]=[n,10*0]
     e :
                 [0,e,0]=[n,10*0]
     n :
```

```
Selected constraint: 0=0->[n,r]<10
Evaluating equation: 0=0
Evaluates true
Tightening possibilities for: n
Solving [n,r]<10 for n
n<[10.0*1,-1.0*r]
Constraint gives possibilities: [2,3,4,5,6,7,8]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are:
OVERCONSTRAINT: n has no values. Backtracking.
_____
VALUES:
    У
              = [2,3,4,5,6,7,8]
             = [9]
    S
             = [2,3,4,5,6,7,8]
              = [0]
             = [2,3,4,5,6,7,8]
              = [1]
    m
             = [2,3,4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
             = [0]
    c4
              = [1]
    c3
             = [0]
    c2
             = [0]
    c1
             = [0,1]
    c0
              = [0]
CONSTRAINTS:
    0=1->[n,r]>9
    [0,d,e]=[y,10*c1]
    \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
    [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    0=1->[-1*n,1*1,1*e]=0
    e=2->\Gamma-1*n,2*17=0
    e=3->[-1*n,3*1]=0
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
    c1 :
              c1=0->[d,e]<10
    c1 :
              c1=1->[d,e]>9
               [0,e,0]=[n,10*0]
    e :
    n: [0,e,0]=[n,10*0]
```

```
Selected constraint: 0=1->[n,r]>9
Evaluating equation: 0=1
Evaluates false
VALUES:
    У
              = [2,3,4,5,6,7,8]
              = [9]
    S
    r
              = [2,3,4,5,6,7,8]
              = [0]
    0
              = [2,3,4,5,6,7,8]
    n
              = [1]
               = [2,3,4,5,6,7,8]
    e
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
    c4
              = [1]
    c3
               = [0]
    c2
              = [0]
               = [0,1]
    c1
    c0
              = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    0=1->[-1*n,1*1,1*e]=0
    e=2->[-1*n,2*1]=0
    e=3->[-1*n,3*1]=0
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
              c1=0->[d,e]<10
    c1 :
               c1=1->\lceil d,e \rceil>9
    c1 :
               [0,e,0]=[n,10*0]
    e :
```

n: [0,e,0]=[n,10\*0]

```
Selected constraint: 0=1->[-1*n,1*1,1*e]=0
Evaluating equation: 0=1
Evaluates false
VALUES:
    У
              = [2,3,4,5,6,7,8]
              = [9]
    S
    r
               = [2,3,4,5,6,7,8]
               = [0]
    0
              = [2,3,4,5,6,7,8]
    n
               = [1]
               = [2,3,4,5,6,7,8]
    e
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
    c4
               = [1]
    c3
               = [0]
    c2
               = [0]
               = [0,1]
    c1
    c0
               = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    e=2->[-1*n,2*1]=0
    e=3->[-1*n,3*1]=0
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
    c1 :
               c1=0->[d,e]<10
    c1 :
               c1=1->[d,e]>9
               [0,e,0]=[n,10*0]
    e :
```

[0,e,0]=[n,10\*0]

```
Selected constraint: e=2->[-1*n,2*1]=0
Tightening possibilities for: e
Solving e=2 for e
e = [2.0*1]
Constraint gives possibilities: [2]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are:
                               [2]
e is now unique. Removing its value 2 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,2,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 2*1 \rceil = 0 for n
n=[2.0*1]
Constraint gives possibilities: [2]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are:
                               OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==2
VALUES:
              = [2,3,4,5,6,7,8]
    У
    S
             = [9]
             = [2,3,4,5,6,7,8]
             = [0]
    0
             = [2,3,4,5,6,7,8]
    n
              = [1]
    m
             = [2,3,4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
             = [0]
    c4
              = [1]
    c3
               = [0]
             = [0]
    c2
    c1
              = [0,1]
    c0
              = [0]
CONSTRAINTS:
    e\==2
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    e=3->[-1*n,3*1]=0
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
```

```
c1 : c1=0 \rightarrow [d,e] < 10

c1 : c1=1 \rightarrow [d,e] > 9

e : [0,e,0]=[n,10*0]

n : [0,e,0]=[n,10*0]
```

```
Selected constraint: e\==2
Tightening possibilities for: e
Solving e = 2 for e
e = [2.0*1]
Constraint gives possibilities: [2]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are:
                             [3,4,5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
_____
VALUES:
              = [2,3,4,5,6,7,8]
    У
             = [9]
    S
             = [2,3,4,5,6,7,8]
    r
             = [0]
              = [2,3,4,5,6,7,8]
    n
             = [1]
              = [3,4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
              = [1]
    c4
              = [0]
    c3
             = [0]
    c2
    c1
            = [0,1]
    с0
             = [0]
CONSTRAINTS:
    [0,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*0]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=3->[-1*n,3*1]=0
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
              [0,e,0]=[n,10*0]
    n:
    c1 :
              c1=1->[d,e]>9
    c1 : c1=0->[d,e]<10
```

```
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [2,3,4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
VALUES:
             = [2,3,4,5,6,7,8]
     У
             = [9]
= [2,3,4,5,6,7,8]
     S
               = [0]
     0
             = [3,4,5,6,7,8]
= [1]
     n
     m
     e
              = [3,4,5,6,7,8]
     d
               = [2,3,4,5,6,7,8]
     c5
               = [0]
               = [1]
     c4
     c3
              = [0]
     c2
               = [0]
              = [0,1]
     c1
           = [0]
     c0
CONSTRAINTS:
     [0,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=3->[-1*n,3*1]=0
     e=4->[-1*n,4*1]=0
     e=5->[-1*n,5*1]=0
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
     c1 : c1=0 \rightarrow [d,e]<10
c1 : c1=1 \rightarrow [d,e]>9
```

Selected constraint: [0,e,0]=[n,10\*0]

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are:
                                 [3,4,5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
Constraint: [0,e,0]=[n,10*0] caused no change. Making conditionals
Solving [0,3,0]=[n,10*0] for 0
Made new conditional constraint: e=3->[-1*n,3*1]=0
Solving [0,4,0]=[n,10*0] for 0
Made new conditional constraint: e=4->[-1*n,4*1]=0
Solving [0,5,0]=[n,10*0] for 0
Made new conditional constraint: e=5->[-1*n,5*1]=0
Solving [0,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,6*1]=0
Solving [0,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,7*1]=0
Solving [0,8,0]=[n,10*0] for 0
Made new conditional constraint: e=8->[-1*n,8*1]=0
Made new demons: [[e,[0,e,0]=[n,10*0]],[n,[0,e,0]=[n,10*0]]]
VALUES:
                = [2,3,4,5,6,7,8]
     У
                = [9]
     S
               = [2,3,4,5,6,7,8]
               = [0]
                = [3,4,5,6,7,8]
                = [1]
     m
                = [3,4,5,6,7,8]
     d
                = [2,3,4,5,6,7,8]
     c5
                = [0]
                = [1]
     c4
     c3
                = [0]
                = [0]
     c2
     c1
                = [0,1]
     с0
                = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
```

```
e=3->[-1*n,3*1]=0
e=4->[-1*n,4*1]=0
e=5->[-1*n,5*1]=0
e=6->[-1*n,6*1]=0
e=7->[-1*n,7*1]=0
e=8->[-1*n,8*1]=0
```

c1 :  $c1=0\rightarrow [d,e]<10$ c1 :  $c1=1\rightarrow [d,e]>9$ e : [0,e,0]=[n,10\*0]n : [0,e,0]=[n,10\*0]

-----

```
Selected constraint: e=3->[-1*n,3*1]=0
Tightening possibilities for: e
Solving e=3 for e
e = [3.0*1]
Constraint gives possibilities: [3]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are:
                               [3]
e is now unique. Removing its value 3 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,3,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 3*1 \rceil = 0 for n
n=[3.0*1]
Constraint gives possibilities: [3]
Old possibilities were: [4,5,6,7,8]
New possibilities are:
                               OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==3
VALUES:
              = [2,3,4,5,6,7,8]
    У
    S
             = [9]
             = [2,3,4,5,6,7,8]
    0
             = [0]
             = [3,4,5,6,7,8]
    n
              = [1]
    m
             = [3,4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
             = [0]
    c4
              = [1]
    c3
               = [0]
             = [0]
    c2
    c1
              = [0,1]
    c0
              = [0]
CONSTRAINTS:
    e\==3
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
               c1=0->[d,e]<10
    c1 :
```

c1 : c1=1->[d,e]>9e : [0,e,0]=[n,10\*0]n : [0,e,0]=[n,10\*0]

\_\_\_\_\_

```
Selected constraint: e\==3
Tightening possibilities for: e
Solving e = 3 for e
e\==[3.0*1]
Constraint gives possibilities: [3]
Old possibilities were:
                               [3,4,5,6,7,8]
New possibilities are:
                               [4,5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
_____
VALUES:
               = [2,3,4,5,6,7,8]
    У
               = [9]
    S
    r
               = [2,3,4,5,6,7,8]
               = [0]
               = [3,4,5,6,7,8]
               = [1]
               = [4,5,6,7,8]
    e
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
               = [1]
    c4
               = [0]
    c3
               = [0]
    c2
    c1
               = [0,1]
    c0
               = [0]
CONSTRAINTS:
    [0,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=4->[-1*n,4*1]=0
    e=5->[-1*n,5*1]=0
    e=6->\Gamma-1*n.6*17=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
                [0,e,0]=[n,10*0]
    n :
               c1=1->[d,e]>9
    c1 :
               c1=0->[d,e]<10
    c1 :
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [4,5,6,7,8]
New possibilities are:
                                [4,5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [4,5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
VALUES:
            = [2,3,4,5,6,7,8]
     У
             = [9]
= [2,3,4,5,6,7,8]
     S
              = [0]
     0
            = [4,5,6,7,8]
    n
     m
              = [1]
     e
              = [4,5,6,7,8]
     d
              = [2,3,4,5,6,7,8]
     c5
              = [0]
              = [1]
     c4
     c3
              = [0]
     c2
              = [0]
             = [0,1]
     c1
           = [0]
     c0
CONSTRAINTS:
     [0,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=4->[-1*n,4*1]=0
     e=5->[-1*n,5*1]=0
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
     c1 : c1=0->\lceil d,e\rceil<10
    c1 : c1=1->[d,e]>9
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [4,5,6,7,8]
Old possibilities were:
                                 [4,5,6,7,8]
New possibilities are:
                                 [4,5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [4,5,6,7,8]
Old possibilities were:
                                [4,5,6,7,8]
New possibilities are:
                                [4,5,6,7,8]
Constraint: [0,e,0]=[n,10*0] caused no change. Making conditionals
Solving [0,4,0]=[n,10*0] for 0
Made new conditional constraint: e=4->[-1*n,4*1]=0
Solving [0,5,0]=[n,10*0] for 0
Made new conditional constraint: e=5->[-1*n,5*1]=0
Solving [0,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,6*1]=0
Solving [0,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,7*1]=0
Solving [0,8,0]=[n,10*0] for 0
Made new conditional constraint: e=8->[-1*n.8*1]=0
Made new demons: [[e,[0,e,0]=[n,10*0]],[n,[0,e,0]=[n,10*0]]]
VALUES:
              = [2,3,4,5,6,7,8]
     У
                = [9]
     S
                = [2,3,4,5,6,7,8]
                = [0]
     0
                = [4,5,6,7,8]
     n
                = [1]
     m
                = [4,5,6,7,8]
     e
     d
                = [2,3,4,5,6,7,8]
     c5
                = [0]
                = [1]
     c4
     c3
                = [0]
     c2
                = [0]
                = [0,1]
     c1
     с0
                = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=4->[-1*n,4*1]=0
     e=5->[-1*n,5*1]=0
```

c1:  $c1=0\rightarrow[d,e]<10$ c1:  $c1=1\rightarrow[d,e]>9$ e: [0,e,0]=[n,10\*0]n: [0,e,0]=[n,10\*0]

```
Selected constraint: e=4->[-1*n,4*1]=0
Tightening possibilities for: e
Solving e=4 for e
e=[4.0*1]
Constraint gives possibilities: [4]
Old possibilities were: [4,5,6,7,8]
New possibilities are:
                              [4]
e is now unique. Removing its value 4 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,4,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 4*1 \rceil = 0 for n
n=[4.0*1]
Constraint gives possibilities: [4]
Old possibilities were: [5,6,7,8]
New possibilities are:
                               OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==4
VALUES:
             = [2,3,4,5,6,7,8]
    У
    S
             = [9]
             = [2,3,4,5,6,7,8]
    0
             = [0]
             = [4,5,6,7,8]
    n
             = [1]
    m
             = [4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
             = [0]
    c4
             = [1]
    c3
               = [0]
             = [0]
    c2
    c1
              = [0,1]
    c0
             = [0]
CONSTRAINTS:
    e\==4
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
    c1 :
              c1=0->[d,e]<10
               c1=1->[d,e]>9
    c1 :
```

e: [0,e,0]=[n,10\*0]n: [0,e,0]=[n,10\*0]

-----

```
Selected constraint: e\==4
Tightening possibilities for: e
Solving e = 4 for e
e\==[4.0*1]
Constraint gives possibilities: [4]
Old possibilities were: [4,5,6,7,8]
New possibilities are:
                             [5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
_____
VALUES:
              = [2,3,4,5,6,7,8]
    У
             = [9]
    S
    r
             = [2,3,4,5,6,7,8]
             = [0]
              = [4,5,6,7,8]
             = [1]
              = [5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
              = [1]
    c4
             = [0]
    c3
             = [0]
    c2
            = [0,1]
    c1
    c0
             = [0]
CONSTRAINTS:
    [0,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*0]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=5->[-1*n,5*1]=0
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
              [0,e,0]=[n,10*0]
    n:
             c1=1->[d,e]>9
c1=0->[d,e]<10
    c1 :
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [4,5,6,7,8]
Old possibilities were: [5,6,7,8]
New possibilities are:
                                  [5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [5,6,7,8]
Old possibilities were: [4,5,6,7,8]
New possibilities are: [5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
VALUES:
            = [2,3,4,5,6,7,8]
= [9]
= [2,3,4,5,6,7,8]
= [0]
= [5,6,7,8]
= [1]
     У
     S
     0
     n
     m
     e
              = [5,6,7,8]
     d
               = [2,3,4,5,6,7,8]
     c5
               = [0]
               = [1]
     c4
     c3
               = [0]
               = [0]
     c2
              = [0,1]
     c1
           = [0]
     c0
CONSTRAINTS:
     [0,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=5->[-1*n,5*1]=0
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
               c1=0->[d,e]<10
     c1 :
     c1: c1=1->\lceil d,e \rceil>9
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [5,6,7,8]
Old possibilities were: [5,6,7,8]
New possibilities are:
                                 [5,6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [5,6,7,8]
Old possibilities were: [5,6,7,8]
New possibilities are: [5,6,7,8]
Constraint: [0,e,0]=[n,10*0] caused no change. Making conditionals
Solving [0.5,0]=[n.10*0] for 0
Made new conditional constraint: e=5->[-1*n,5*1]=0
Solving [0,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,6*1]=0
Solving [0,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,7*1]=0
Solving [0,8,0]=[n,10*0] for 0
Made new conditional constraint: e=8->[-1*n,8*1]=0
Made new demons: [[e,[0,e,0]=[n,10*0]],[n,[0,e,0]=[n,10*0]]]
VALUES:
     У
              = [2,3,4,5,6,7,8]
              = [9]
     S
              = [2,3,4,5,6,7,8]
              = [0]
     0
               = [5,6,7,8]
     n
                = [1]
     m
                = [5,6,7,8]
     e
               = [2,3,4,5,6,7,8]
     d
     c5
               = [0]
     c4
                = [1]
     c3
               = [0]
     c2
                = [0]
                = [0,1]
     c1
                = [0]
     с0
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=5->[-1*n,5*1]=0
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
```

```
DEMONS:
```

c1 :  $c1=0 \rightarrow [d,e] < 10$ c1 :  $c1=1 \rightarrow [d,e] > 9$ e : [0,e,0]=[n,10\*0]n : [0,e,0]=[n,10\*0]

-----

```
Selected constraint: e=5->[-1*n,5*1]=0
Tightening possibilities for: e
Solving e=5 for e
e=[5.0*1]
Constraint gives possibilities: [5]
Old possibilities were: [5,6,7,8]
New possibilities are:
                              [5]
e is now unique. Removing its value 5 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,5,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 5*1 \rceil = 0 for n
n=[5.0*1]
Constraint gives possibilities: [5]
Old possibilities were: [6,7,8]
New possibilities are:
                               OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==5
VALUES:
             = [2,3,4,5,6,7,8]
    У
    S
             = [9]
             = [2,3,4,5,6,7,8]
    0
             = [0]
             = [5,6,7,8]
    n
             = [1]
    m
             = [5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
             = [0]
    c4
             = [1]
    c3
               = [0]
             = [0]
    c2
    c1
             = [0,1]
             = [0]
    c0
CONSTRAINTS:
    e\==5
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
    c1 :
               c1=0->[d,e]<10
               c1=1->[d,e]>9
    c1 :
    e :
               [0,e,0]=[n,10*0]
```

n : [0,e,0]=[n,10\*0]

```
Selected constraint: e\==5
Tightening possibilities for: e
Solving e = 5 for e
e\==[5.0*1]
Constraint gives possibilities: [5]
Old possibilities were:
                          [5,6,7,8]
New possibilities are:
                              [6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
_____
VALUES:
               = [2,3,4,5,6,7,8]
    У
              = [9]
    S
    r
              = [2,3,4,5,6,7,8]
              = [0]
               = [5,6,7,8]
    n
              = [1]
               = [6,7,8]
    e
    d
              = [2,3,4,5,6,7,8]
    c5
               = [0]
    c4
               = [1]
               = [0]
    c3
              = [0]
    c2
              = [0,1]
    c1
    c0
               = [0]
CONSTRAINTS:
    [0,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*0]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=6->[-1*n,6*1]=0
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
               [0,e,0]=[n,10*0]
    n :
              c1=1->[d,e]>9
    c1 :
    c1: c1=0 \rightarrow [d,e] < 10
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [5,6,7,8]
Old possibilities were: [6,7,8]
New possibilities are:
                                 [6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [6,7,8]
Old possibilities were: [5,6,7,8]
New possibilities are: [6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
VALUES:
            = [2,3,4,5,6,7,8]
     У
             = [9]
= [2,3,4,5,6,7,8]
= [0]
     S
     0
            = [6,7,8]
     n
     m
              = [1]
     e
              = [6,7,8]
     d
               = [2,3,4,5,6,7,8]
     c5
               = [0]
               = [1]
     c4
     c3
              = [0]
               = [0]
     c2
              = [0,1]
     c1
     c0
                = [0]
CONSTRAINTS:
     [0,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
     c1 : c1=0->[d,e]<10
c1 : c1=1->[d,e]>9
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [6,7,8]
Old possibilities were:
                                [6,7,8]
New possibilities are:
                                 [6,7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [6,7,8]
Old possibilities were:
                                 [6,7,8]
New possibilities are:
                                [6,7,8]
Constraint: [0,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 0.6.0 \rceil = \lceil n.10*0 \rceil for 0
Made new conditional constraint: e=6->[-1*n,6*1]=0
Solving [0,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,7*1]=0
Solving [0,8,0]=[n,10*0] for 0
Made new conditional constraint: e=8->[-1*n,8*1]=0
Made new demons: [[e,[0,e,0]=[n,10*0]],[n,[0,e,0]=[n,10*0]]]
VALUES:
     У
                = [2,3,4,5,6,7,8]
               = [9]
     S
               = [2,3,4,5,6,7,8]
                = [0]
     0
                = [6,7,8]
     n
                = [1]
     m
                = [6,7,8]
     e
     d
                = [2,3,4,5,6,7,8]
     c5
                = [0]
                = [1]
     c4
     c3
                = [0]
     c2
                = [0]
     c1
                = \lceil 0, 1 \rceil
     с0
                = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=6->[-1*n,6*1]=0
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
                c1=0->\lceil d,e\rceil<10
     c1 :
```

c1 : c1=1->[d,e]>9e : [0,e,0]=[n,10\*0]n : [0,e,0]=[n,10\*0]

\_\_\_\_\_

```
Selected constraint: e=6->[-1*n,6*1]=0
Tightening possibilities for: e
Solving e=6 for e
e = [6.0*1]
Constraint gives possibilities: [6]
Old possibilities were:
                           [6,7,8]
New possibilities are:
                                [6]
e is now unique. Removing its value 6 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,6,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 6*1 \rceil = 0 for n
n=[6.0*1]
Constraint gives possibilities: [6]
Old possibilities were:
                               [7,8]
New possibilities are:
                                OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==6
VALUES:
              = [2,3,4,5,6,7,8]
    y
    S
              = [9]
              = [2,3,4,5,6,7,8]
    0
              = [0]
              = [6,7,8]
    n
              = [1]
    m
              = [6,7,8]
    e
     d
              = [2,3,4,5,6,7,8]
    c5
              = [0]
    c4
              = [1]
    c3
               = [0]
     c2
              = [0]
     c1
               = [0,1]
              = [0]
     c0
CONSTRAINTS:
    e\==6
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
                c1=0\rightarrow \lceil d,e \rceil < 10
    c1 :
                 c1=1->[d,e]>9
    c1 :
                 [0,e,0]=[n,10*0]
     e :
                [0,e,0]=[n,10*0]
    n :
```

```
Selected constraint: e\==6
Tightening possibilities for: e
Solving e = 6 for e
e\==[6.0*1]
Constraint gives possibilities: [6]
Old possibilities were: [6,7,8]
New possibilities are:
                            [7,8]
Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
_____
VALUES:
              = [2,3,4,5,6,7,8]
    У
            = [9]
    S
    r
             = [2,3,4,5,6,7,8]
             = [0]
             = [6,7,8]
    n
             = [1]
              = [7,8]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
    c4
              = [1]
             = [0]
    c3
             = [0]
    c2
            = [0,1]
    c1
    c0
             = [0]
CONSTRAINTS:
    [0,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*0]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=7->[-1*n,7*1]=0
    e=8->[-1*n,8*1]=0
DEMONS:
              [0,e,0]=[n,10*0]
    n:
              c1=1->[d,e]>9
    c1 :
    c1 : c1=0->[d,e]<10
```

```
Selected constraint: [0,e,0]=[n,10*0]
 Tightening possibilities for: e
 Solving [0,e,0]=[n,10*0] for e
 e=[1.0*n,0.0*1]
 Constraint gives possibilities: [6,7,8]
Old possibilities were: [7,8]
New possibilities are:
                                                                                                                                 [7,8]
 Tightening possibilities for: n
 Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
 Constraint gives possibilities: [7,8]
Old possibilities were: [6,7,8]
New possibilities are: [7,8]
 Values have changed. Checking demons
Moving demon to constraint list: [0,e,0]=[n,10*0]
VALUES:
                                             = [2,3,4,5,6,7,8]
= [9]
= [2,3,4,5,6,7,8]
= [0]
= [7,8]
= [1]
                    У
                    S
                    0
                   n
                    m
                                                     = [7,8]
                    e
                    d
                                                        = [2,3,4,5,6,7,8]
                    c5
                                                       = [0]
                                                        = [1]
                    c4
                                                     = [0]
                    c3

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CONSTRAINTS:
                    [0,e,0]=[n,10*0]
                    [0,d,e]=[y,10*c1]
                    \lceil c1, n, r \rceil = \lceil e, 10*0 \rceil
                    [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
                    e=7->[-1*n,7*1]=0
                    e=8->[-1*n,8*1]=0
DEMONS:
                   c1 : c1=0->[d,e]<10
c1 : c1=1->[d,e]>9
```

```
Selected constraint: [0,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [0,e,0]=[n,10*0] for e
e=[1.0*n,0.0*1]
Constraint gives possibilities: [7,8]
Old possibilities were:
                               [7,8]
New possibilities are:
                                 [7,8]
Tightening possibilities for: n
Solving [0,e,0]=[n,10*0] for n
n=[0.0*1,1.0*e]
Constraint gives possibilities: [7,8]
Old possibilities were:
                                [7,8]
New possibilities are:
                                [7,8]
Constraint: [0,e,0]=[n,10*0] caused no change. Making conditionals
Solving [0,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,7*1]=0
Solving [0,8,0]=[n,10*0] for 0
Made new conditional constraint: e=8->[-1*n,8*1]=0
Made new demons: [[e,[0,e,0]=[n,10*0]],[n,[0,e,0]=[n,10*0]]]
VALUES:
     У
              = [2,3,4,5,6,7,8]
     S
              = [9]
              = [2,3,4,5,6,7,8]
              = [0]
     0
     n
                = [7,8]
                = [1]
     m
                = [7,8]
     e
               = [2,3,4,5,6,7,8]
     d
     c5
                = [0]
                = [17
     c4
     c3
                = [0]
     c2
                = [0]
     c1
                = \lceil 0.1 \rceil
     c0
                = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=7->[-1*n,7*1]=0
     e=8->[-1*n,8*1]=0
DEMONS:
                 c1=0\rightarrow \lceil d,e \rceil < 10
     c1 :
                 c1=1->[d,e]>9
     c1 :
                 [0,e,0]=[n,10*0]
     e :
                 [0,e,0]=[n,10*0]
     n:
```

```
Selected constraint: e=7->[-1*n,7*1]=0
Tightening possibilities for: e
Solving e=7 for e
e = [7.0*1]
Constraint gives possibilities: [7]
Old possibilities were: [7,8]
New possibilities are:
                                  [7]
e is now unique. Removing its value 7 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,7,0]=[n,10*0]
Tightening possibilities for: n
Solving [-1*n,7*1]=0 for n
n=[7.0*1]
Constraint gives possibilities: [7]
Old possibilities were:
New possibilities are:
OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==7
VALUES:
             = [2,3,4,5,6,7,8]
= [9]
= [2,3,4,5,6,7,8]
= [0]
     У
     S
     0
             = [7,8]
= [1]
= [7,8]
= [2,3,4,5,6,7,8]
     n
     m
     e
     d
              = [0]
= [1]
     c5
     c4
              = [0]
= [0]
     c3
     c2
     c1
               = [0,1]
            = [0]
     c0
CONSTRAINTS:
     e\==7
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*0]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=8->[-1*n,8*1]=0
DEMONS:
     c1: c1=0 \rightarrow [d,e]<10

c1: c1=1 \rightarrow [d,e]>9

e: [0,e,0]=[n,10*0]

n: [0,e,0]=[n,10*0]
```

```
Selected constraint: e\==7
Tightening possibilities for: e
Solving e = 7 for e
e\==[7.0*1]
Constraint gives possibilities: [7]
Old possibilities were: [7,8]
New possibilities are:
                            [8]
e is now unique. Removing its value 8 from others
Values have changed. Checking demons
Moving demon to constraint list: [0,8,0]=[n,10*0]
_____
VALUES:
           = [0]
= [0,1]
    c0
    c1
            = [0]
    c2
            = [0]
= [1]
    c3
    c4
           = [0]
= [2,3,4,5,6,7]
= [8]
    c5
    d
    e
            = [1]
    m
           = [7]
    n
           = [0]
= [2,3,4,5,6,7]
= [9]
= [2,3,4,5,6,7]
    0
    r
    S
    У
CONSTRAINTS:
    [0,8,0]=[n,10*0]
    [0,d,8]=[y,10*c1]
    [c1,n,r]=[8,10*0]
    [9000*1,900*0,90*n,y]=[1000*9,91*8,d,10*r]
    8=8->[-1*n,8*1]=0
DEMONS:
            [0,8,0]=[n,10*0]
    n:
    c1 :
              c1=1->[d,8]>9
    c1 : c1=0->[d,8]<10
```

```
Selected constraint: [0,8,0]=[n,10*0]
Tightening possibilities for: n
Solving [0,8,0]=[n,10*0] for n
n=[8.0*1]
Constraint gives possibilities: [8]
Old possibilities were:
                               [7]
New possibilities are:
                                OVERCONSTRAINT: n has no values. Backtracking.
Conditional constraint failed, asserting negation: c2\==0
VALUES:
               = [2,3,4,5,6,7,8]
    У
               = [9]
    S
     r
               = [2,3,4,5,6,7,8]
               = [0]
               = [2,3,4,5,6,7,8]
               = [1]
               = [2,3,4,5,6,7,8]
     e
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
               = [1]
    c4
               = [0]
    c3
    c2
               = [0,1]
     c1
               = [0,1]
    c0
               = [0]
CONSTRAINTS:
    c2\==0
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*c2]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     c2=1->[-1*n,1*1,1*e]=0
DEMONS:
    c2 :
                c2=1->[n,r]>9
               c2=0->[n,r]<10
    c2 :
               c1=1->[d,e]>9
    c1 :
                c1=0->[d,e]<10
    c1 :
    c2 :
                [c2,e,0]=[n,10*0]
                [c2,e,0]=[n,10*0]
    e :
                [c2,e,0]=[n,10*0]
    n :
```

```
Selected constraint: c2\==0
Tightening possibilities for: c2
Solving c2 = 0 for c2
c2 = [0.0*1]
Constraint gives possibilities: [0]
Old possibilities were: [0,1]
New possibilities are:
                             [1]
Values have changed. Checking demons
Moving demon to constraint list: 1=1->[n,r]>9
Moving demon to constraint list: 1=0->[n,r]<10
Moving demon to constraint list: [1,e,0]=[n,10*0]
______
VALUES:
           = [2,3,4,5,6,7,8]
    У
             = [9]
    S
             = [2,3,4,5,6,7,8]
             = [0]
            = [2,3,4,5,6,7,8]
    n
             = [1]
    m
             = [2,3,4,5,6,7,8]
    e
    d
             = [2,3,4,5,6,7,8]
             = [0]
    c5
             = [1]
    c4
    c3
             = [0]
    c2
             = [1]
    c1
              = [0,1]
    c0
              = [0]
CONSTRAINTS:
    [1,e,0]=[n,10*0]
    1=0->[n,r]<10
    1=1->[n,r]>9
    [0,d,e]=[y,10*c1]
    \lceil c1, n, r \rceil = \lceil e, 10*1 \rceil
    [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    1=1->[-1*n,1*1,1*e]=0
DEMONS:
             [1,e,0]=[n,10*0]
    n :
              [1,e,0]=[n,10*0]
    c1 :
             c1=0>[d,e]<10
    c1 : c1=1->[d,e]>9
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [1,2,3,4,5,6,7]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are:
                              [2,3,4,5,6,7]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [2,3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
______
VALUES:
             = [2,3,4,5,6,7,8]
    У
             = [9]
    S
             = [2,3,4,5,6,7,8]
    r
    0
             = [0]
    n
             = [3,4,5,6,7,8]
             = [1]
    m
    e
             = [2,3,4,5,6,7]
    d
               = [2,3,4,5,6,7,8]
    c5
              = [0]
    c4
               = [1]
              = [0]
    c3
    c2
               = [1]
            = [0,1]
    c1
    c0
               = [0]
CONSTRAINTS:
     \lceil 1, e, 0 \rceil = \lceil n, 10*0 \rceil
    [1,e,0]=[n,10*0]
    1=0 -> [n,r] < 10
    1=1->[n,r]>9
    [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
    [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    1=1->[-1*n,1*1,1*e]=0
DEMONS:
              c1=0->[d,e]<10
c1=1->[d,e]>9
    c1 :
    c1 :
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [2,3,4,5,6,7]
Old possibilities were: [2,3,4,5,6,7]
New possibilities are:
                                  [2,3,4,5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
Constraint: [1,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 1,2,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=2->\Gamma-1*n.3*17=0
Solving \lceil 1,3,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=3->[-1*n,4*1]=0
Solving [1,4,0]=[n,10*0] for 0
Made new conditional constraint: e=4->[-1*n.5*1]=0
Solving [1,5,0]=[n,10*0] for 0
Made new conditional constraint: e=5->[-1*n,6*1]=0
Solving [1,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,7*1]=0
Solving [1,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,8*1]=0
Made new demons: [[e,[1,e,0]=[n,10*0]],[n,[1,e,0]=[n,10*0]]]
VALUES:
                 = [2,3,4,5,6,7,8]
     У
                 = [9]
     S
                = [2,3,4,5,6,7,8]
                = [0]
                 = [3,4,5,6,7,8]
                 = [1]
     m
                 = [2,3,4,5,6,7]
     e
     d
                 = [2,3,4,5,6,7,8]
     c5
                 = [0]
                 = [1]
     c4
     c3
                 = [0]
                 = [1]
     c2
     c1
                 = [0,1]
     с0
                 = [0]
CONSTRAINTS:
     [1,e,0]=[n,10*0]
     1=0->[n,r]<10
     1=1->[n,r]>9
```

```
[0,d,e]=[y,10*c1]
[c1,n,r]=[e,10*1]
[9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
1=1->[-1*n,1*1,1*e]=0
e=2->[-1*n,3*1]=0
e=3->[-1*n,4*1]=0
e=4->[-1*n,5*1]=0
e=5->[-1*n,6*1]=0
e=6->[-1*n,7*1]=0
e=7->[-1*n,8*1]=0
```

# DEMONS:

c1 :  $c1=0 \rightarrow [d,e]<10$ c1 :  $c1=1 \rightarrow [d,e]>9$ e : [1,e,0]=[n,10\*0]n : [1,e,0]=[n,10\*0]

-----

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [2,3,4,5,6,7]
Old possibilities were: [2,3,4,5,6,7]
New possibilities are:
                                  [2,3,4,5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
Constraint: [1,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 1,2,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=2->[-1*n,3*1]=0
Solving \lceil 1,3,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=3->[-1*n,4*1]=0
Solving [1,4,0]=[n,10*0] for 0
Made new conditional constraint: e=4->[-1*n.5*1]=0
Solving [1,5,0]=[n,10*0] for 0
Made new conditional constraint: e=5->[-1*n,6*1]=0
Solving [1,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,7*1]=0
Solving [1,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,8*1]=0
Made new demons: [[e,[1,e,0]=[n,10*0]],[n,[1,e,0]=[n,10*0]]]
VALUES:
                 = [2,3,4,5,6,7,8]
     У
                 = [9]
     S
                = [2,3,4,5,6,7,8]
                = [0]
                 = [3,4,5,6,7,8]
                 = [1]
     m
                 = [2,3,4,5,6,7]
     e
     d
                = [2,3,4,5,6,7,8]
     c5
                = [0]
                 = [1]
     c4
     c3
                 = [0]
                = [1]
     c2
     c1
                 = [0,1]
     c0
                 = [0]
CONSTRAINTS:
     1=0->[n,r]<10
     1=1->[n,r]>9
     [0,d,e]=[y,10*c1]
```

```
[c1,n,r]=[e,10*1]
    [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    1=1->[-1*n,1*1,1*e]=0
    e=2->[-1*n,3*1]=0
    e=3->[-1*n,4*1]=0
    e=4->[-1*n,5*1]=0
    e=5->[-1*n,6*1]=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
            c1=0->[d,e]<10
    c1 :
```

c1=1->[d,e]>9 c1 : [1,e,0]=[n,10\*0]e : [1,e,0]=[n,10\*0]n:

```
Selected constraint: 1=0->[n,r]<10
Evaluating equation: 1=0
Evaluates false
VALUES:
    У
             = [2,3,4,5,6,7,8]
              = [9]
    S
    r
              = [2,3,4,5,6,7,8]
              = [0]
    0
              = [3,4,5,6,7,8]
    n
              = [1]
               = [2,3,4,5,6,7]
    e
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
    c4
              = [1]
               = [0]
    c3
    c2
              = [1]
               = [0,1]
    c1
    c0
             = [0]
CONSTRAINTS:
    1=1->[n,r]>9
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*1]
    [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
    1=1->[-1*n,1*1,1*e]=0
    e=2->[-1*n,3*1]=0
    e=3->[-1*n,4*1]=0
    e=4->[-1*n,5*1]=0
    e=5->[-1*n,6*1]=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
             c1=0->[d,e]<10
c1=1->[d,e]>9
    c1 :
    c1 :
               [1,e,0]=[n,10*0]
    n : [1,e,0]=[n,10*0]
```

```
Selected constraint: 1=1->[n,r]>9
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: n
Solving [n,r]>9 for n
n>[9.0*1,-1.0*r]
Constraint gives possibilities: [1,2,3,4,5,6,7]
Old possibilities were:
                           [3,4,5,6,7,8]
New possibilities are:
                               [8]
n is now unique. Removing its value 8 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[8,10*0]
Tightening possibilities for: r
Solving [n,r]>9 for r
r > [9.0*1, -1.0*n]
Constraint gives possibilities: [1]
Old possibilities were: [2,3,4,5,6,7]
New possibilities are:
                              [2,3,4,5,6,7]
VALUES:
               = [0]
    c0
              = \lceil 0, 1 \rceil
    c1
    c2
              = [1]
     c3
               = [0]
    c4
               = [1]
    c5
              = [0]
              = [2,3,4,5,6,7]
    d
             = [2,3,4,5,6,7]
    e
              = [1]
    m
              = [8]
    n
               = [0]
    0
              = [2,3,4,5,6,7]
     r
     S
              = [9]
             = [2,3,4,5,6,7]
    У
CONSTRAINTS:
     [1,e,0]=[8,10*0]
     [0,d,e]=[y,10*c1]
     [c1,8,r]=[e,10*1]
     [9000*1,900*0,90*8,y]=[1000*9,91*e,d,10*r]
     1=1->[-1*8,1*1,1*e]=0
    e=2->[-1*8,3*1]=0
    e=3->[-1*8,4*1]=0
    e=4->[-1*8,5*1]=0
    e=5->[-1*8,6*1]=0
    e=6->[-1*8,7*1]=0
    e=7->[-1*8,8*1]=0
```

DEMONS:

e: [1,e,0]=[8,10\*0] c1: c1=1->[d,e]>9 c1: c1=0->[d,e]<10

-----

```
Selected constraint: [1,e,0]=[8,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[8,10*0] for e
e = [7.0*1]
Constraint gives possibilities: [7]
Old possibilities were: [2,3,4,5,6,7]
New possibilities are:
                                 [7]
e is now unique. Removing its value 7 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,7,0]=[8,10*0]
_____
VALUES:
            = [2,3,4,5,6]
= [9]
= [2,3,4,5,6]
= [0]
     У
     S
               = [8]
             = [1]
     m
               = [7]
     e
            = L/J
= [2,3,4,5,6]
= [0]
= [1]
= [0]
= [1]
= [0,1]
= [0]
     d
     c5
     c4
     c3
     c2
     c1
     c0
CONSTRAINTS:
     [1,7,0]=[8,10*0]
     [0,d,7]=[y,10*c1]
     \lceil c1, 8, r \rceil = \lceil 7, 10*1 \rceil
     [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
     1=1->[-1*8,1*1,1*7]=0
     7=2->\Gamma-1*8,3*17=0
     7=3->[-1*8,4*1]=0
     7=4->[-1*8,5*1]=0
     7=5->[-1*8,6*1]=0
     7=6->[-1*8,7*1]=0
     7=7->[-1*8,8*1]=0
DEMONS:
     c1 : c1=0 \rightarrow [d,7]<10
c1 : c1=1 \rightarrow [d,7]>9
```

```
Selected constraint: [1,7,0]=[8,10*0]
Evaluating equation: [1,7,0]=[8,10*0]
Evaluates true
VALUES:
         = [2,3,4,5,6]
= [9]
= [2,3,4,5,6]
= [0]
     У
     S
     r
     0
               = [8]
     n
               = [1]
                = [7]
     e
     d
               = [2,3,4,5,6]
               = [0]
     c5
     c4
               = [1]
     c3
               = [0]
               = [1]
     c2
     c1 = [0,1]

c0 = [0]
CONSTRAINTS:
     [0,d,7]=[y,10*c1]
     [c1,8,r]=[7,10*1]
     [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
     1=1->[-1*8,1*1,1*7]=0
     7=2->[-1*8,3*1]=0
     7=3->[-1*8,4*1]=0
     7=4->[-1*8,5*1]=0
     7=5->[-1*8,6*1]=0
     7=6->[-1*8,7*1]=0
     7=7->[-1*8,8*1]=0
DEMONS:
     c1 : c1=0 \rightarrow [d,7]<10
c1 : c1=1 \rightarrow [d,7]>9
```

```
Selected constraint: 1=1->[-1*8,1*1,1*7]=0
Evaluating equation: 1=1
Evaluates true
Evaluating equation: [-1*8,1*1,1*7]=0
Evaluates true
VALUES:
     y = [2,3,4,5,6]

s = [9]
               = [2,3,4,5,6]
               = [0]
               = [8]
     n
               = [1]
               = [7]
     e
               = [2,3,4,5,6]
     d
     c5
               = [0]
     c4
               = [1]
              = [0]
     c3
     c2
              = [1]
              = [0,1]
     c1
     c0
               = [0]
CONSTRAINTS:
     [0,d,7]=[y,10*c1]
     [c1,8,r]=[7,10*1]
     [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
     7=2->[-1*8,3*1]=0
     7=3 \rightarrow [-1*8, 4*1]=0
     7=4->[-1*8,5*1]=0
     7=5->[-1*8,6*1]=0
     7=6->[-1*8,7*1]=0
     7=7->[-1*8,8*1]=0
DEMONS:
    c1 : c1=0 \rightarrow [d,7]<10
c1 : c1=1 \rightarrow [d,7]>9
```

```
Selected constraint: 7=2->[-1*8,3*1]=0
Evaluating equation: 7=2
Evaluates false
VALUES:
           = [2,3,4,5,6]
= [9]
    У
    S
            = [2,3,4,5,6]
    r
              = [0]
    0
              = [8]
    n
               = [1]
               = [7]
    e
    d
              = [2,3,4,5,6]
    c5
              = [0]
    c4
              = [1]
    c3
              = [0]
              = [1]
    c2
          = [0,1]
= [0]
    c1
    с0
CONSTRAINTS:
     [0,d,7]=[y,10*c1]
    [c1,8,r]=[7,10*1]
     [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
    7=3 \rightarrow [-1*8, 4*1]=0
    7=4->[-1*8,5*1]=0
    7=5 - [-1*8, 6*1] = 0
    7=6->[-1*8,7*1]=0
    7=7->[-1*8,8*1]=0
DEMONS:
    c1 : c1=0 \rightarrow [d,7]<10
```

c1 : c1=1->[d,7]>9

```
Selected constraint: 7=3->[-1*8,4*1]=0
Evaluating equation: 7=3
Evaluates false
VALUES:
          = [2,3,4,5,6]
= [9]
= [2,3,4,5,6]
= [0]
    У
    S
    r
    0
              = [8]
    n
              = [1]
               = [7]
    e
    d
              = [2,3,4,5,6]
    c5
              = [0]
    c4
              = [1]
    c3
              = [0]
             = [1]
    c2
    c1 = \begin{bmatrix} 0,1 \end{bmatrix}
c0 = \begin{bmatrix} 0 \end{bmatrix}
CONSTRAINTS:
     [0,d,7]=[y,10*c1]
    [c1,8,r]=[7,10*1]
    [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
    7=4->[-1*8,5*1]=0
    7=5->[-1*8,6*1]=0
    7=6->[-1*8,7*1]=0
    7=7->[-1*8,8*1]=0
DEMONS:
    c1 : c1=0->[d,7]<10
c1 : c1=1->[d,7]>9
Selected constraint: 7=4->[-1*8,5*1]=0
Evaluating equation: 7=4
Evaluates false
______
VALUES:
           = [2,3,4,5,6]
    У
    S
             = [9]
             = [2,3,4,5,6]
              = [0]
    0
              = [8]
    n
              = [1]
    m
    e
             = [7]
    d
              = [2,3,4,5,6]
```

```
c5 = \begin{bmatrix} 0 \end{bmatrix}
        = [0]
= [0]
= [1]
= [0,1]
= [0]
c4
c3
c2
c1
c0
```

# CONSTRAINTS:

```
[0,d,7]=[y,10*c1]
[c1,8,r]=[7,10*1]
[9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
7=5->[-1*8,6*1]=0
7=6->[-1*8,7*1]=0
7=7->[-1*8,8*1]=0
```

## DEMONS:

c1 : c1=0->[d,7]<10 c1 : c1=1->[d,7]>9

```
Selected constraint: 7=5 \rightarrow [-1*8,6*1]=0
```

Evaluating equation: 7=5

Evaluates false

-----

```
VALUES:
```

```
y = [2,3,4,5,6]

s = [9]

r = [2,3,4,5,6]

o = [0]

n = [8]

m = [1]

e = [7]

d = [2,3,4,5,6]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

### CONSTRAINTS:

### **DEMONS:**

c1 :  $c1=0\rightarrow[d,7]<10$ c1 :  $c1=1\rightarrow[d,7]>9$ 

\_\_\_\_\_

```
Selected constraint: 7=6 \rightarrow [-1*8, 7*1]=0
Evaluating equation: 7=6
Evaluates false
VALUES:
     y = [2,3,4,5,6]

s = [9]

r = [2,3,4,5,6]

o = [0]
               = [8]
     n
               = [1]
                = [7]
     e
     d
               = [2,3,4,5,6]
     c5
               = [0]
     c4
               = [1]

\begin{array}{cccc}
c4 & = & [1] \\
c3 & = & [0] \\
c2 & = & [1] \\
c1 & = & [0,1] \\
c0 & = & [0]
\end{array}

CONSTRAINTS:
     [0,d,7]=[y,10*c1]
     [c1,8,r]=[7,10*1]
     [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
     7=7->[-1*8,8*1]=0
DEMONS:
     c1 : c1=0->[d,7]<10
c1 : c1=1->[d,7]>9
Selected constraint: 7=7->[-1*8,8*1]=0
Evaluating equation: 7=7
Evaluates true
Evaluating equation: [-1*8,8*1]=0
Evaluates true
______
VALUES:
          = [2,3,4,5,6]
= [9]
     У
     S
              = [2,3,4,5,6]
     r
               = [0]
     0
               = [8]
     n
              = [1]
     m
               = [7]
     e
             = [2,3,4,5,6]
= [0]
     d
     c5
```

```
c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

# DEMONS:

c1 : c1=0->[d,7]<10 c1 : c1=1->[d,7]>9

```
Selected constraint: [c1,8,r]=[7,10*1]
Tightening possibilities for: c1
Solving [c1,8,r]=[7,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [3,4,5,6,7]
Old possibilities were: [0,1]
New possibilities are:
OVERCONSTRAINT: c1 has no values. Backtracking.
_____
VALUES:
         = [2,3,4,5,6]
= [9]
    У
    S
            = [2,3,4,5,6]
            = [0]
            = [8]
            = [1]
            = [7]
           = [2,3,4,5,6]
    d
    c5
            = [0]
          = [1]
= [0]
= [1]
= [0,1]
    c4
    c3
    c2
    c1
          = [0]
    c0
CONSTRAINTS:
    [0,d,7]=[y,10*c1]
    [c1,8,r]=[7,10*1]
    [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
DEMONS:
    c1 : c1=0->[d,7]<10
c1 : c1=1->[d,7]>9
```

```
Selected constraint: [c1,8,r]=[7,10*1]
Tightening possibilities for: c1
Solving [c1,8,r]=[7,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [3,4,5,6,7]
Old possibilities were: [0,1]
New possibilities are:
OVERCONSTRAINT: c1 has no values. Backtracking.
_____
VALUES:
          = [2,3,4,5,6]
= [9]
= [2,3,4,5,6]
    У
    S
             = [0]
             = [8]
             = [1]
    m
             = [7]
            = [2,3,4,5,6]
    d
    c5
             = [0]
           = [1]
= [0]
= [1]
= [0,1]
    c4
    c3
    c2
    c1
           = [0]
    c0
CONSTRAINTS:
    [0,d,7]=[y,10*c1]
    [c1,8,r]=[7,10*1]
    [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
    7=2->[-1*8,3*1]=0
    7=3->[-1*8,4*1]=0
    7=4->[-1*8,5*1]=0
    7=5->[-1*8,6*1]=0
    7=6->[-1*8,7*1]=0
    7=7->[-1*8,8*1]=0
DEMONS:
    c1 : c1=0\rightarrow [d,7]<10
c1 : c1=1\rightarrow [d,7]>9
```

```
Selected constraint: 7=2->[-1*8,3*1]=0
Evaluating equation: 7=2
Evaluates false
VALUES:
           = [2,3,4,5,6]
= [9]
    У
    S
            = [2,3,4,5,6]
    r
              = [0]
    0
              = [8]
    n
               = [1]
               = [7]
    e
    d
              = [2,3,4,5,6]
    c5
              = [0]
    c4
              = [1]
    c3
              = [0]
              = [1]
    c2
          = [0,1]
= [0]
    c1
    с0
CONSTRAINTS:
     [0,d,7]=[y,10*c1]
    [c1,8,r]=[7,10*1]
     [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
    7=3 \rightarrow [-1*8, 4*1]=0
    7=4->[-1*8,5*1]=0
    7=5 - [-1*8, 6*1] = 0
    7=6->[-1*8,7*1]=0
    7=7->[-1*8,8*1]=0
DEMONS:
    c1 : c1=0 \rightarrow [d,7]<10
```

c1 : c1=1->[d,7]>9

```
Selected constraint: 7=3->[-1*8,4*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [2,3,4,5,6]

s = [9]

r = [2,3,4,5,6]

o = [0]

n = [8]

m = [1]

e = [7]

d = [2,3,4,5,6]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

## DEMONS:

c1 :  $c1=0\rightarrow [d,7]<10$ c1 :  $c1=1\rightarrow [d,7]>9$ 

```
Selected constraint: 7=4->[-1*8,5*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [2,3,4,5,6]

s = [9]

r = [2,3,4,5,6]

o = [0]

n = [8]

m = [1]

e = [7]

d = [2,3,4,5,6]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

## **DEMONS:**

c1 : c1=0->[d,7]<10c1 : c1=1->[d,7]>9

- · · -

```
Selected constraint: 7=5 \rightarrow [-1*8,6*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [2,3,4,5,6]

s = [9]

r = [2,3,4,5,6]

o = [0]

n = [8]

m = [1]

e = [7]

d = [2,3,4,5,6]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

## **DEMONS:**

c1 :  $c1=0\rightarrow[d,7]<10$ c1 :  $c1=1\rightarrow[d,7]>9$ 

```
Selected constraint: 7=6 \rightarrow [-1*8, 7*1]=0
```

Evaluates false

```
VALUES:
```

```
y = [2,3,4,5,6]

s = [9]

r = [2,3,4,5,6]

o = [0]
n
           = [8]
           = [1]
e
            = [7]
d
          = [2,3,4,5,6]
c5
          = [0]
```

= [1] c4  $\begin{array}{cccc}
c4 & = & [1] \\
c3 & = & [0] \\
c2 & = & [1] \\
c1 & = & [0,1] \\
c0 & = & [0]
\end{array}$ 

## CONSTRAINTS:

# DEMONS:

c1 : c1=0->[d,7]<10c1 : c1=1->[d,7]>9

```
Selected constraint: 7=7->[-1*8,8*1]=0
```

Evaluates true

Evaluating equation: [-1\*8,8\*1]=0

Evaluates true

\_\_\_\_\_

```
VALUES:
    y = [2,3,4,5,6]

s = [9]
            = [2,3,4,5,6]
            = [0]
            = [8]
    n
            = [1]
    e
            = [7]
           = [2,3,4,5,6]
    d
    c5
            = [0]
    c4
            = [1]
          = [0]
= [1]
= [0,1]
    c3
    c2
    c1
    c0
            = [0]
```

## CONSTRAINTS:

```
[0,d,7]=[y,10*c1]
[c1,8,r]=[7,10*1]
[9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
```

#### DEMONS:

c1 : c1=0->[d,7]<10 c1 : c1=1->[d,7]>9

```
Selected constraint: [c1,8,r]=[7,10*1]
Tightening possibilities for: c1
Solving [c1,8,r]=[7,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [3,4,5,6,7]
Old possibilities were: [0,1]
New possibilities are:
OVERCONSTRAINT: c1 has no values. Backtracking.
_____
VALUES:
         = [2,3,4,5,6]
= [9]
    У
    S
            = [2,3,4,5,6]
            = [0]
            = [8]
            = [1]
            = [7]
           = [2,3,4,5,6]
    d
    c5
            = [0]
          = [1]
= [0]
= [1]
= [0,1]
    c4
    c3
    c2
    c1
          = [0]
    c0
CONSTRAINTS:
    [0,d,7]=[y,10*c1]
    [c1,8,r]=[7,10*1]
    [9000*1,900*0,90*8,y]=[1000*9,91*7,d,10*r]
DEMONS:
    c1 : c1=0->[d,7]<10
c1 : c1=1->[d,7]>9
```

```
Selected constraint: [c1,8,r]=[7,10*1]
Tightening possibilities for: c1
Solving [c1,8,r]=[7,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [3,4,5,6,7]
Old possibilities were: [0,1]
New possibilities are:
                                  OVERCONSTRAINT: c1 has no values. Backtracking.
_____
VALUES:
              = [2,3,4,5,6,7,8]
= [9]
     У
     S
               = [2,3,4,5,6,7,8]
               = [0]
               = [3,4,5,6,7,8]
                = [1]
               = [2,3,4,5,6,7]
     d
               = [2,3,4,5,6,7,8]
     c5
               = [0]
               = [1]
     c4
     c3
               = [0]
               = [1]
     c2
     c1
               = [0,1]
     c0
              = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     1=1->[-1*n,1*1,1*e]=0
     e=2->[-1*n,3*1]=0
     e=3->[-1*n,4*1]=0
     e=4->[-1*n,5*1]=0
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
DEMONS:
     \begin{array}{lll} \text{c1} & & \text{c1=0}\text{-}\text{>}[\text{d},\text{e}]\text{<}10 \\ \text{c1} & & \text{c1=1-}\text{>}[\text{d},\text{e}]\text{>}9 \\ \text{e} & & \text{[1,e,0]=[n,10*0]} \end{array}
     n: [1,e,0]=[n,10*0]
```

```
Selected constraint: 1=1->[-1*n,1*1,1*e]=0
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: e
Solving [-1*n,1*1,1*e]=0 for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [2,3,4,5,6,7]
Old possibilities were: [2,3,4,5,6,7]
New possibilities are:
                               [2,3,4,5,6,7]
Tightening possibilities for: n
Solving [-1*n,1*1,1*e]=0 for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [3,4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [3,4,5,6,7,8]
VALUES:
              = [2,3,4,5,6,7,8]
    У
              = [9]
    S
              = [2,3,4,5,6,7,8]
    r
              = [0]
    0
               = [3,4,5,6,7,8]
    n
    m
              = [1]
    e
               = [2,3,4,5,6,7]
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
               = [1]
    c4
    c3
               = [0]
    c2
               = [1]
    c1
               = [0,1]
    с0
               = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
     \lceil 9000*1,900*0,90*n,y \rceil = \lceil 1000*9,91*e,d,10*r \rceil
    e=2->[-1*n,3*1]=0
    e=3->[-1*n,4*1]=0
    e=4->[-1*n,5*1]=0
    e=5->[-1*n,6*1]=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
                c1=0->\lceil d,e\rceil<10
    c1 :
                c1=1->[d,e]>9
    c1 :
                 [1,e,0]=[n,10*0]
    e :
                 [1,e,0]=[n,10*0]
    n:
```

```
Selected constraint: e=2->[-1*n,3*1]=0
Tightening possibilities for: e
Solving e=2 for e
e = [2.0*1]
Constraint gives possibilities: [2]
Old possibilities were: [2,3,4,5,6,7]
New possibilities are:
                              [2]
e is now unique. Removing its value 2 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,2,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 3*1 \rceil = 0 for n
n=[3.0*1]
Constraint gives possibilities: [3]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are:
                              [3]
n is now unique. Removing its value 3 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,2,0]=[3,10*0]
-----
VALUES:
           = [4,5,6,7,8]
= [9]
    У
    S
             = [4,5,6,7,8]
             = [0]
    0
    n
             = [3]
             = [1]
    m
             = [2]
    e
    d
             = [4,5,6,7,8]
    c5
             = [0]
    c4
              = [1]
    c3
             = [0]
    c2
             = [1]
    c1
             = [0,1]
    c0
               = [0]
CONSTRAINTS:
    [1,2,0]=[3,10*0]
    [1,2,0]=[3,10*0]
    [0,d,2]=[y,10*c1]
    [c1,3,r]=[2,10*1]
    [9000*1,900*0,90*3,y]=[1000*9,91*2,d,10*r]
    2=3->[-1*3,4*1]=0
    2=4->[-1*3,5*1]=0
    2=5->[-1*3,6*1]=0
    2=6 \rightarrow [-1*3,7*1]=0
    2=7->[-1*3,8*1]=0
```

DEMONS:

c1 : c1=0->[d,2]<10 c1 : c1=1->[d,2]>9

```
Selected constraint: [1,2,0]=[3,10*0]
Evaluating equation: [1,2,0]=[3,10*0]
Evaluates true
VALUES:
          = [4,5,6,7,8]
= [9]
    У
    S
           = [4,5,6,7,8]
    r
             = [0]
    0
             = [3]
    n
              = [1]
              = [2]
    e
    d
              = [4,5,6,7,8]
    c5
             = [0]
    c4
             = [1]
    c3
             = [0]
             = [1]
    c2
          = [0,1]
= [0]
    c1
    с0
CONSTRAINTS:
    [0,d,2]=[y,10*c1]
    [c1,3,r]=[2,10*1]
    [9000*1,900*0,90*3,y]=[1000*9,91*2,d,10*r]
    2=3->[-1*3,4*1]=0
    2=4->[-1*3,5*1]=0
    2=5->[-1*3,6*1]=0
    2=6->[-1*3,7*1]=0
    2=7->[-1*3,8*1]=0
DEMONS:
    c1 : c1=0->[d,2]<10
```

c1: c1=1->[d,2]>9

```
Selected constraint: 2=3->[-1*3,4*1]=0
Evaluating equation: 2=3
Evaluates false
```

-----

# VALUES:

```
y = [4,5,6,7,8]

s = [9]

r = [4,5,6,7,8]

o = [0]

n = [3]

m = [1]

e = [2]

d = [4,5,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

## DEMONS:

c1 :  $c1=0 \rightarrow [d,2]<10$ c1 :  $c1=1 \rightarrow [d,2]>9$ 

```
Selected constraint: 2=4->[-1*3,5*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [4,5,6,7,8]

s = [9]

r = [4,5,6,7,8]

o = [0]

n = [3]

m = [1]

e = [2]

d = [4,5,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c0 = [0,1]
```

## CONSTRAINTS:

## **DEMONS:**

c1 : c1=0->[d,2]<10 c1 : c1=1->[d,2]>9

- / -

```
Selected constraint: 2=5 \rightarrow [-1*3,6*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [4,5,6,7,8]

s = [9]

r = [4,5,6,7,8]

o = [0]

n = [3]

m = [1]

e = [2]

d = [4,5,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

#### DEMONS:

c1 : c1=0->[d,2]<10 c1 : c1=1->[d,2]>9

```
Selected constraint: 2=6 \rightarrow [-1*3,7*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [4,5,6,7,8]

s = [9]

r = [4,5,6,7,8]

o = [0]

n = [3]

m = [1]

e = [2]

d = [4,5,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

#### DEMONS:

c1 :  $c1=0 \rightarrow [d,2]<10$ c1 :  $c1=1 \rightarrow [d,2]>9$ 

```
Selected constraint: 2=7->[-1*3,8*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [4,5,6,7,8]
s = [9]
r = [4,5,6,7,8]
o = [0]
n = [3]
m = [1]
e = [2]
d = [4,5,6,7,8]
c5 = [0]
c4 = [1]
c3 = [0]
c2 = [1]
c1 = [0,1]
c0 = [0]
```

## CONSTRAINTS:

```
[0,d,2]=[y,10*c1]
[c1,3,r]=[2,10*1]
[9000*1,900*0,90*3,y]=[1000*9,91*2,d,10*r]
```

## **DEMONS:**

c1 :  $c1=0 \rightarrow [d,2]<10$ c1 :  $c1=1 \rightarrow [d,2]>9$ 

- */* -

```
Selected constraint: [c1,3,r]=[2,10*1]
Tightening possibilities for: c1
Solving [c1,3,r]=[2,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [1,2,3,4,5]
Old possibilities were: [0,1]
New possibilities are:
                                 [1]
Values have changed. Checking demons
Moving demon to constraint list: 1=0->[d,2]<10
Moving demon to constraint list: 1=1->[d,2]>9
Tightening possibilities for: r
Solving [c1,3,r]=[2,10*1] for r
r=[9.0*1,-1.0*c1]
Constraint gives possibilities: [8]
Old possibilities were: [4,5,6,7,8]
New possibilities are: [8]
r is now unique. Removing its value 8 from others
Values have changed. Checking demons
VALUES:
            = [0]

= [1]

= [1]

= [0]

= [1]

= [0]

= [4,5,6,7]

= [2]
     c0
     c1
     c2
     c3
     c4
     c5
     d
     e
               = [1]
     m
               = [3]
     n
            = [0]
= [8]
= [9]
= [4,5,6,7]
     0
     r
     У
CONSTRAINTS:
     1=1->[d,2]>9
     1=0 \rightarrow [d, 2] < 10
     [0,d,2]=[y,10*1]
     [9000*1,900*0,90*3,y]=[1000*9,91*2,d,10*8]
DEMONS:
```

```
Selected constraint: 1=1->[d,2]>9
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: d
Solving [d,2]>9 for d
d>[7.0*1]
Constraint gives possibilities: [7]
Old possibilities were: [4,5,6,7] New possibilities are: []
OVERCONSTRAINT: d has no values. Backtracking.
_____
VALUES:
    c0
            = [0]
            = [1]
    c1
            = [1]
    c2
            = [0]
    c3
            = [1]
    c4
    c5
            = [0]
    d
            = [4,5,6,7]
            = [2]
    e
            = [1]
    m
    n
            = [3]
            = [0]
    0
    r
            = [8]
    S
            = [9]
           = [4,5,6,7]
    У
CONSTRAINTS:
    1=0 \rightarrow [d, 2] < 10
    [0,d,2]=[y,10*1]
    [9000*1,900*0,90*3,y]=[1000*9,91*2,d,10*8]
```

**DEMONS:** 

```
Selected constraint: 1=0 \rightarrow [d,2]<10
```

Evaluates false

-----

```
VALUES:
         = [0]
= [1]
    c0
    c1
    c2
             = [1]
    c3
             = [0]
    c4
             = [1]
    c5
             = [0]
    d
             = [4,5,6,7]
    e
             = [2]
    m
             = [1]
             = [3]
    o = [0]
r = [8]
s = [9]
y = [4,5,6,7]
```

# CONSTRAINTS:

```
[0,d,2]=[y,10*1]
[9000*1,900*0,90*3,y]=[1000*9,91*2,d,10*8]
```

#### **DEMONS:**

```
Selected constraint: [0,d,2]=[y,10*1]
Tightening possibilities for: d
Solving [0,d,2]=[y,10*1] for d
d=[8.0*1,1.0*y]
Constraint gives possibilities: [12,13,14,15]
Old possibilities were: [4,5,6,7]
New possibilities are:
                              OVERCONSTRAINT: d has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==2
_____
VALUES:
              = [2,3,4,5,6,7,8]
    У
             = [9]
    S
    r
             = [2,3,4,5,6,7,8]
             = [0]
              = [3,4,5,6,7,8]
             = [1]
              = [2,3,4,5,6,7]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
              = [1]
    c4
              = [0]
    c3
    c2
             = [1]
            = [0,1]
    c1
    c0
             = [0]
CONSTRAINTS:
    e\==2
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*1]
    \lceil 9000*1,900*0,90*n,y \rceil = \lceil 1000*9,91*e,d,10*r \rceil
    e=3->[-1*n,4*1]=0
    e=4->[-1*n,5*1]=0
    e=5->\Gamma-1*n.6*17=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
            c1=0->[d,e]<10
    c1 :
    c1 :
              c1=1->\lceil d,e\rceil>9
              [1,e,0]=[n,10*0]
    e :
    n: [1,e,0]=[n,10*0]
```

```
Selected constraint: e\==2
Tightening possibilities for: e
Solving e = 2 for e
e\==[2.0*1]
Constraint gives possibilities: [2]
Old possibilities were:
                              [2,3,4,5,6,7]
New possibilities are:
                               [3,4,5,6,7]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
_____
VALUES:
               = [2,3,4,5,6,7,8]
    У
               = [9]
    S
    r
               = [2,3,4,5,6,7,8]
               = [0]
               = [3,4,5,6,7,8]
               = [1]
               = [3,4,5,6,7]
    e
    d
               = [2,3,4,5,6,7,8]
    c5
               = [0]
               = [1]
    c4
               = [0]
    c3
    c2
               = [1]
    c1
               = [0,1]
    c0
               = [0]
CONSTRAINTS:
    [1,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=3->[-1*n,4*1]=0
    e=4->[-1*n,5*1]=0
    e=5->\Gamma-1*n.6*17=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
               [1,e,0]=[n,10*0]
    n :
               c1=1->[d,e]>9
    c1 :
               c1=0->[d,e]<10
    c1 :
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [2,3,4,5,6,7]
Old possibilities were: [3,4,5,6,7]
New possibilities are: [3,4,5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [4,5,6,7,8]
Old possibilities were: [3,4,5,6,7,8]
New possibilities are: [4,5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
VALUES:
            = [2,3,4,5,6,7,8]
     У
             = [9]
= [2,3,4,5,6,7,8]
     S
              = [0]
     0
             = [4,5,6,7,8]
     n
     m
              = [1]
     e
              = [3,4,5,6,7]
     d
              = [2,3,4,5,6,7,8]
     c5
              = [0]
              = [1]
     c4
     c3
              = [0]
              = [1]
     c2
     c1
              = [0,1]
     c0
               = [0]
CONSTRAINTS:
     [1,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*1 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=3->[-1*n,4*1]=0
     e=4->[-1*n,5*1]=0
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
DEMONS:
     c1 : c1=0->\lceil d,e\rceil<10
     c1 : c1=1->[d,e]>9
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [3,4,5,6,7]
Old possibilities were:
                                  [3,4,5,6,7]
New possibilities are:
                                  [3,4,5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [4,5,6,7,8]
Old possibilities were:
                                 [4,5,6,7,8]
New possibilities are:
                                  [4,5,6,7,8]
Constraint: [1,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 1,3,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=3->[-1*n,4*1]=0
Solving \lceil 1,4,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=4->[-1*n,5*1]=0
Solving [1,5,0]=[n,10*0] for 0
Made new conditional constraint: e=5->[-1*n,6*1]=0
Solving [1,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,7*1]=0
Solving [1,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n.8*1]=0
Made new demons: [[e,[1,e,0]=[n,10*0]],[n,[1,e,0]=[n,10*0]]]
VALUES:
               = [2,3,4,5,6,7,8]
     У
                = [9]
     S
                = [2,3,4,5,6,7,8]
                = [0]
     0
                = [4,5,6,7,8]
     n
                = [1]
     m
                 = [3,4,5,6,7]
     e
     d
                 = [2,3,4,5,6,7,8]
     c5
                = [0]
                = [1]
     c4
     c3
                = [0]
     c2
                 = [1]
                = [0,1]
     c1
     с0
                 = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*1 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=3->[-1*n,4*1]=0
     e=4->[-1*n,5*1]=0
```

```
e=5->[-1*n,6*1]=0
e=6->[-1*n,7*1]=0
e=7->[-1*n,8*1]=0
```

# DEMONS:

c1 :  $c1=0 \rightarrow [d,e]<10$ c1 :  $c1=1 \rightarrow [d,e]>9$ e : [1,e,0]=[n,10\*0]n : [1,e,0]=[n,10\*0]

```
Selected constraint: e=3->[-1*n,4*1]=0
Tightening possibilities for: e
Solving e=3 for e
e = [3.0*1]
Constraint gives possibilities: [3]
Old possibilities were: [3,4,5,6,7]
New possibilities are:
                             [3]
e is now unique. Removing its value 3 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,3,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 4*1 \rceil = 0 for n
n=[4.0*1]
Constraint gives possibilities: [4]
Old possibilities were: [4,5,6,7,8]
New possibilities are:
                             [4]
n is now unique. Removing its value 4 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,3,0]=[4,10*0]
_____
VALUES:
           = [2,5,6,7,8]
= [9]
= [2,5,6,7,8]
    y
    S
             = [0]
    0
    n
             = [4]
             = [1]
    m
             = [3]
    e
    d
             = [2,5,6,7,8]
    c5
             = [0]
    c4
             = [1]
    c3
             = [0]
    c2
             = [1]
    c1
             = [0,1]
    c0
              = [0]
CONSTRAINTS:
    [1,3,0]=[4,10*0]
    [1,3,0]=[4,10*0]
    [0,d,3]=[y,10*c1]
    [c1,4,r]=[3,10*1]
    [9000*1,900*0,90*4,y] = [1000*9,91*3,d,10*r]
    3=4->[-1*4,5*1]=0
    3=5->[-1*4,6*1]=0
    3=6->[-1*4,7*1]=0
    3=7->[-1*4,8*1]=0
```

**DEMONS:** 

c1 :  $c1=0 \rightarrow [d,3]<10$ c1 :  $c1=1 \rightarrow [d,3]>9$ 

·

```
Selected constraint: [1,3,0]=[4,10*0]
Evaluating equation: [1,3,0]=[4,10*0]
```

Evaluates true

-----

# VALUES:

```
y = [2,5,6,7,8]

s = [9]

r = [2,5,6,7,8]

o = [0]

n = [4]

m = [1]

e = [3]

d = [2,5,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

## DEMONS:

c1 :  $c1=0 \rightarrow [d,3]<10$ c1 :  $c1=1 \rightarrow [d,3]>9$ 

```
Selected constraint: 3=4->[-1*4,5*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [2,5,6,7,8]

s = [9]

r = [2,5,6,7,8]

o = [0]

n = [4]

m = [1]

e = [3]

d = [2,5,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

## CONSTRAINTS:

## **DEMONS:**

c1 : c1=0->[d,3]<10 c1 : c1=1->[d,3]>9

- · · -

```
Selected constraint: 3=5 - [-1*4, 6*1] = 0
```

Evaluates false

-----

```
VALUES:
```

## CONSTRAINTS:

#### DEMONS:

c1 : c1=0->[d,3]<10 c1 : c1=1->[d,3]>9

```
Selected constraint: 3=6 \rightarrow [-1*4,7*1]=0
```

Evaluates false

```
VALUES:
```

```
y = [2,5,6,7,8]
s = [9]
r = [2,5,6,7,8]
o = [0]
n
              = [4]
```

= [1] e = [3]

d = [2,5,6,7,8]c5 = [0]

= [1] c4  $\begin{array}{cccc} c4 & = & [1] \\ c3 & = & [0] \\ c2 & = & [1] \\ c1 & = & [0,1] \\ c0 & = & [0] \end{array}$ 

## CONSTRAINTS:

#### DEMONS:

c1 :  $c1=0 \rightarrow [d,3]<10$ c1 :  $c1=1 \rightarrow [d,3]>9$ 

```
Selected constraint: 3=7->[-1*4,8*1]=0
```

Evaluates false

-----

```
VALUES:

y = [2,5,6,7,8]

s = [9]

r = [2,5,6,7,8]

o = [0]
```

$$\begin{array}{ll} n & = [4] \\ m & = [1] \end{array}$$

d = 
$$[2,5,6,7,8]$$
  
c5 =  $[0]$ 

$$\begin{array}{cccc} c4 & = & [1] \\ c3 & = & [0] \\ c2 & = & [1] \\ c1 & = & [0,1] \\ c0 & = & [0] \end{array}$$

# CONSTRAINTS:

## **DEMONS:**

c1 :  $c1=0 \rightarrow [d,3]<10$ c1 :  $c1=1 \rightarrow [d,3]>9$ 

- */* -

```
Selected constraint: [c1,4,r]=[3,10*1]
Tightening possibilities for: c1
Solving [c1,4,r]=[3,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [1,2,3,4,7]
Old possibilities were: [0,1]
New possibilities are:
                                 [1]
Values have changed. Checking demons
Moving demon to constraint list: 1=0->[d,3]<10
Moving demon to constraint list: 1=1->[d,3]>9
Tightening possibilities for: r
Solving [c1,4,r]=[3,10*1] for r
r=[9.0*1,-1.0*c1]
Constraint gives possibilities: [8]
Old possibilities were: [2,5,6,7,8]
New possibilities are: [8]
r is now unique. Removing its value 8 from others
Values have changed. Checking demons
VALUES:
            = [0]

= [1]

= [1]

= [0]

= [1]

= [0]

= [2,5,6,7]

= [3]
     c0
     c1
     c2
     c3
     c4
     c5
     d
     e
               = [1]
     m
             = [4]
     n
            = [4]
= [0]
= [8]
= [9]
= [2,5,6,7]
     0
     r
     У
CONSTRAINTS:
     1=1->[d,3]>9
     1=0 \rightarrow [d,3]<10
     [0,d,3]=[y,10*1]
     [9000*1,900*0,90*4,y]=[1000*9,91*3,d,10*8]
DEMONS:
```

```
Selected constraint: 1=1->[d,3]>9
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: d
Solving [d,3]>9 for d
d > [6.0*1]
Constraint gives possibilities: [6]
Old possibilities were: [2,5,6,7]
New possibilities are:
                             [7]
d is now unique. Removing its value 7 from others
Values have changed. Checking demons
VALUES:
           = [2,5,6]
    y
             = [9]
    S
             = [8]
             = [0]
             = [4]
    n
             = [1]
    m
             = [3]
    e
    d
              = [7]
             = [0]
    c5
             = [1]
    c4
    c3
             = [0]
    c2
             = [1]
    c1
             = [1]
    c0
          = [0]
CONSTRAINTS:
    1=0 \rightarrow [7,3] < 10
    [0,7,3]=[y,10*1]
    [9000*1,900*0,90*4,y]=[1000*9,91*3,7,10*8]
```

**DEMONS:** 

```
Selected constraint: 1=0->[7,3]<10
```

Evaluates false

-----

# VALUES:

```
y = [2,5,6]
s = [9]
r = [8]
         = [0]
0
n
         = [4]
         = [1]
e
          = [3]
d
          = [7]
c5
         = [0]
c4
         = [1]
       = [0]
= [1]
c3
c2
c1 = [1]

c0 = [0]
```

## CONSTRAINTS:

```
[0,7,3]=[y,10*1]
[9000*1,900*0,90*4,y]=[1000*9,91*3,7,10*8]
```

#### DEMONS:

```
Selected constraint: [0,7,3]=[y,10*1]
Tightening possibilities for: y
Solving [0,7,3]=[y,10*1] for y
y=[0.0*1]
Constraint gives possibilities: []
Old possibilities were: [2,5,6]
New possibilities are:
OVERCONSTRAINT: y has no values. Backtracking.
_____
VALUES:
           = [0]
    c0
    c1
           = [1]
    c2
            = [1]
    c3
            = [0]
            = [1]
    c4
    c5
            = [0]
    d
           = [2,5,6,7]
            = [3]
    e
            = [1]
    m
           = [4]
    n
          = [0]
= [8]
    0
    r
    S
            = [9]
         = [2,5,6,7]
CONSTRAINTS:
    1=0 \rightarrow [d,3]<10
    [0,d,3]=[y,10*1]
    [9000*1,900*0,90*4,y]=[1000*9,91*3,d,10*8]
DEMONS:
```

```
Selected constraint: 1=0 \rightarrow [d,3]<10
```

Evaluates false

-----

```
VALUES:
          = [0]
= [1]
    c0
    c1
    c2
              = [1]
              = [0]
    c3
    c4
              = [1]
    c5
              = [0]
    d
              = [2,5,6,7]
              = [3]
    e
              = [1]
    m
              = [4]
    n = [4]
o = [0]
r = [8]
s = [9]
y = [2,5,6,7]
```

## CONSTRAINTS:

```
[0,d,3]=[y,10*1]
[9000*1,900*0,90*4,y]=[1000*9,91*3,d,10*8]
```

#### **DEMONS:**

```
Selected constraint: [0,d,3]=[y,10*1]
Tightening possibilities for: d
Solving [0,d,3]=[y,10*1] for d
d=[7.0*1,1.0*y]
Constraint gives possibilities: [9,12,13,14]
Old possibilities were: [2,5,6,7]
New possibilities are:
                                OVERCONSTRAINT: d has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==3
VALUES:
                = [2,3,4,5,6,7,8]
     У
              = [9]
     S
     r
               = [2,3,4,5,6,7,8]
               = [0]
                = [4,5,6,7,8]
               = [1]
                = [3,4,5,6,7]
     e
     d
               = [2,3,4,5,6,7,8]
                = [0]
     c5
                = [1]
     c4
                = [0]
     c3
     c2
               = [1]
     c1
               = [0,1]
     c0
                = [0]
CONSTRAINTS:
     e\==3
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
     \lceil 9000*1,900*0,90*n,y \rceil = \lceil 1000*9,91*e,d,10*r \rceil
     e=4->[-1*n,5*1]=0
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
DEMONS:
                 c1=0->[d,e]<10
     c1 :
               c1=1->[d,e]>9
     c1 :
                [1,e,0]=[n,10*0]
     e :
                 [1,e,0]=[n,10*0]
     n :
```

```
Selected constraint: e\==3
Tightening possibilities for: e
Solving e = 3 for e
e\==[3.0*1]
Constraint gives possibilities: [3]
Old possibilities were: [3,4,5,6,7]
New possibilities are:
                              [4,5,6,7]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
_____
VALUES:
               = [2,3,4,5,6,7,8]
    У
             = [9]
    S
    r
             = [2,3,4,5,6,7,8]
             = [0]
              = [4,5,6,7,8]
    n
             = [1]
              = [4,5,6,7]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
               = [1]
    c4
              = [0]
    c3
             = [1]
    c2
             = [0,1]
    c1
    c0
             = [0]
CONSTRAINTS:
    [1,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*1]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=4->[-1*n,5*1]=0
    e=5->[-1*n,6*1]=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
             [1,e,0]=[n,10*0]
c1=1->[d,e]>9
c1=0->[d,e]<10
    n:
    c1 :
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [3,4,5,6,7]
Old possibilities were: [4,5,6,7]
New possibilities are:
                                  [4,5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [5,6,7,8]
Old possibilities were: [4,5,6,7,8]
New possibilities are: [5,6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
VALUES:
            = [2,3,4,5,6,7,8]
= [9]
= [2,3,4,5,6,7,8]
= [0]
= [5,6,7,8]
= [1]
     У
     S
     0
     n
     m
     e
              = [4,5,6,7]
     d
               = [2,3,4,5,6,7,8]
     c5
               = [0]
               = [1]
     c4
     c3
              = [0]
               = [1]
     c2
              = [0,1]
     c1
           = [0]
     c0
CONSTRAINTS:
     [1,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*1 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=4->[-1*n,5*1]=0
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
DEMONS:
                c1=0->[d,e]<10
     c1 :
     c1 : c1=1->\lceil d,e \rceil>9
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [4,5,6,7]
Old possibilities were: [4,5,6,7]
New possibilities are:
                                  [4,5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [5,6,7,8]
Old possibilities were: [5,6,7,8]
New possibilities are: [5,6,7,8]
Constraint: [1,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 1,4,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=4->[-1*n,5*1]=0
Solving \lceil 1,5,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=5->[-1*n,6*1]=0
Solving [1,6,0]=[n,10*0] for 0
Made new conditional constraint: e=6->[-1*n,7*1]=0
Solving [1,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,8*1]=0
Made new demons: [[e,[1,e,0]=[n,10*0]],[n,[1,e,0]=[n,10*0]]]
VALUES:
     У
               = [2,3,4,5,6,7,8]
               = [9]
     S
               = [2,3,4,5,6,7,8]
               = [0]
     0
               = [5,6,7,8]
     n
                = [1]
     m
                = [4,5,6,7]
     e
                = [2,3,4,5,6,7,8]
     d
     c5
                = [0]
     c4
                 = [1]
     c3
                = [0]
                = [1]
     c2
                = [0,1]
     c1
                = [0]
     с0
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=4->[-1*n,5*1]=0
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
```

```
DEMONS:
```

c1 :  $c1=0 \rightarrow [d,e]<10$ c1 :  $c1=1 \rightarrow [d,e]>9$ e : [1,e,0]=[n,10\*0]n : [1,e,0]=[n,10\*0]

```
Selected constraint: e=4->[-1*n,5*1]=0
Tightening possibilities for: e
Solving e=4 for e
e = [4.0*1]
Constraint gives possibilities: [4]
Old possibilities were: [4,5,6,7]
New possibilities are:
                             [4]
e is now unique. Removing its value 4 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,4,0]=[n,10*0]
Tightening possibilities for: n
Solving [-1*n,5*1]=0 for n
n=[5.0*1]
Constraint gives possibilities: [5]
Old possibilities were: [5,6,7,8]
New possibilities are:
                              [5]
n is now unique. Removing its value 5 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,4,0]=[5,10*0]
_____
VALUES:
           = [2,3,6,7,8]
= [9]
    У
    S
             = [2,3,6,7,8]
             = [0]
    0
    n
             = [5]
             = [1]
    m
             = [4]
    e
    d
             = [2,3,6,7,8]
    c5
             = [0]
    c4
             = [1]
    c3
             = [0]
    c2
             = [1]
    c1
             = [0,1]
    c0
              = [0]
CONSTRAINTS:
    [1,4,0]=[5,10*0]
    [1,4,0]=[5,10*0]
    [0,d,4]=[y,10*c1]
    [c1,5,r]=[4,10*1]
    [9000*1,900*0,90*5,y]=[1000*9,91*4,d,10*r]
    4=5->[-1*5,6*1]=0
    4=6->[-1*5,7*1]=0
    4=7->[-1*5,8*1]=0
DEMONS:
    c1 : c1=0->\lceil d,4\rceil<10
```

c1 : c1=1->[d,4]>9

```
Selected constraint: [1,4,0]=[5,10*0]
Evaluating equation: [1,4,0]=[5,10*0]
```

Evaluates true

-----

# VALUES:

```
y = [2,3,6,7,8]

s = [9]

r = [2,3,6,7,8]

o = [0]

n = [5]

m = [1]

e = [4]

d = [2,3,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

### CONSTRAINTS:

### **DEMONS:**

c1 : c1=0->[d,4]<10c1 : c1=1->[d,4]>9

- · · -

```
Selected constraint: 4=5 \rightarrow [-1*5,6*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
\begin{array}{lll} y & = & [2,3,6,7,8] \\ s & = & [9] \\ r & = & [2,3,6,7,8] \\ o & = & [0] \\ n & = & [5] \\ m & = & [1] \\ e & = & [4] \\ d & = & [2,3,6,7,8] \\ c5 & = & [0] \\ c4 & = & [1] \\ c3 & = & [0] \\ c2 & = & [1] \\ c1 & = & [0,1] \\ c0 & = & [0] \end{array}
```

### CONSTRAINTS:

## DEMONS:

c1 :  $c1=0\rightarrow[d,4]<10$ c1 :  $c1=1\rightarrow[d,4]>9$ 

```
Selected constraint: 4=6 \rightarrow [-1*5, 7*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [2,3,6,7,8]

s = [9]

r = [2,3,6,7,8]

o = [0]

n = [5]

m = [1]

e = [4]

d = [2,3,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

### CONSTRAINTS:

## DEMONS:

c1 :  $c1=0 \rightarrow [d,4]<10$ c1 :  $c1=1 \rightarrow [d,4]>9$ 

```
Selected constraint: 4=7->[-1*5,8*1]=0
```

Evaluates false

-----

```
VALUES:
```

```
y = [2,3,6,7,8]

s = [9]

r = [2,3,6,7,8]

o = [0]

n = [5]

m = [1]

e = [4]

d = [2,3,6,7,8]

c5 = [0]

c4 = [1]

c3 = [0]

c2 = [1]

c1 = [0,1]

c0 = [0]
```

### CONSTRAINTS:

### **DEMONS:**

c1 :  $c1=0 \rightarrow [d,4]<10$ c1 :  $c1=1 \rightarrow [d,4]>9$ 

- / -

```
Selected constraint: [c1,5,r]=[4,10*1]
Tightening possibilities for: c1
Solving [c1,5,r]=[4,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [1,2,3,6,7]
Old possibilities were: [0,1]
New possibilities are:
                                 [1]
Values have changed. Checking demons
Moving demon to constraint list: 1=0->[d,4]<10
Moving demon to constraint list: 1=1->[d,4]>9
Tightening possibilities for: r
Solving [c1,5,r]=[4,10*1] for r
r=[9.0*1,-1.0*c1]
Constraint gives possibilities: [8]
Old possibilities were: [2,3,6,7,8]
New possibilities are: [8]
r is now unique. Removing its value 8 from others
Values have changed. Checking demons
VALUES:
            = [0]

= [1]

= [1]

= [0]

= [1]

= [0]

= [2,3,6,7]

= [4]
     c0
     c1
     c2
     c3
     c4
     c5
     d
     e
               = [1]
     m
               = [5]
     n
            = [0]
= [8]
= [9]
= [2,3,6,7]
     0
     r
     У
CONSTRAINTS:
     1=1->[d,4]>9
     1=0->[d,4]<10
     [0,d,4]=[y,10*1]
     [9000*1,900*0,90*5,y]=[1000*9,91*4,d,10*8]
DEMONS:
```

```
Selected constraint: 1=1->[d,4]>9
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: d
Solving [d,4]>9 for d
d>[5.0*1]
Constraint gives possibilities: [5]
Old possibilities were: [2,3,6,7]
New possibilities are:
                         [6,7]
Values have changed. Checking demons
-----
VALUES:
    c0
            = [0]
           = [1]
    c1
            = [1]
    c2
            = [0]
    c3
           = [1]
    c4
    c5
           = [0]
    d
            = [6,7]
           = [4]
    e
            = [1]
    m
    n
            = [5]
            = [0]
    0
    r
           = [8]
    S
           = [9]
          = [2,3,6,7]
    У
CONSTRAINTS:
    1=0 - > [d, 4] < 10
    [0,d,4]=[y,10*1]
    [9000*1,900*0,90*5,y]=[1000*9,91*4,d,10*8]
```

**DEMONS:** 

```
Selected constraint: 1=0->[d,4]<10
```

Evaluates false

-----

```
VALUES:
    c0 = [0]

c1 = [1]
     c2
              = [1]
     c3
              = [0]
     c4
              = [1]
     c5
              = [0]
     d
              = [6,7]
     e
              = [4]
     m
              = [1]
              = [5]
    n = [5]
o = [0]
r = [8]
s = [9]
y = [2,3,6,7]
```

## CONSTRAINTS:

```
[0,d,4]=[y,10*1]
[9000*1,900*0,90*5,y]=[1000*9,91*4,d,10*8]
```

#### **DEMONS:**

```
Selected constraint: [0,d,4]=[y,10*1]
Tightening possibilities for: d
Solving [0,d,4]=[y,10*1] for d
d=[6.0*1,1.0*y]
Constraint gives possibilities: [8,9,12,13]
Old possibilities were: [6,7]
New possibilities are:
OVERCONSTRAINT: d has no values. Backtracking.
______
VALUES:
          = [0]
= [1]
    c0
    c1
    c2
            = [1]
            = [0]
    c3
            = [1]
    c4
    c5
            = [0]
    d
            = [2,3,6,7]
            = [4]
    e
            = [1]
    m
           = [5]
    n
          = [0]
= [8]
    0
    r
    S
            = [9]
          = [2,3,6,7]
CONSTRAINTS:
    1=0 \rightarrow [d, 4] < 10
    [0,d,4]=[y,10*1]
    [9000*1,900*0,90*5,y]=[1000*9,91*4,d,10*8]
DEMONS:
```

```
Selected constraint: 1=0 \rightarrow [d,4]<10
```

Evaluates false

-----

```
VALUES:
    c0 = [0]

c1 = [1]
    c2
             = [1]
             = [0]
    c3
    c4
              = [1]
    c5
             = [0]
    d
             = [2,3,6,7]
             = [4]
    e
    m
              = [1]
             = [5]
    o = [0]
r = [8]
s = [9]
y = [2,3,6,7]
```

## CONSTRAINTS:

```
[0,d,4]=[y,10*1]
[9000*1,900*0,90*5,y]=[1000*9,91*4,d,10*8]
```

#### **DEMONS:**

```
Selected constraint: [0,d,4]=[y,10*1]
Tightening possibilities for: d
Solving [0,d,4]=[y,10*1] for d
d=[6.0*1,1.0*y]
Constraint gives possibilities: [8,9,12,13]
Old possibilities were: [2,3,6,7]
New possibilities are:
                             OVERCONSTRAINT: d has no values. Backtracking.
Conditional constraint failed, asserting negation: e\==4
_____
VALUES:
              = [2,3,4,5,6,7,8]
    У
             = [9]
    S
             = [2,3,4,5,6,7,8]
    r
             = [0]
              = [5,6,7,8]
             = [1]
              = [4,5,6,7]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
              = [1]
    c4
             = [0]
    c3
             = [1]
    c2
    c1
            = [0,1]
    c0
             = [0]
CONSTRAINTS:
    e\==4
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*1]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=5->[-1*n,6*1]=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
    c1 :
              c1=0->[d,e]<10
              c1=1->[d,e]>9
    c1 :
              [1,e,0]=[n,10*0]
    e :
              [1,e,0]=[n,10*0]
```

```
Selected constraint: e\==4
Tightening possibilities for: e
Solving e = 4 for e
e\==[4.0*1]
Constraint gives possibilities: [4]
Old possibilities were:
                         [4,5,6,7]
                              [5,6,7]
New possibilities are:
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
_____
VALUES:
               = [2,3,4,5,6,7,8]
    У
             = [9]
    S
    r
             = [2,3,4,5,6,7,8]
             = [0]
              = [5,6,7,8]
    n
             = [1]
              = [5,6,7]
    e
    d
             = [2,3,4,5,6,7,8]
    c5
              = [0]
    c4
              = [1]
              = [0]
    c3
              = [1]
    c2
              = [0,1]
    c1
    c0
              = [0]
CONSTRAINTS:
    [1,e,0]=[n,10*0]
    [0,d,e]=[y,10*c1]
    [c1,n,r]=[e,10*1]
    \lceil 9000*1, 900*0, 90*n, y \rceil = \lceil 1000*9, 91*e, d, 10*r \rceil
    e=5->[-1*n,6*1]=0
    e=6->[-1*n,7*1]=0
    e=7->[-1*n,8*1]=0
DEMONS:
              [1,e,0]=[n,10*0]
    n :
              c1=1->[d,e]>9
    c1 :
    c1 : c1=0 \rightarrow [d,e]<10
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n, -1.0*1]
Constraint gives possibilities: [4,5,6,7]
Old possibilities were: [5,6,7]
New possibilities are:
                                 [5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [6,7,8]
Old possibilities were: [5,6,7,8]
New possibilities are: [6,7,8]
Values have changed. Checking demons
Moving demon to constraint list: [1,e,0]=[n,10*0]
VALUES:
            = [2,3,4,5,6,7,8]
     У
              = [9]
     S
             = [2,3,4,5,6,7,8]
              = [0]
     0
            = [6,7,8]
     n
     m
              = [1]
     e
              = [5,6,7]
     d
              = [2,3,4,5,6,7,8]
     c5
              = [0]
                = [1]
     c4
     c3
              = [0]
              = [1]
     c2
     c1
              = [0,1]
     c0
                = [0]
CONSTRAINTS:
     [1,e,0]=[n,10*0]
     [0,d,e]=[y,10*c1]
     \lceil c1, n, r \rceil = \lceil e, 10*1 \rceil
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
DEMONS:
     c1 : c1=0->[d,e]<10
c1 : c1=1->[d,e]>9
```

```
Selected constraint: [1,e,0]=[n,10*0]
Tightening possibilities for: e
Solving [1,e,0]=[n,10*0] for e
e=[1.0*n,-1.0*1]
Constraint gives possibilities: [5,6,7]
Old possibilities were:
                                  [5,6,7]
New possibilities are:
                                  [5,6,7]
Tightening possibilities for: n
Solving [1,e,0]=[n,10*0] for n
n=[1.0*1,1.0*e]
Constraint gives possibilities: [6,7,8]
Old possibilities were:
                                  [6,7,8]
New possibilities are:
                                 [6,7,8]
Constraint: [1,e,0]=[n,10*0] caused no change. Making conditionals
Solving \lceil 1,5,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=5->[-1*n,6*1]=0
Solving \lceil 1,6,0 \rceil = \lceil n,10*0 \rceil for 0
Made new conditional constraint: e=6->[-1*n,7*1]=0
Solving [1,7,0]=[n,10*0] for 0
Made new conditional constraint: e=7->[-1*n,8*1]=0
Made new demons: [[e,[1,e,0]=[n,10*0]],[n,[1,e,0]=[n,10*0]]]
VALUES:
     У
                 = [2,3,4,5,6,7,8]
               = [9]
     S
               = [2,3,4,5,6,7,8]
                = [0]
     0
                = [6,7,8]
     n
                = [1]
     m
                = [5,6,7]
     e
     d
                = [2,3,4,5,6,7,8]
     c5
                = [0]
                 = [1]
     c4
     c3
                = [0]
     c2
                 = [1]
                = \lceil 0, 1 \rceil
     c1
     с0
                 = [0]
CONSTRAINTS:
     [0,d,e]=[y,10*c1]
     [c1,n,r]=[e,10*1]
     [9000*1,900*0,90*n,y]=[1000*9,91*e,d,10*r]
     e=5->[-1*n,6*1]=0
     e=6->[-1*n,7*1]=0
     e=7->[-1*n,8*1]=0
DEMONS:
                 c1=0->\lceil d,e\rceil<10
     c1 :
```

c1 : c1=1->[d,e]>9e : [1,e,0]=[n,10\*0]n : [1,e,0]=[n,10\*0]

```
Selected constraint: e=5->[-1*n,6*1]=0
Tightening possibilities for: e
Solving e=5 for e
e=[5.0*1]
Constraint gives possibilities: [5]
Old possibilities were: [5,6,7]
New possibilities are:
                              [5]
e is now unique. Removing its value 5 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,5,0]=[n,10*0]
Tightening possibilities for: n
Solving \lceil -1*n, 6*1 \rceil = 0 for n
n=[6.0*1]
Constraint gives possibilities: [6]
Old possibilities were: [6,7,8]
New possibilities are:
                              [6]
n is now unique. Removing its value 6 from others
Values have changed. Checking demons
Moving demon to constraint list: [1,5,0]=[6,10*0]
-----
VALUES:
           = [2,3,4,7,8]
= [9]
    У
    S
             = [2,3,4,7,8]
             = [0]
    0
    n
             = [6]
              = [1]
    m
             = [5]
    e
    d
             = [2,3,4,7,8]
    c5
             = [0]
    c4
              = [1]
    c3
             = [0]
    c2
             = [1]
    c1
             = [0,1]
    c0
              = [0]
CONSTRAINTS:
    [1,5,0]=[6,10*0]
    [1,5,0]=[6,10*0]
    [0,d,5]=[y,10*c1]
    [c1,6,r]=[5,10*1]
    [9000*1,900*0,90*6,y]=[1000*9,91*5,d,10*r]
    5=6->[-1*6,7*1]=0
    5=7->[-1*6,8*1]=0
DEMONS:
    c1 :
             c1=0->[d,5]<10
              c1=1->[d,5]>9
    c1 :
```

```
Selected constraint: [1,5,0]=[6,10*0]
Evaluating equation: [1,5,0]=[6,10*0]
```

Evaluates true

-----

# VALUES:

```
y = [2,3,4,7,8]
s = [9]
r = [2,3,4,7,8]
o = [0]
              = [6]
n
              = [1]
                = [5]
e
d
              = [2,3,4,7,8]
c5
              = [0]
              = [1]
c4
            = [0]
= [1]
c3
c2
c1 = \begin{bmatrix} 0,1 \end{bmatrix}
c0 = \begin{bmatrix} 0 \end{bmatrix}
```

### CONSTRAINTS:

### **DEMONS:**

c1 : c1=0->[d,5]<10 c1 : c1=1->[d,5]>9

```
Selected constraint: 5=6 \rightarrow [-1*6,7*1]=0
```

Evaluates false

```
VALUES:
```

$$y = [2,3,4,7,8]$$
s = [9]
r = [2,3,4,7,8]
o = [0]

$$s = [9]$$

$$r = [2,3,4,7,8]$$

$$\begin{array}{rcl}
o & = [0] \\
n & = [6]
\end{array}$$

$$m = \begin{bmatrix} 1 \end{bmatrix}$$

$$d = [2,3,4,7,8]$$

$$\begin{array}{rcl}
 \text{c5} & = & [0] \\
 \text{c4} & = & [1]
 \end{array}$$

$$\begin{array}{ccc} C4 & = \begin{bmatrix} 1 \end{bmatrix} \\ C3 & = \begin{bmatrix} 0 \end{bmatrix} \end{array}$$

$$\begin{array}{ccc} C3 & = \lfloor 0 \rfloor \\ c2 & = \lceil 1 \rceil \end{array}$$

$$\begin{array}{cccc}
c4 & = [1] \\
c3 & = [0] \\
c2 & = [1] \\
c1 & = [0,1] \\
c0 & = [0]
\end{array}$$

### CONSTRAINTS:

$$[0,d,5]=[y,10*c1]$$

$$[9000*1,900*0,90*6,y]=[1000*9,91*5,d,10*r]$$

### DEMONS:

c1 : c1=0->[d,5]<10c1 : c1=1->[d,5]>9

```
Selected constraint: 5=7->[-1*6,8*1]=0
```

Evaluates false

```
VALUES:
```

$$y = [2,3,4,7,8]$$
s = [9]
r = [2,3,4,7,8]
o = [0]

$$s = [9]$$

$$r = [2,3,4,7,8]$$

$$0 = [0]$$

$$m = [1]$$
 $e = [5]$ 

$$d = [2,3,4,7,8]$$

$$c5 = [0]$$
  
 $c4 = [1]$ 

$$\begin{bmatrix} C3 \\ - \end{bmatrix}$$

$$\begin{array}{ccc}
 & c3 & = [0] \\
 & c2 & = [1] \\
 & c1 & = [0,1] \\
 & c0 & = [0]
 \end{array}$$

$$c0 = [0]$$

### CONSTRAINTS:

$$[0,d,5]=[y,10*c1]$$

$$[c1,6,r]=[5,10*1]$$

$$[9000*1,900*0,90*6,y]=[1000*9,91*5,d,10*r]$$

### **DEMONS:**

c1 : c1=0->[d,5]<10 c1 : c1=1->[d,5]>9

```
Selected constraint: [c1,6,r]=[5,10*1]
Tightening possibilities for: c1
Solving [c1,6,r]=[5,10*1] for c1
c1=[9.0*1,-1.0*r]
Constraint gives possibilities: [1,2,5,6,7]
Old possibilities were: [0,1]
New possibilities are:
                                [1]
Values have changed. Checking demons
Moving demon to constraint list: 1=0->[d,5]<10
Moving demon to constraint list: 1=1->[d,5]>9
Tightening possibilities for: r
Solving [c1,6,r]=[5,10*1] for r
r=[9.0*1,-1.0*c1]
Constraint gives possibilities: [8]
Old possibilities were: [2,3,4,7,8]
New possibilities are: [8]
r is now unique. Removing its value 8 from others
Values have changed. Checking demons
VALUES:
            = [0]
= [1]
= [1]
= [0]
= [1]
= [0]
     c0
     c1
     c2
     c3
     c4
     c5
             = [2,3,4,7]
= [5]
     d
     e
               = [1]
     m
              = [6]
     n
            = [0]
= [0]
= [8]
= [9]
= [2,3,4,7]
     0
     r
     У
CONSTRAINTS:
     1=1->[d,5]>9
     1=0->[d,5]<10
     [0,d,5]=[y,10*1]
     [9000*1,900*0,90*6,y]=[1000*9,91*5,d,10*8]
DEMONS:
```

```
Selected constraint: 1=1->[d,5]>9
Evaluating equation: 1=1
Evaluates true
Tightening possibilities for: d
Solving [d,5]>9 for d
d > [4.0*1]
Constraint gives possibilities: [4]
Old possibilities were: [2,3,4,7]
New possibilities are:
                             [7]
d is now unique. Removing its value 7 from others
Values have changed. Checking demons
VALUES:
           = [2,3,4]
    y
             = [9]
    S
             = [8]
             = [0]
             = [6]
    n
             = [1]
    m
             = [5]
    e
    d
              = [7]
             = [0]
    c5
             = [1]
    c4
    c3
             = [0]
    c2
             = [1]
    c1
             = [1]
    c0
          = [0]
CONSTRAINTS:
    1=0->[7,5]<10
    [0,7,5] = [y,10*1]
    [9000*1,900*0,90*6,y]=[1000*9,91*5,7,10*8]
```

**DEMONS:** 

```
Selected constraint: 1=0->[7,5]<10
```

Evaluates false

-----

## VALUES:

```
y = [2,3,4]
s = [9]
r = [8]
         = [0]
0
n
         = [6]
         = [1]
e
          = [5]
d
          = [7]
c5
         = [0]
c4
         = [1]
       = [0]
= [1]
c3
c2
c1 = [1]

c0 = [0]
```

### CONSTRAINTS:

[0,7,5] = [y,10\*1]

[9000\*1,900\*0,90\*6,y]=[1000\*9,91\*5,7,10\*8]

#### DEMONS:

```
Selected constraint: [0,7,5]=[y,10*1]
Tightening possibilities for: y
Solving [0,7,5]=[y,10*1] for y
y=[2.0*1]
Constraint gives possibilities: [2]
Old possibilities were: [2,3,4]
New possibilities are:
                          [2]
y is now unique. Removing its value 2 from others
Values have changed. Checking demons
_____
VALUES:
    c0
             = [0]
           = [1]
    c1
            = [1]
    c2
    c3
            = [0]
             = [1]
    c4
    c5
            = [0]
             = [7]
    d
            = [5]
    e
           = [1]
    m
           = [6]
    n
    0
           = [0]
           = [8]
         = [9]
    S
    у
           = [2]
CONSTRAINTS:
    [9000*1,900*0,90*6,2]=[1000*9,91*5,7,10*8]
DEMONS:
```

```
Evaluating equation: [9000*1,900*0,90*6,2]=[1000*9,91*5,7,10*8] Evaluates true Done.

yes
[trace]
| ?- ^D
[ End of Prolog execution ]
376.2u 7.5s 16:28 38% 80+2328k 13+10io 0pf+0w
moon(2)-> ^D
script done on Fri Oct 30 02:26:09 198
```