

# Chapter 13: Visualization Techniques

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ECLiPSe ELearning [Overview](#)



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# Outline

- 1 Introduction
- 2 Visualization by Annotation
- 3 Visualization Interface
- 4 Conclusions



# What we want to introduce

- Why visualize?
- How to visualize constraint programs
- Visualization Interface
- Visualization Tool



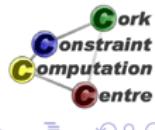
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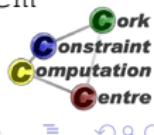
4 Conclusions



# Background

- Gift grant from Cisco Systems/Silicon Valley Community Foundation
- Cisco owns open-sourced ECLiPSe system
- How to expand user-base?
- Self-taught course in constraint programming
- Intended for Cisco engineers/programmers
- Open source/available to community
- Website

<http://4c.ucc.ie/~hsimonis/ELearning/index.htm>



# Format

- Video lectures
- Slides
- Handout
- Exercises

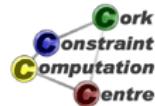
# Problems Handled in Course

- Must have puzzles!
- Send+More=Money
- Sudoku
- N-queens
- Shikaku



# Practical Example Problems

- Test plan generation (BIBD)
- Progressive party problem
- Routing and wavelength assignment
- Optical network design
- Car sequencing
- Costas arrays
- Sports scheduling
- Still to come
  - Production scheduling
  - Nurse rostering
  - Airport stand allocation



# Intention

- Realistic, life like problems
- Must address scalability issues
- Often, problem not completely specified
- Issue: Hard to verify by hand
- Complexity still limited, not real problems
- No attempt at integration



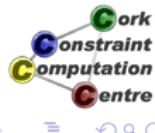
# How do we understand behavior?

- Mental model
- Formal analysis
- Debugging
- Tracing
- Life visualization
- Post-mortem analysis



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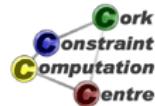


# Why Visualize?

- Understand what is done
- Understand what is done in which order
- Understand what is *not* done
- Understand when to give up

# Design Choices

- No deep integration with solver
- Post-mortem visualization
- Intermediate file format
- No view of detailed propagation
  - Tool not intended for debugging constraint engine



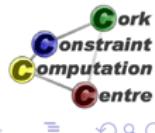
# Conceptual Model

- Stable state at defined program points
- Granularity
  - Assign value
  - Post constraint
- Show stable state after propagation
- Do not show individual propagation steps



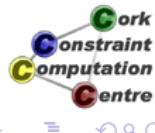
# Visualizers

- Search tree
- Variables
- Constraints

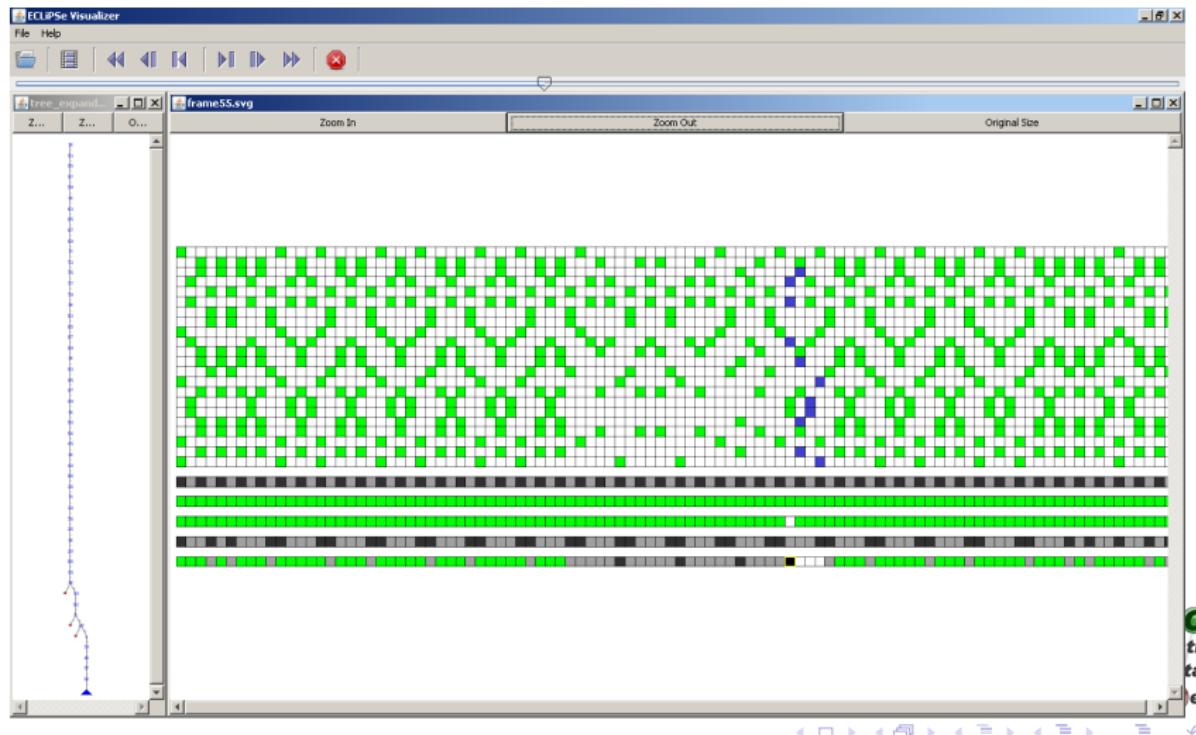


# Visualization Tool

- Developed in Java
- Show two panes: tree and state
- Navigate along timeline



# Visualization Tool: Car Sequencing

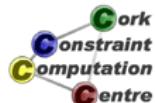


# How many visualizers do we need?

- Develop few primitives
  - Cell based view
  - Domain vector
- Allow aggregation
  - Vector/matrix
  - General layout
- Which global constraints require more?
  - Task based view for cumulative
  - Matching/flow based representation does not scale

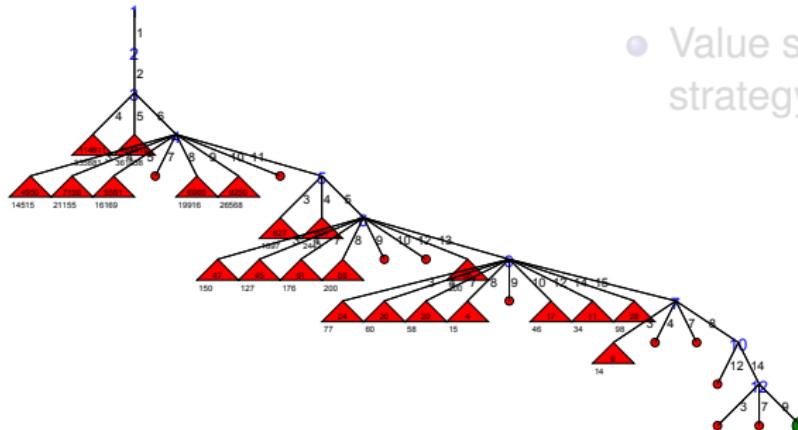
# How to Interpret Visualization

- Search tree
  - Good/bad choices
  - Place of backtracking
- State
  - Missing propagation



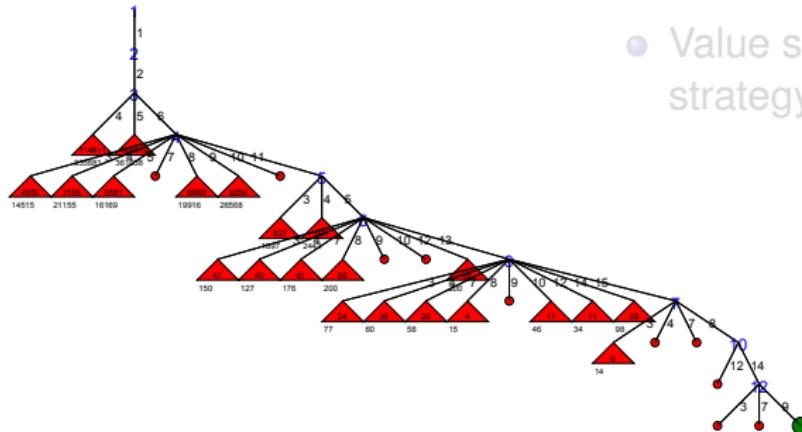
# Costas Array Search tree (Size 16)

- Deep backtracking
- Third choice wrong
- Last choice wrong
- Value selection strategy useless



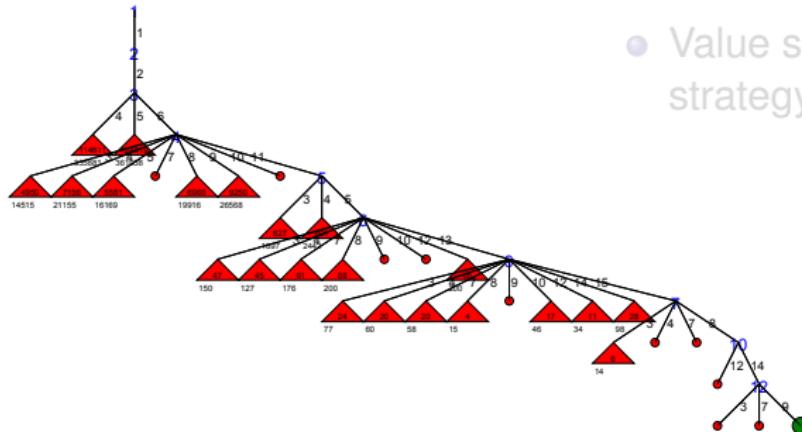
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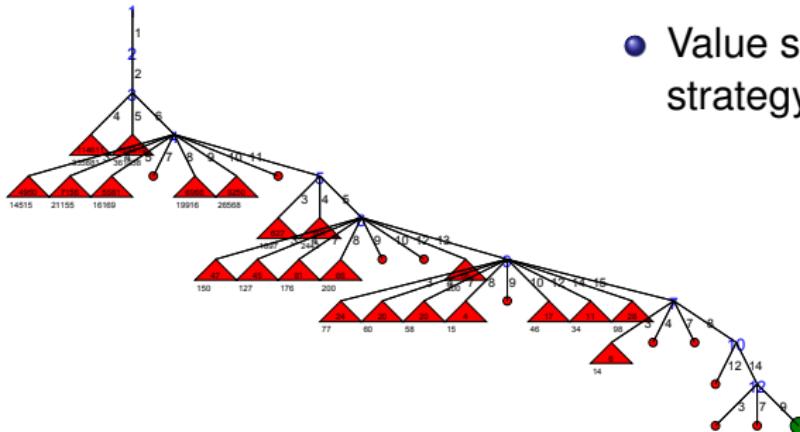
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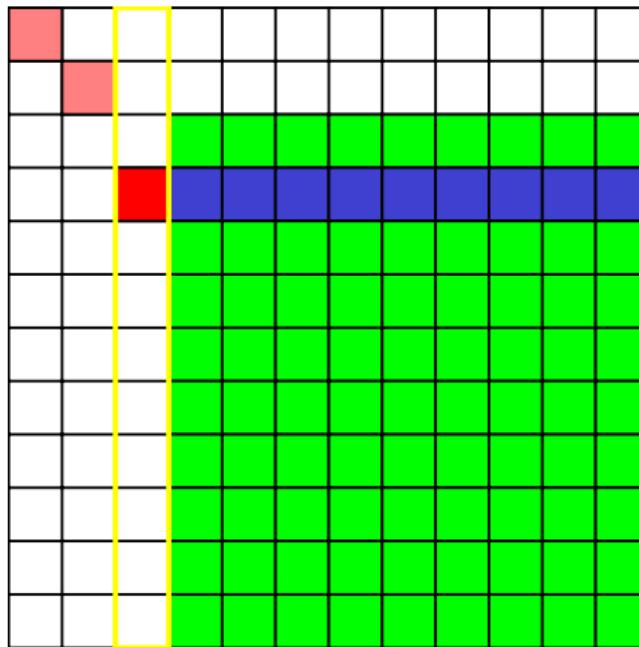


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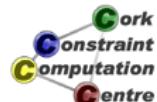
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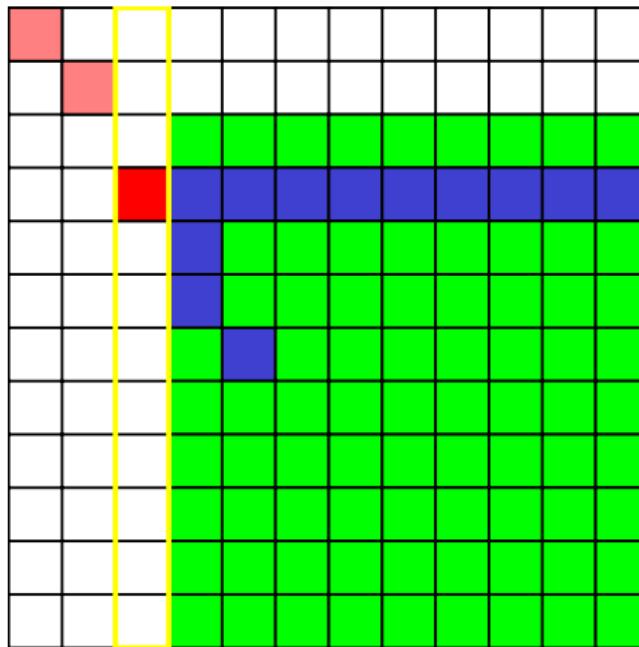
# Missing Propagation



The model is  
doing this



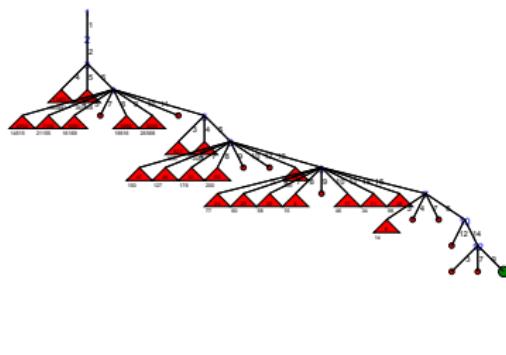
# Missing Propagation



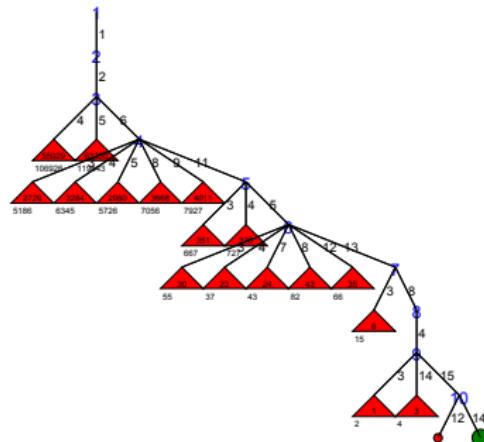
It could be doing  
that!

# Comparison (Search Tree, size 16)

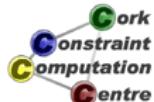
Initial Model



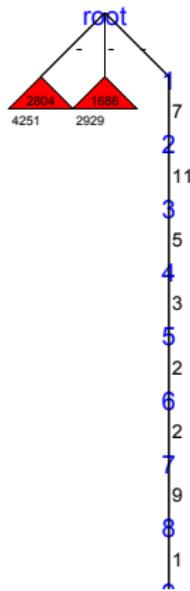
Improved Model



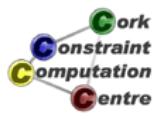
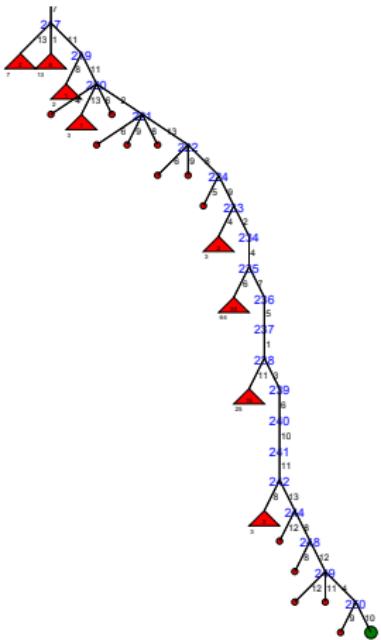
# Progressive Party Problem, 9 Time Periods



## 2 Restarts Before Solution Found

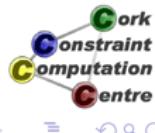


# Value Choice Strategy Not Focused



# Progressive Party

- Clearly impossible to explore search space
- Either many solutions or good value selection
- Value selection at end rather poor
- Probably many solutions



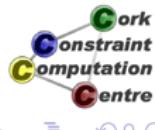
# Missing Propagation: Shikaku

<b>1</b>	<b>4</b>	9 1	9 1	29 13	29 16	<b>29</b>	29 22	29 25	<b>29</b> 5	33 29
9 1	9 1	<b>9</b> 6	16 13	<b>16</b> 3	16	16	29 22	29 25	33 30 29	<b>33</b> 2
13 8 1	13 10 1	9 13 4	13 10	22 16 13	25 22 13	25 22 13	<b>25</b> 3	30 25	33 30 25	
10 1	<b>10</b> 4	10 10	14 15 10	22 16 13 10	30 22 19 10	30	30 26 22 25	<b>30</b> 4	30	
<b>2</b> 2	<b>2</b> 2	2	14 13	22 17	22 19 17	<b>22</b> 5	30 26 25	30 26	34 30	
2 2	2	2	14 13	26 22 17 14	26 22 19 17	26 22	<b>26</b> 4	31 30 26	34 26	
2 9	2	2	<b>14</b> 4	22 17 14	22 19 17 14	26 22 23 19 17 14	26 17	31 30 26	34	
3	5 6	5 5	5	<b>17</b> 8	19 17	23 22 19 17	31 26 19 17	<b>31</b> 31	34 31	
3 6	5 5	5 5		<b>18</b>	<b>19</b> 6	31 23 22 19	31 26 19	<b>31</b> 4	34 31	
3	6 9	6 6	6	<b>18</b> 4	20 18	23 22 20 19	32 21 27 23 19	<b>32</b> 31	34 35	
3	6 9	6 6	6	<b>18</b>	<b>20</b> 4	32 23 22 20	32 27 23	<b>32</b> 4	35 34 32	
3	6 6	6 6	6	<b>18</b>	<b>23</b> 20	32 27 23	35 32 23	<b>35</b> 2	36 34 32	
3	11 7	<b>11</b> 4	15 11	15 11	23 20 15 11	27 24 23 15	27 23	32 27 23	36 35	
15 7 4	15 11 7	<b>15</b> 8	15 7	<b>15</b>	27 23 20 15	27 24 23 15	27 23 15	<b>32</b> 27 15	36 27 15	
7 4	<b>7</b> 6	27 15 12 7	27 15 7	27 15 7	27 24 21 15 7	27 24 23 16 7	<b>27</b> 6	<b>27</b> 27	36 27	
7 4	12 7 4	<b>12</b> 2	24 15 12	24 15 15	24 21	<b>24</b> 4	28 27 24	36 28 27 24	36 28 27 24	
4	8 4	12 8 4	4	21 15 15	<b>21</b> 3	28 24 21	<b>28</b> 6	36 28	36 28	
8 4	<b>8</b> 4	8	8	36 8	36 21	36 28 24	36 28	36 28	<b>36</b> 6	



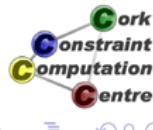
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# Sendmore Program Annotated

```
sendmory(L,Output,IgnoreFixed) :-  
    L=[S,E,N,D,M,O,R,Y],  
    L :: 0..9,  
    create_visualization([output:Output,  
                         ignore_fixed:IgnoreFixed,  
                         width:8,  
                         height:10],Handle),  
    add_visualizer(Handle,  
                  vector(L),  
                  [display:expanded]),  
    alldifferent(L), draw_visualization(Handle),  
    S #\= 0, draw_visualization(Handle),  
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```



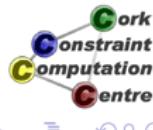
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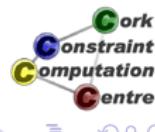
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```
1000*S + 100*E + 10*N + D +
1000*M + 100*O + 10*R + E #=
10000*M + 1000*O + 100*N + 10*E + Y,
name_variables(Handle,L,
                ['S','E','N','D','M','O','R','Y'],
                Pairs),
root(Handle),
search(Pairs,1,input_order,
        tree_indomain(Handle,_),
        complete,[]),
solution(Handle),
close_visualization(Handle).
```

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```
1000*S + 100*E + 10*N + D +
1000*M + 100*O + 10*R + E #=
10000*M + 1000*O + 100*N + 10*E + Y,
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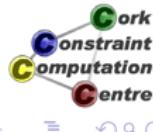
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1000*S + 100*E + 10*N + D +
1000*M + 100*O + 10*R + E #=
10000*M + 1000*O + 100*N + 10*E + Y,
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                ['S','E','N','D','M','O','R','Y'],
                Pairs),
root(Handle),
search(Pairs,1,input_order,
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```

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```
1000*S + 100*E + 10*N + D +
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10000*M + 1000*O + 100*N + 10*E + Y,
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                ['S','E','N','D','M','O','R','Y'],
                Pairs),
root(Handle),
search(Pairs,1,input_order,
        tree_indomain(Handle,_),
        complete,[]),
solution(Handle),
close_visualization(Handle).
```

# Sudoku Program Annotated

```
model(Matrix,Method,Output) :-  
    Matrix[1..9,1..9] :: 1..9,  
    create_visualization([output:Output,  
                         width:9,  
                         height:9],Handle),  
    add_visualizer(Handle,  
                  domain_matrix(Matrix),  
                  [display:text]),  
    draw_visualization(Handle),  
    (for(I,1,9),  
     param(Matrix,Method,Handle) do  
       Method:alldifferent(Matrix[I,1..9]),  
       draw_visualization(Handle,[focus:row(I)]),  
       Method:alldifferent(Matrix[1..9,I]),  
       draw_visualization(Handle,[focus:col(I)]))  
    ),
```



# Sudoku Program Annotated

```
(multifor([I,J],[1,1],[7,7],[3,3]),
param(Matrix,Method,Handle) do
    Method:alldifferent(Matrix[I..I+2,J..J+2]),
    draw_visualization(Handle,
                       [focus:block(I,J,3,3)])
),
extract_array(Handle,row,Matrix,NamedList),
root(Handle),
search(NamedList,1,input_order,
       tree_indomain(Handle,_),
       complete,[]),
solution(Handle),
close_visualization(Handle).
```

# Propagation Steps (Forward Checking)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	1	7	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	8	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	3	2	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	6	4 5 6	4 5 6	8	2	5	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	9	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	8	4 5 6	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	3	7	6	4 5 6	4 5 6	4 5 6	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	9	4 5 6	4 5 6	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6	4 5 6	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	

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# Propagation Steps (Forward Checking)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	1	7	1 2 3	1 2 3	1 2 3	1 2 3
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	8	4 5 6	4 5 6	4 5 6
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	3	2	1 2 3
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	8	2	5	4 5 6
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	6	8	2	5	1 2 3	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	8	7 8 9	7 8 9	7 8 9
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	9	8	7 8 9	7 8 9	7 8 9	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	9	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	3	9	4 5 6	4 5 6	4 5 6	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	9	7 8 9	7 8 9	7 8 9
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	9	7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	7	9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	1	4	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	1	4	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6	4 5 6
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	6	7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	4	1 2 3	4 5 6

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# Propagation Steps (Forward Checking)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6		5 6	5 6	5 6	5 6	5 6	5 6	5 6
7 9	7 9	7 9 7	9 7	9 7	9 7	9 7	9 7	9 7
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	1	7	4 5 6	4 5 6	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	7 8 9	7 8 9	7 8 9	7 8 9
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	9	4 5 6	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	3	7	6	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6				1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
7 8 9				4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
2	7			7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6	5 6	7 9	5 6	5 6	5 6	5 6	5 6	5 6
7 9	7 9	7 9 7	9 7	9 7	9 7	9 7	9 7	9 7
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	1	7	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	1	7	7 8 9	7 8 9	7 8 9	7 8 9
1 3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	8	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	3	2	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	6	4 5 6	4 5 6	8	2	5	4 5 6	7 8 9
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	8	4 5 6	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	9	4 5 6	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6	3	7	6	4 5 6	4 5 6	9	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	7 8 9	7 8 9	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6	4 5 6
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
	5 6		5 6	5 6	5 6	5 6	5 6	5 6
7	9		7	9	7	9	7	9
3	2 3	2 3		2 3	2 3	2 3	2 3	2 3
5 6	4 5 6	4 5 6	1	7	4 5 6	4 5 6	4 5 6	4 5 6
8 9	8 9	8 9			8 9	8 9	8 9	8 9
1	3 1 2 3	1 2 3	1 2 3	8	1 2 3	1 2 3	3	2
5 6	4 5 6	4 5 6			4 5 6	4 5 6		
7 8 9	7 8 9	7 8 9	8	7 8 9	7 8 9	3	2	
1	3 1 2 3		1 2 3	1 2 3	8	2	5	
5 6	4 5 6	6	4 5 6	4 5 6			4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	8			7 8 9
1	3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	9	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	8		7 8 9
1	3	3 7 6		1 2 3	1 2 3	1 2 3	1 2 3	
5 6			5	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9				7 8 9	7 8 9	9		7 8 9
2	7		5	4 5 6	4 5 6	4 5 6	4 5 6	
				7 8 9	7 8 9	7 8 9	7 8 9	
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6	
5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4		
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	1 2 3 5 6 7 9	1 2 3 5 6 9 7				
3	2 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	1 7	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	3 2	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9
1	3 1 2 5 6 4 5 6 7 8 9	6	1 2 3 4 5 6 4 5 6 7 8 9	8 2	1 2 3 4 5 6 4 5 6 7 8 9	5 2	1 2 3 4 5 6 4 5 6 7 8 9	3 2
1	3 5 6 7 8 9	9	1 2 3 4 5 6 4 5 6 7 8 9	7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	8 2	1 2 3 4 5 6 4 5 6 7 8 9	7 8 9
1	3 5 6 7 8 9	3 7 6	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	9 2	1 2 3 4 5 6 4 5 6 7 8 9	7 8 9
2	7	1 2 3 4 5 6 4 5 6 7 8 9	5	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 4	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	7 8 9 7 8 9 7 8 9	7 8 9 7 8 9 7 8 9	7 8 9 7 8 9 7 8 9	6 4	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	1 2 3 5 6 5 6				
3	2 5 6 8 9	2 3 4 5 6 8 9	1	7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 7 9	8	1 4 5 6 7 9	1 4 5 6 7 9	3	2
1	3 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	8 2 5	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	8	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	3 7 6	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
2	7	1 2 3 4 5 6 7 8 9	5	1 2 3 4 5 6 7 8 9			
1	3 5 6 7 8 9	1 2 3 4 5 6 8	1	4	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	1 2 3 4 5 6 8	7 8 9	7 8 9	6	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	1 2 3 5 6 7	1 2 3 5 6 9	1 2 3 5 6 7	1 2 3 5 6 9	1 2 3 5 6 9	1 2 3 5 6 9
3	2 5 6 8 9	2 3 4 5 6 8	1 9	7 9	2 3 4 5 6 8 9			
1	1 5 6 7 9	1 4 5 6 9 7 9	1 4 5 6 8	1 7 9 7	1 4 5 6 7 9 7	1 4 5 6 9	3 4 5 6 3	2 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 2	1 2 3 4 5 6 4 5 6 5	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 5	2 7 8 9
1	3 5 6 7 8 9	1 2 3 4 5 9	1 2 3 4 5 6 4 5 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 8	3 7 8 9
1	3 5 6 7 8 9	1 2 3 4 5 9	1 2 3 4 5 6 4 5 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 9	1 2 3 4 5 6 4 5 6 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 9
2	7	1 2 3 4 5 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 5	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8	1 2 3 4 5 6 4 5 9 7 8 9	1 2 3 4 5 6 4 5 6 1	1 2 3 4 5 6 4 5 6 4	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8	1 2 3 4 5 6 4 5 9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 6	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 4	1 2 3 4 5 6 4 5 6 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	1 2 3 5 6 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 8 9	2 3 4 5 6 8	1 9	7 1 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 9 7 9	1 8	1 4 5 6 7 9 7	1 4 5 6 7 9 7	3 8	2 4 5 6 7 8 9	2 4 5 6 7 8 9
1	3 1 4 7 9	1 6 7 9 7 9	1 3 1 3 4 4 8	1 3 1 3 4 4 8	1 3 1 3 4 4 8	1 3 4 5 6 7 8 9	1 3 4 5 6 7 8 9	1 3 4 5 6 7 8 9
1	3 5 6 7 8 9	9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	8 4 5 6 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9
1	3 5 6 7 8 9	3 7 6	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	9 4 5 6 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9
2	7	5	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9 8	1	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9 8	4	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9 7 8 9	6 4 5 6 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	4 4 5 6 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 8 9	2 3 4 5 8	1 9	7 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 9 7 9	3 4 5 6 7 8 9	2 4 5 6 7 8 9	1 4 5 6 7 8 9
1	3 1 4 7 9	6 4 7 9 7 9	3 1 3	8 4 5 6 7 8 9 7 8 9	2 4 5 6 7 8 9 7 8 9	5 4 5 6 7 8 9 7 8 9	1 3 4 7 9	1 3 4 7 9
1	3 5 6 7 8 9	9 4 5 9 7 8 9	1 2 3 4 5 7 8 9 7 8 9	2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	8 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 5 6 7 8 9	3 7 6 4 5 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	9 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	5 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	6 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	4 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7 9	7 9 7 9 7 9 7	2 3 4 5 6 8 9 8 9	2 3 4 5 6 8 9 8 9	2 3 4 5 6 8 9 8 9
1	1 5 6 7 9	1 4 5 6 9 7 9	8	1 4 5 6 7 9 7 9	1 4 5 6 7 9 7 9	3 4 5 6 8	2 4 5 6 7 9
1	3 1 4 7 9	1 6 4 5 7 9 7 9	3 1 3 4 4 8	8	2 4 5 6 7 9 7 9	5 1 3 4 7 9	1 3 4 5 6 7 9
1	3 5 6 7	1 2 3 4 5 7	2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 7 7 7	1 2 3 4 5 6 4 5 6 4 5 6 7 7 7 7	1 2 3 4 5 6 4 5 6 4 5 6 7 7 7 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7 7
1	3 5 6 7 8 9	3 7 6 4 5 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 5	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8 9 7 8 9	2 3 4 5 1 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8 9 7 8 9	2 3 4 5 1 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 9 7 9	3 4 5 6 7 9	2 4 5 6 7 9	1 3 4 7 9
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 9	8 7 9 7	2 8 9	5 8	1 3 4 7 9
1	3 5 6 9 7 8 9	1 2 3 4 5 7	2 3 4 5 7	2 3 6 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1	3 5 6 9 7 8 9	3 7 9	6 7 9	4 6 4 5 6 9 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	5	1 2 3 4 5 6 7 8 9			
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 4 9 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 4 5 6 9 7 8 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4 7 8 9	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	1 7	1 4 5 6 8 9	1 4 5 6 8 9	3 4 5 6 8 9	2 4 5 6 8 9
7	9	1 3 1 4 7 9	1 3 4 7 9	1 3 4 9 7 9	1 3 4 9 7 9	3 4 5 6 8 9	2 4 5 6 8 9
1	3 5 6 9	1 2 3 4 5 7	1 3 4 7 9	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7
7	8	3 5 8	7 6 4	1 2 3 4 5 8	1 2 3 4 5 8	2 4 5 8	1 2 3 4 5 6 7
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 8	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	4

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 5 6 9	2 3 4 5 6 8 9			
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 6 9 7 9	3 4 5 6 8 9	2 4 5 6 8 9	2 4 5 6 8 9
1	3 1 4 7 9	1 6 4 5 7 9	3 4 9	3 4 6 7	8 5 6 7	2 4 5 6 8	5 4 5 6 8	1 3 4 7 9
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 7	2 3 4 6 7	1 2 3 5 6 7	1 2 3 4 5 6 8	1 2 3 4 5 6 8	1 2 3 4 5 6 8
1	5 8	3 9 7	7 6 4	2 5 4	1 2 5 6 7	1 2 4 5 6 8	1 2 4 5 6 8	1 2 4 5 6 8
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 5	1 2 3 5 6 7 9	1 2 3 4 5 6 8 9			
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	1 2 3 4 5 9 7 8 9	1 2 3 4 6 9 7 9	1 2 3 4 5 6 7 8 9			
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 5 6 9	2 3 4 5 6 8 9			
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 6 9	3 4 5 6 8 9	2 4 5 6 8 9	2 4 5 6 8 9
1	3 1 4 7 9	1 6 4 5 7 9	3 4 9	3 4 6 7	8 5 6 7	2 4 5 6 9	5 4 5 6 8	1 3 4 7 9
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1	5 8	3 7 4 9	7 6 4 9	2 1 2 5	9 4 5 7	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8 9	3 1 6 4 8 9	1 3 1 6 4 8 9	1 3 1 6 4 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 5 6 9 7 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 9	2 3 1 2 3 4 6 5 6 9 7 9	6 4 5 6 7 8 9	4 7 8 9	4 7 8 9	4 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 3 5 6 7 9	1 2 3 5 6 7 9
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 5 6 9 8	3 4 5 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 4 5 8 9	2 3 4 5 7 9	2 3 4 5 7 9
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 9	8 7 9	2 5 7	5 1 3 4 7 9	1 3 4 7 9
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 6	2 3 4 6 7	1 2 3 5 6 7	1 3 8 7	1 2 3 4 5 6 8 7	1 2 3 4 5 6 8 7
1	5 8	3 7 9	6 4 9	2 4 5	1 2 5 9	1 2 4 5 8 7	1 2 4 5 8 7	1 2 4 5 8 7
2	7 4 9	1 3 4 8 9	3 5	1 6 4 9 8	3 1 6 4 8 9	1 3 4 6 8 9	1 3 4 6 8 9	1 3 4 6 8 9
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 9	1 2 3 5 6 9 7 9	1 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 5 6 9 7 9	6 4 5 6 7 8 9	4 5 6 7 8 9	4

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 3 5 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3 5 6 8 9	2 4 5 6 8	2 3 4 5 9	1 7	2 3 5 6 9 8	3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	1 4 5 8	1 5 6 7 9 7	1 4 5 9 7	3 4 5 6 8 9	2 4 5 6 8 9	2 4 5 6 8 9	2 4 5 6 8 9
1 5 6 7 9	3 1 4	1 6	3 4 5 7 9	3 4 6 9	8 7 9 7	2 8 2 5	1 3 4 7 9	1 3 4 7 9
1 5 6 7	3 1 4	1 6	2 3 4 5 7	2 3 4 6 7	1 2 3 5 6 4 5 7 7	3 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 8	3 7 4	3 7	6 4	2 1 2 5	9 4 5 8	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3 4 8 9	5	1 3 1 3 1 3 6 4 9 8 8 9	1 2 3 4 6 4 6 4 6 8 9 8 9 8 9	1 3 1 3 1 3 2 3 5 6 5 6 5 6 8 9 8 9 8 9	1 3 1 3 1 3 2 3 5 6 5 6 5 6 8 9 8 9 8 9
3 5 6 7 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	1 4 9 7 9	3 5 7 8 9 2 3 5 6 5 6 5 6 7 8 9 7 8 9	2 3 4 6 4 6 4 6 8 9 8 9 8 9	2 3 5 6 5 6 5 6 8 9 8 9 8 9	2 3 5 6 5 6 5 6 8 9 8 9 8 9
1 5 6 7 8 9	3 1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 5 6 9 7 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5 5 7	1 2 6 7 9	1 2 3 5 6 7 9
3	2 5 6 8 9	2 3 4 5 8	1 7	2 3 5 6 9 8	3 4 5 9	2 4 6 9	2 3 4 5 6 8 9	
1	1 5 6 7 9	1 4 5 6 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 5 7	2 3 2	
1	3 1 4 7 9	1 6	3 4 5 7 9	3 4 6 9	8 5 6 7 7	2 4 5 9	5 1 3 4 7 9	
1	3 5 6 7	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 7 7	1 3 4 5 8	1 2 3 4 5 6 7	
1	5 8	3 7	6	2 4 5	1 2 5 9	9 4	1 2 4 5 8	
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8	3 4 9	1 2 6 4 8 9	1 3 2 3 5 6
3	2 5 6 7 8 9	2 3 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 5 6 9 7 9	1 2 4 6 7 9	1 2 6 4 8 9	2 3 5 6
1	3 1 2 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 5 6 9 7 9	6 4 9	1 2 4 6 7 9	4	

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 6 7 9	1 2 3 5 6 7 9
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 5 6 9 8	3 4 5 6 9	2 4 6 9	2 3 4 5 6 8 9	
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 5	2 4 7 9	
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 6 7	8 5 6 7	2 4 5 7	5 1 3 4 7 9	
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 6	2 3 4 6 7	1 2 3 5 6 7	1 3 8	1 2 3 4 5 6 7	
1	5 8	3 7 4	7 6 5	2 4 5	1 2 3 5	9 4	1 2 4 5 8	
2	7 4	1 3 4 9	3 8 9	5	1 6 4 9 8	3 4 9	1 3 4 6 8 9	
3	2 5 6 8 7 8 9	2 3 5 9 7 8 9	2 3 5 9 7 9	2 3 5 9 7 9	1 2 3 5 6 7 9	2 6 7 9	2 3 5 6 7 8 9	
1	3 1 2 5 5 7 8 9	1 2 3 5 5 9 7 8 9	2 3 5 9 7 9	2 3 1 2 3 5 9 7 9	6	1 2 7 9	4	

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# Propagation Steps (Forward Checking)

4	1 2	5 6	8	2 3	2 3	1 2 3	1	3	1 2	1 3
3	2	2 3		5	6	5 6	5	6	5 6	3
5 6	4 5 6	4 5	1	7	2 3	5 6 4 5	3	2	6	5 6
8 9	8	9			9	8	9	8	9	8 9
1	1	1			1	1	1			
5 6	4 5 6	4 5	8	1	5 6	4 5	3	2	6	5 6
7 9	9	7 9			7	9 7	7	9	8	9
1	3 1		6	3	3	8	2	5	1 3	
4				4	4				7	9
7 9				7	9	9				
1	3	1 2 3	2 3	2 3	1 2 3	1	3		1 3	
5 6	9	4 5	4 5	4 6	5 6	4 5	8		5 6	
7		7		7	7	7			7	
1	5	3 7 6	4	2	1 2	9	4	1 2	1	
8				5					5	8
2	7	1 3	3	5	1	3 1	3	1	3	
		4	4		6	4	4	6	6	
		9	8 9		9	8	9	9	8 9	
3	2	2 3	2 3			3	2	3		
5 6	5 6	5	5	1	4	5		6	5 6	
7 8 9	8	9	7 8 9			7 8	7	9	7 8 9	
1	3 1 2	1 2 3	2 3	2 3	1 2 3	5	6	1 2		
5	5	5	5			7	7			
7 8 9	8	9	7 8 9			9	7	9		

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	3 7	1 2 6 7 9	1 3 5 6 7 9
3	2	2 3 5 9	1	7	2 3 5 6 4 5 9 8	3	2	3 4 6 9	5 6 8 9
5 6 9	5 6	5 9	1	7	5 6 4 5 9 8	4	6	5 6 9	8 9
1	1	1	8	1	1	3	2	3	2
5 6 7 9	5 6	5 4 5 9 7 9	8	1	5 6 4 5 7 9 7	3	2	3	2
1 3 1	1	6	3 3	8	2	5	1	3	2
4	4	6	4 4	8	2	5	7	9	2
7 9	7 9	7 9 9	7 9 9	7 9 7	7 7	8	1	3	2
1 3 5 6	9	1 2 3 4 5 7	2 3 4 5 4 6	2 3 1 2 3 1 5 6 4 5 7 7	3 1 3 8	1	3 7	5 6 7	8 9
1	5	3 7 6	2 1 2 4 5	9	1 2	1	5	8	6
8	3	7	6	4	5	4	5	8	6
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8	3 1	2	3 4 6 9	6 6 8 9
3 2 5 6 7 8 9	2 3 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	2 3 1 2 3 5 7 8 9	3 1 5 7 8 9	2	3 6 7 9	5 6 7 8 9	3 6 8 9
1 3 1 2	1 2 3	2 3	2 3	2 3 1 2 3 5 9 7 9	1 2 3 6 7 9	1 2	1	3 4 6 7 9	4
5	5	5	5	5	6	4	5	6 6 7 8 9	4
7 8 9	8	9 7 8 9	9 7 8 9	9 7 9	7 9	4	5	6 6 7 8 9	4

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5	3	1 2 6 7	1 3 5 6 9
3 5 6 9	2 5 6 9	2 3 5 9	1 7	2 3 5 6 4 5 9 8	3 4 9	2 6 9	3 5 6 8 9	2 6 9	3
1 5 6 7 9	1 5 6 9	1 5 9	4 5 9	8	1 5 6 4 5 9 7	3 8	2 5	3 2	1 3
1 3 7 9	1 4	6	3 4 7 9	3 4 9	8 2	2 5	5	1 3 7 9	1 3
1 3 5 6 7	1 2 3 4 5 7	1 2 3 4 5 7	2 3 4 5 6	2 3 1 2 3 1 4 6 5 6 4 5 7 7	3 4 5 8	1 5 6 7	1 5 6 8	1 5 6 7	1 3
1 5 8	3 7	7	6	2 4 5	1 2 5	9	4 9	1 2 5	1 5 8
2	7	1 3 4 9	3 4 8 9	5	1 6 4 9 8	3 5	1 4 9	1 3 6 9	1 3 6 8 9
3 5 6 7 8 9	2 5 6 8	2 3 5 9	2 3 7 8 9	1 2 3 9 7 8 9	3 5 7 8	2 6 7 9	3 6 9	2 5 6 7 8 9	3
1 3 5 7 8 9	1 2 5 8	1 2 3 5 9	2 3 7 8 9	2 3 1 2 3 5 9 7 9	6	1 2 7 9	4	1 2 6 9	4

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5	1	6 9	1 5 6 9 7 9
3 5 6 9	2 5 6 9	2 3 1 9	7	2 3 5 6 9 8	4 5	4	6 9	5 6 8 9	
1 5 6 7	1 5 6 9	1 5 9	8	5 6 9 7	4 5	3	2		
1 5 7	4 9 2 7	6 2 3 4 5 7	3 4 9	3 2 3 4 6 7	1 2 3 5 6 4 5 7 7	2 5	1 3 7 9		
5 8	9 3 7 4	2 2 3 4 5 7	8	2 3 1 2 3 5 6 4 5 7 7	1 2 3 5 6 4 5 7 7	8	1 3 7	5 6	
8 2	3 7 4	7 6 4	6	2 1 2 4 5 7 5	9	1 2 4	1 5 8		
2 3	7 4 9	1 3 4 9	5	1 3 1 3 6 4 9 8	1 3 1 3 4 6 9 9	1 3 6 6 8 9			
3 5 6 7 8 9	2 5 6 8 9	2 3 5 9 7 8 9	1 4 9 7 8 9	2 3 1 2 3 5 9 7 9	3 2 5 6 6 7 9 7 8 9	6	1 2 7 9	3 5 6 7 8 9	
1 5 7 8 9	3 5 8 9	1 2 1 2 3 5 9 7 8 9	2 3 2 3 9 7 8 9	2 3 1 2 3 5 9 7 9	1 2 6 7 9	4			

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5	1	6 7 9	1 5 6 7 9
3 6 9	2 5 6 9	1	7	2 3 5 6 9 8	4 5	4	6 9	5 6 8 9	
1 6 7	1 5 6 9	8		1 5 6 9 7	4 5	3	2		
1	4 6 7	3 9 9	3 8	3 8	3 9 7	2	5		3 7 9
5	9 2 7	2 4 7	3 4 6	3 1 6 4 7 7	3 1 6 4 7 7	8	1 2 7	3 6	
8	3 7 6	7 6 4	2 4 5	1 2 5 5	9	1 2 4	1 5		
2	7 4 9	1 3 4 9	3 4 8 9	5	1 3 1 3 6 4 9 8	1 4 6 9	1 3 6 8 9	1 3 6 8 9	
3 6 7	2 5 6 8	3 5 9	2 3 7 8 9	1 4 9 7 9	2 3 1 2 3 5 7 8 7 9	3 5 7 8 9	2 6 7 9	3 5 6 7 8 9	
3 7	1 2 5 9	1 3 5 9	2 3 5 9 7 8 9	2 3 1 2 3 5 9 7 9	6	1 2 7 9	4		

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5 9	1 7	6 9	1 5 6 7 9 7 9
3 6 9	2 5 6 9	1	7	2 3 5 6 9 8	4 5 9	4	6 9	5 6 8 9	
1 6 7	1 5 6 9	5 4 5 9	8	1 5 6 9 7	4 5 9	3	2		
1 5	4 9	6 2	3 7 9	3 3 1 7	8 2 3 1 4	5 3 1 7	7 9	3 1 3 7	
8	3	7	6	2	5	9	4	1	
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8	3 1 4 9	1 3 6 9	6 8 9	
3 6 7	2 5 6 8	5	2 3 5 9 7 8 9	1	4 7 8	5 7 8	2 7 9	6 7 8 9	3
3 5 7	1 2 5 9	1 3 5 9 7 8 9	2 3 5 9 7 9	2 3 1 2 3 5 9	6	1 2 7 9	4		

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	3 6 9	2 3 6 9	1 5 7	1 7 9	6 9 7	5 6 9 9
3 6 9	2 5 6 9	1	7	2 3 6 9	4 5 8			6 9	5 6 8 9
1 6 7	1 5 6 9	5 4 5 9	8		1 6 4 5 9 7	3 2			
1 5	4 9	6 2	3 7	3 9	8 3 1 3	2 3	5 7		3
8	3	7	6	2	5	9	4	1	
2 3 7 9	7 2 5 8	1 4 9 7	3 4 8 9	5	1 6 4 9 8	3 5 7	1 6 9	3 6 8 9	
3 6 7 9	2 5 6 8 9	1 5 9 7	3 5 8 9	1 4 7 8 9	2 5 7 8 9	3 1 7	2 6 9	3 5 6 7 8 9	
3 7 9	1 5 9 8	2 5 9 7	1 5 9 8 9	3 1 9 7	2 5 7 9	6 1 7	2 6 9	4 5 6 7 8 9	

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	3 6 9	2 3 6 9 7	1 5	1 7	6 9	5 6 7 9
3 6 9	2 5 6 9	1	7	2 3 6 9 8	4 5		6 9	5 6 8 9	
1 6 7	1 5 6 9	5 4 5 9	8	1 6 9 7	4 5	3 9	2 7		
1	4	6	3 7 9	3 9	8	2 6 9 7	5 7		3
5	9	2	4 7	3 4	3 1 7 7	3 8	8 7		3 6
8	3	7	6	2	5	9	4	1	
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8	3 1 5 9	1 2 6 9	3 6 9	6 8 9
3 6 9	5 6 8	5	2 3 5 9 7 8 9	1 4	3 7 8	2 5 7 9	6 7 9	3 6 7 8 9	3 5 6
3 6 9	1 3 5 9 8	1 3 5 9 7 8 9	2 3 5 9 7 9	3 1 2 3 6	1 2 7 9	4			

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	3 6 9	2 3 6 9 7	1 5	1 7	6 9 7 9	5 6
3 6 9	2 5 6 9	1	7	2 3 6 9 8	4 5		6 9	5 6 8 9	
1 6 7	1 5 6 9	5 4 5 9	8	1 6 9 7	4 5	3 9	2		3
1	4	6	3 7 9	3 9	8	2	5		7
5	9	2	3 4 7	3 1 4 7	3 7	8		3 6 7	
8	3	7	6	2	5	9	4	1	
2	7	1 3 4 9	3 8 9	5	3 1 6 4 9 8	3 1		6 9 8 9	3
3 6 9	5 6 8	5 9 7 8 9	3 2 3 7 8 9	1 4 7 8	5 7 8	3 7 9	2 6 5 6 7 8 9		3
3 1 5 9	1 3 5 8	2 3 9 7 8 9	3 2 3 9 7 9	6	1 2 7 9		4		

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# Propagation Steps (Forward Checking)

4	1 2 5 6	8	2 3 5 9	3 6 9	2 3 6 9 7	1 5	1 7	6 9 7 9	5 6
3 6 9	2 5 6 9	1	7	2 3 6 9 8	4 5		6 9	5 6 8 9	
1 6 7	1 5 6 9	5 4 5 9	8		1 6 9 7	4 5	3 7	2	3
1	4	6	3 7 9	3 9	8	2	5		3
5	9	2	4 7	4	3 1 7 7	3	8		3 6
8	3	7	6	2	5	9	4	1	
2	7	1 4	3 9	3 8 9	5	3 1 6 9	3 1 8 9		3 8 9
3 6 9	5 6 8	5	3 9	2 3 7 8 9	1 4	5 7 8	3 7 9	2 5 7 8 9	
3 5 9	1 5 8	3 5	2 3 9 7 8 9	3 9 7 9	6	1 2 7 9		4	

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# After Setup (Forward Checking)

		1 2 5 6	8	2 3 5 9	3 6 9	2 3 6 9	1 5 7	1 7 9	6 9 5 6
4	3 6 9	2 5 6	3 5 9	1 7	2 3 6 9	4 5 8		6 9 5 6	
	6 9	1 5 6	1 5 9	8		1 6 9	4 5 7	3 2	
7	6 9	5 9	4 5 9	8		6 9 7	4 5 7		3
1	4	6	7 9	3 9	8	2 9	5 7		3
5	9	2	4 7	3 4	3 1 7	3 7	3 7	8 7	3 6
8	3	7	6	2 9	5 8	9 7	4 8	1 9	1 8 9
2	7	1 4	3 9	3 8 9	5 5	3 1 6 9	3 1 8		3 8 9
3 6 9	5 8	3 9	2 3 7 8 9	1 9		3 7 8	2 7 9	5 7 8 9	
3 9	1 8	1 5	3 5	2 3 9 7 8 9	3 9 7 9	6 7 9	1 2 7 9	4 4	

# Propagation Steps (Bounds Consistency)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	6	1 2 3	1 2 3	8	1 2 3	1 2 3	3	2
4 5 6	4 5 6	6	4 5 6	4 5 6	8	4 5 6	4 5 6	3	2
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	9	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	9	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	3	7	6	1 2 3	1 2 3	9	1 2 3	1 2 3
4 5 6	4 5 6	3	7	6	4 5 6	4 5 6	9	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	1 2 3	1 2 3	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	1 2 3	4
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

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# Propagation Steps (Bounds Consistency)

	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
5	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
6	8	8	8	8	8	8	8	8
7	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
8	1	1	1	1	1	1	1	1
9	7	7	7	7	7	7	7	7
1	7	7	7	7	7	7	7	7
2	8	8	8	8	8	8	8	8
3	3	3	3	3	3	3	3	3
4	6	6	6	6	6	6	6	6
5	2	2	2	2	2	2	2	2
6	5	5	5	5	5	5	5	5
7	3	3	3	3	3	3	3	3
8	2	2	2	2	2	2	2	2
9	4	4	4	4	4	4	4	4
1	5	5	5	5	5	5	5	5
2	6	6	6	6	6	6	6	6
3	8	8	8	8	8	8	8	8
4	7	7	7	7	7	7	7	7
5	9	9	9	9	9	9	9	9
6	8	8	8	8	8	8	8	8
7	7	7	7	7	7	7	7	7
8	5	5	5	5	5	5	5	5
9	4	4	4	4	4	4	4	4
1	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2
3	1	1	1	1	1	1	1	1
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
1	2	2	2	2	2	2	2	2
2	3	3	3	3	3	3	3	3
3	4	4	4	4	4	4	4	4
4	5	5	5	5	5	5	5	5
5	6	6	6	6	6	6	6	6
6	7	7	7	7	7	7	7	7
7	8	8	8	8	8	8	8	8
8	9	9	9	9	9	9	9	9
9	9	9	9	9	9	9	9	9

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# Propagation Steps (Bounds Consistency)

4	1 2 3	5 6	8	1 2 3	5 6	5 6	5 6	5 6	5 6	5 6	5 6	
7	9		7	9	7	9	7	9	7	9	7	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
2	7		1	2	3	1	2	3	1	2	3	
4	5	6	3	7	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	2	7		5	4	5	6	4	5	6
4	5	6	1	2	3	1	2	3	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	
1	2	3	1	2	3	1	2	3	1	2	3	
4	5	6	4	5	6	4	5	6	4	5	6	
7	8	9	7	8	9	7	8	9	7	8	9	

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# Propagation Steps (Bounds Consistency)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6	5 6	5 6	5 6	5 6	5 6	5 6	5 6	5 6
7 9	7 9	7 9	7 9	7 9	7 9	7 9	7 9	7 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	1	7	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	1	7	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	8	4 5 6	4 5 6	3	2	3	2
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	6	1 2 3	1 2 3	8	2	5	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	9	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6	4 5 6	9	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	3	7	6	1 2 3	1 2 3	1 2 3	1 2 3
5 6	4 5 6	3	7	6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	9	4 5 6	4 5 6	7 8 9
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	5	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6	4
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	6	4 5 6	4
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
	5 6		5 6	5 6	5 6	5 6	5 6	5 6
	7 9		7 9 7	9 7	9 7	9 7	9 7	9 7
3	2 3	2 3		2 3	2 3	2 3	2 3	
5 6	4 5 6	4 5 6	1	7	4 5 6	4 5 6	4 5 6	4 5 6
8 9	8 9	8 9			8 9	8 9	8 9	8 9
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	4 5 6	4 5 6	6	8	2	5	4 5 6	
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	
1	3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	9	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	
1	3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	3	7	6	4 5 6	4 5 6	9	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	
		4 5 6	4 5 6		4 5 6	4 5 6	4 5 6	
		7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	
1	3 1 2 3	1 2 3	1 2 3	1	4	1 2 3	1 2 3	1 2 3
5 6	4 5 6	4 5 6	4 5 6			4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	4 5 6	4 5 6	4 5 6			4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	1 2 3 5 6 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	1 8	7 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	3 8	2 7	2 3 4 5 6 4 5 6 8 9
1	3 1 2 5 6 4 5 6 7 8 9	6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 8	5 7	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 8	5 7	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	3 7 6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 9	5 7	1 2 3 4 5 6 4 5 6 7 8 9
2	7 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	5 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 9	5 7	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	3 7	4 6	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 6	4 7	1 2 3 4 5 6 4 5 6 7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	1 2 3 5 6 5 6				
3	2 5 6 8 9	2 3 4 5 6 8 9	1	7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 7 9	8	1 4 5 6 7 9	1 4 5 6 7 9	3	2
1	3 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	8 2 5	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	8	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	3 7 6	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
2	7	1 2 3 4 5 6 7 8 9	5	1 2 3 4 5 6 7 8 9			
1	3 5 6 7 8 9	1 2 3 4 5 6 8	1	4	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	1 2 3 4 5 6 8	7 8 9	7 8 9	6	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	1 2 3 5 6 7	1 2 3 5 6 9	1 2 3 5 6 7	1 2 3 5 6 9	1 2 3 5 6 9	1 2 3 5 6 9
3	2 5 6 8 9	2 3 4 5 6 8	1 9	7 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 9	1 4 5 6 8	1 7 9	1 4 5 6 7 9	1 4 5 6 7 9	3 4 5 6 8	2 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 8	1 2 3 4 5 6 8	1 2 3 4 5 6 7 8 9	2 5			
1	3 5 6 7 8 9	1 2 3 4 5 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 7 8 9	8
1	3 5 6 7 8 9	1 2 3 4 5 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 7 8 9	8
2	7 4 5 9	1 2 3 4 5 6 9	1 2 3 4 5 6 5	1 2 3 4 5 6 4	1 2 3 4 5 6 4	1 2 3 4 5 6 4	1 2 3 4 5 6 7 8 9	3 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 8	1 2 3 4 5 6 8	1 2 3 4 5 6 7 8 9	2 6			
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 8	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 9	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	1 2 3 5 6 7 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 4 5 8 9	2 3 9	1 7	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9
1	1 5 6 4 5 6 4 5 7 9	1 9 7 9	1 8	1 4 5 6 4 5 6 7 9 7 9	1 4 5 6 4 5 6 7 9 7 9	3 4 5 6 4 5 6 7 9	2 4 5 6 4 5 6 7 9	
1	3 1 4 7 9	1 4 7 9 7 9	3 1 3 4 4 8	1 4 5 6 4 5 6 7 9 7 9	2 4 5 6 4 5 6 7 9 7 9	5 4 5 6 4 5 6 7 8 9	1 3 4 7 9	
1	3 5 6 4 5 6 4 5 7 8 9	9 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	8 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	
1	3 1 2 5 6 4 5 6 4 5 7 8 9	3 7 6 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	9 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	
2	7 4 5 9 7 8 9	1 2 3 1 2 3 4 5 9 7 8 9	5 5	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	
1	3 1 2 5 6 4 5 6 4 5 7 8 9	8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	
1	3 1 2 5 6 4 5 6 4 5 7 8 9	8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	6 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	4 4 5 6 4 5 6 7 8 9	

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 5 6 9 7	1 2 3 5 6 5 6 9 7	1 2 3 5 6 5 6 9 7	1 2 3 5 6 5 6 9 7	1 2 3 5 6 5 6 9 7
3	2 4 5 6 8 9	2 3 4 5 9	1	7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 9 9	3	2
1	3 1 4 7 9	1 6 7 9 7 9	3 1 3	8 2 5	1 3 4 7 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 4 5 7 8 9	1 2 3 4 5 9 7 8 9	2 3 1 2 3	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	8	1 2 3 4 5 6 7 8 9
1	3 5 6 4 5 7 8 9	3 7 6 4 5 9 7 8 9	1 2 3 1 2 3	4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	9	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 9	5	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	6	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 7 8 9 7 8 9	4	

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6
3	2 5 6 4 5 6 4 5	2 3 1 8 9	7 9 9 9	7 9 9 9	2 3 4 5 6 4 5 6 4 5 6	2 3 4 5 6 4 5 6 4 5 6	2 3 4 5 6 4 5 6 4 5 6
1	1 5 6 4 5 6 4 5	1 8	1 8	1 8 7 9	1 4 5 6 4 5 6 4 5 6	1 4 5 6 4 5 6 4 5 6	1 4 5 6 4 5 6 4 5 6
7 9	9 7 9	9 7 9	9 7 9	9 7 9	3 2 5	3 2 5	2 9
1	3 4	1 6	3 1 4 4	3 1 8	1 2 3 8 2	1 2 3 8 2	1 3 4 7 9
7 9	9 7	9 7 9	9 7 9	9 7 9	5 8	5 8	6 7 9
1	3 5 6	9	1 2 3 4 5 4 5	2 3 1 2 3 1 2 3	1 2 3 4 5 6 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6
7	7	7	7	7	7	7	7
1	3 5 6	3 7	7 6	1 2 3 1 2 3 4 5 6 4 5 6	9 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6	1 2 3 1 2 3 4 5 6 4 5 6 4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
2	7	1 2 3 4 5 4 5	2 3 9 7 8 9	1 2 3 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6
1	3 5 6 4 5 6 4 5	1 2 3 4 5 4 5	1 2 3 9 7 8 9	1 2 3 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6	1 2 3 4 5 6 4 5 6 4 5 6
7 8 9	8	9 7 8 9	9 7 8 9	9 7 8 9	7 8 9 7 8 9	7 8 9 7 8 9	7 8 9 7 8 9
1	3 5 6 4 5 6 4 5	1 2 3 4 5 4 5	2 3 9 7 8 9	1 2 3 7 8 9 7 8 9	6 7 8 9	1 2 3 4 5 6 4 5 6	4 7 8 9
7 8 9	8	9 7 8 9	9 7 8 9	9 7 8 9	9 7 8 9	7 8 9	7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 9 7 9	3 4 5 6 7 9	2 4 5 6 7 9	1 3 4 7 9
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 8	2 3 8 2	5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 9 7 8 9	1 2 3 4 5 7	2 3 4 7	2 3 6 4 5 6 7 7	1 2 3 4 5 6 7 8 9			
1	3 5 6 9 7 8 9	3 7 9 7 8 9	6 4 9 7 8 9	2 3 1 2 3 6 4 5 6 9 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
2	7 4 5 9 7 8 9	1 2 3 4 5 9 7 8 9	5 4 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9 8	1 2 3 4 5 6 9 7 8 9	1 4 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9 8	1 2 3 4 5 6 9 7 8 9	2 3 4 9 7 8 9	2 3 1 2 3 6 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9	1 2 3 4 5 6 9 7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 1 9	7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 9 9	3 4 5 6 8 9	2 8 9
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 9	8 2 8 2 7 7	5 5 7 9	1 3 4 7 9
1	3 5 6 9 7	1 2 3 4 5 4 5 7	2 3 4 6 4 5 6 7	2 3 1 2 3 4 6 4 5 6 7 7 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1	5 8	3 7 9 7 8 9	6 4 8	2 1 2 4 5 8	9 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 2 3 4 5 4 5 9 7 8 9	5	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	1 4 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 4 5 6 9 7 8 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 5 6 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 6 9 9	3 4 5 6 8 7	2 4 5 6 8 7	2 4 5 6 8 7
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 9	8 7 9 7	2 4 5 6 8 7	5 4 5 6 8 7	1 3 4 7 9
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 6	2 3 4 6 7	1 2 3 5 6 7	1 2 3 4 5 6 8	1 2 3 4 5 6 8	1 2 3 4 5 6 8
1	5 8	3 7 8	7 6 4	2 1 2 5	9 7 8 9	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 8 9	5	1 2 3 5 6 7 9 8 9	1 2 3 4 5 6 8 9 7 8 9	1 2 3 4 5 6 8 9 7 8 9	1 2 3 4 5 6 8 9 7 8 9
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 5 6 9 7 9	6 4 5 6 7 8 9	4 4 5 6 7 8 9	4 4 5 6 7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 4 5 8 9	1	7	2 3 5 6 4 5 6 4 5 6 9 8 9	2 3 5 6 4 5 6 4 5 6 9 8 9	2 3 5 6 4 5 6 4 5 6 8 9	2 3 5 6 4 5 6 4 5 6 8 9	2 3 5 6 4 5 6 4 5 6 8 9
1	1 5 6 4 5 6 4 5 7 9	8	1 5 6 4 5 6 4 5 6 7 9 7 9	1 5 6 4 5 6 4 5 6 7 9 7 9	3	2		
1	3 1 4 7 9	6	3 4 5 4 5 4 5 7 9 9	3 4 6 5 6 4 5 6 7 7 7	8 2 5	1 3 4 7 9		
1	3 5 6 9 7	9	1 2 3 4 5 4 5 4 5 7	2 3 4 6 5 6 4 5 6 7 7 7	1 2 3 5 6 4 5 6 4 5 6 8	1 2 3 4 5 6 7		
1	5 8 3 7 6 8	6	2 4 4 4 5 5 5 5 6	1 2 5 5 5 6 9	9 1 2 4 5 4 5 8 8	1 2 4 5 4 5 8 8		
2	7 4 4 4 5 9 8 9	5	3 4 4 4 5 9 8 9	1 3 1 3 1 3 6 4 6 4 6 4 6 9 8 9 8 9 8 9	1 2 3 1 2 3 1 2 3 6 4 6 4 6 4 6 9 8 9 8 9 8 9	1 2 3 1 2 3 1 2 3 6 4 6 4 6 4 6 9 8 9 8 9 8 9		
1	3 1 2 5 6 4 5 6 4 5 7 8 9 8	1	2 3 4 5 4 5 4 5 9 7 8 9	1 2 3 4 6 5 6 4 5 6 7 8 9 7 8 9	4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9		
1	3 1 2 5 6 4 5 6 4 5 7 8 9 8	4	2 3 4 5 4 5 4 5 9 7 8 9	1 2 3 4 6 5 6 4 5 6 9 7 9	6 4 5 6 4 5 6 7 8 9 7 8 9	4 5 6 4 5 6 4 5 6 7 8 9 7 8 9		

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 3 5 6 7 9	1 2 3 5 6 7 9
3 5 6 8 9	2 4 5 6 8	1	7	2 3 5 6 9 8	3	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3	2	1 3 4 7 9	1 3 4 5 6 7
1 5 6 7 9	3 1 4	6	3 4 9	3 4 6 7 9	8 2	5	1 3 4 7 9	1 2 3 4 5 6 7
1 5 6 7	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 7	1 3 4 5 7	8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 8	3 7	6	4	2 1 2 5	9	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2 7	1 3 4 9	3 4 8 9	5	1 6 4 9 8	3 6 4 8 9	1 3 4 6 8 9	1 3 4 6 8 9	1 3 4 6 8 9
1 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	1 4 9 7 8 9	1 2 3 4 6 9 7 9	1 3 4 5 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 4 5 6 7 8 9	6	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 3 5 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3 5 6 8 9	2 4 5 6 8	2 3 1 9	7 1 9	2 3 5 6 9	3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	1 8 9 7 9	1 8 7 9 7	1 5 6 4 5 7 9 7	1 3 8	1 2 5	2 3 4	2 3 4
1 5 6 7 9	3 1 4 9	6 4 5 7 9	3 4 9	3 4 5 6 6 7 7	8 2 7	2 5 7 9	1 3 4 8	1 3 4 7
1 5 6 7	3 1 4 9 4 5 7	1 2 3 2 3 4 5 7	2 3 4 5 6 6 9	1 2 3 5 6 4 5 7 7	1 3 8 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 8	3 7 6	3 4 4	2 4 5	1 2 5 7	9 4 5 8	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3 4 8 9	5	1 3 6 4 9 8	1 3 4 6 8 9	1 3 4 6 8 9	1 3 4 6 8 9
3 5 6 7 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	1 2 3 4 6 9 7 9	3 5 7 8 9	2 3 5 6 7 8 9	2 3 5 6 7 8 9	2 3 5 6 7 8 9
1 5 6 7 8 9	3 1 2 4 5 6 8	1 2 3 2 3 4 5 9 7 8 9	2 3 4 5 6 6 9 7 9	1 2 3 5 6 9 7 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4	4

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	3 7	1 2 6 7 9	1 2 3 5 6 7 9
3 5 6 8 9	2 4 5 6 8	1	7	2 3 5 6 9 8	3 4 5 9	2 4 6	2 3 4 5 6 8 9	2 3 4 5 6 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 4 5 9	3 5	2 4 7 9	3 2 4 7 9	3 2 4 7 9
1 5 6 7 9	1 4 5 6 9 7 9	6	3 4 5 7 9 9	3 4 6 7 9 7	8 5 6 7 7	2 4 5 9	5 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 7	3 4 5 6 9 7	9	1 2 3 4 5 6 7	2 3 4 6 7	1 2 3 5 6 7	1 3 4 5 7	8 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 8	3 4 5 6 9	7	6	2 4 5	1 2 5 9	9 4	1 2 4 8	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3 4 8 9	5	1 3 6 4 9 8	3 4 9	1 2 4 9	1 3 4 6 8 9	1 3 4 6 8 9
3 5 6 7 8 9	2 5 6 8	5	2 3 5 6 9 7 8 9	1 4 4 6 7 8 9	3 5 7 8	2 6 7 9	2 3 6 5 6 7 8 9	2 3 6 5 6 7 8 9	2 3 6 5 6 7 8 9
1 5 6 7 8 9	3 4 5 6 8	1 2 4 5 9 7 8 9	1 2 3 4 5 9 7 9	2 3 4 6 9 7 9	1 2 3 5 6 9	1 2 4 6 7 9	4 4 4	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 6 7 9	1 2 3 5 6 7 9
3	2 5 6 4 5 6 8 9	2 3 4 5 9	1	7	2 3 5 6 9 8	3 4 5 6 9	2 6 4 5 6 9 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 5 6 7 9	2 5 7 9	1 2 3 4 5 6 7
1	3 1 4 7 9	1 6 4 5 7 9	3 4 9	3 8	2 8 2 7 9	5 3 7 9	1 3 4 7 9	1 2 3 4 5 6 7
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 7	1 3 4 5 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1	5 8	3 7 6 4	2 4 5	1 2 5	9 4	1 2 4	1 2 4 5 8	1 2 3 4 5 6 8
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8	3 4 9	1 3 4 6 4 8 9	1 2 3 4 5 6 8 9
3	2 5 6 8 7 8 9	2 3 5 9	2 3 7 8 9	1	4 5 7 8	5 7 8 7 9	2 6 7 9 7 8 9	2 3 5 6 7 8 9
1	3 1 2 5 7 8 9	1 2 3 5 9	2 3 7 8 9	2 3 1 2 3 5 9 7 9	1 2 3 5 9 7 9	1 2 6 7 9	1 2 4 7 9	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Bounds Consistency)

4	1 2	5 6	8	2 3	2 3	1 2 3	1	3	1 2	1 3	
3	2	2 3		5	6	5 6	5	6	5 6	5 6	
5 6	4 5 6	4 5	1	7	2 3	4 5	4	6	5 6	5 6	
8 9	8	9			5 6	4 5	9	8	9	8 9	
7	1	1			1	1	3	2	3	2	
4 5 6	4 5	4 5	8	1	5 6	4 5	3	4	6	5 6	
9 7 9	9 7	9		7	9 7	7	9 7	9	8 9	8 9	
1	3 1		6	4	3	3	1	3	1	3	
4				7	9	9	8	2	5	7 9	
7	9										
1	3	1 2 3	2 3	2 3	1 2 3	1	3	1	3	1	3
5 6	9	4 5	4 5	4 6	5 6	4 5	8	2	5	7 9	
7		7		7	7	7	7				
1											
5	3	7	6	4	1 2	1 2	9	4	1 2	1	3
8					5	5			5	8	
2	7	1 3	3	5	1	3 1	3	1	3	1	3
4		4			6 4	6 4	4	6	6	6	6
9	8 9	8 9			9 8	9 8	9	8 9	8 9	8 9	8 9
3	2	2 3	2 3				3	2	3		
5 6	5 6	5	5	1	4	5	5	6	5 6		
7 8 9	8	9 7 8 9	9 7 8 9		7 8	7 8	7 9	7 8 9			
1	3 1 2	1 2 3	2 3	2 3	2 3 1 2 3	5	6	1 2			
5	5	5	5			5					
7 8 9	8	9 7 8 9		9 7 9		6	7	9			

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 6 7 9	1 3 5 6 7 9
3 5 6 9	2 5 6 9	2 3 5 1 9	7	2 3 5 6 4 5 9 8	3	2 4 6 9	3 5 6 8 9	
7	1 5 6 9	1 5 4 5 9	8	1 5 6 4 5 9	1 3	3 2 5	2 7 9	
1 3 4 9	3 6	1 4 7 9	3 4 9	3 8	2 8	5 7	1 3 5 6 7	
1 3 5 6 9	1 2 3 4 5 7	2 3 4 5 4 6	2 3 7 7	1 2 3 5 6 4 5 7	1 3 8	1 5 6 7	1 3 5 6 7	
1 5 8	3 7	7 6	4	2 1 2 5	9	1 2 4	1 5 8	
2	7	1 3 4 9	3 8 9	5	1 6 4 9 8	3 1 4 9	1 3 6 9 8 9	
3 5 6 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 9	1 2 3 5 9 7 9	3 5 7 8 9	2 6 7 9 7 8 9	3 5 6 8 9	
1 3 5 8 9	1 2 5 8	1 2 3 5 9 7 8 9	2 3 5 9 7 9	1 2 3 5 9 7 9	6	1 2 7 9	4	

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5 9	1 2 6 7	1 3 5 6 9
3 5 6 9	2 5 6 9	2 3 5 9	1 7	2 3 5 6 4 5 9 8	3 4 9	2 4 6 9	3 5 6 8 9	3
7	1 5 6 9	1 5 9	4 5 9	8	1 5 6 4 5 9	3 8	2 5	2
1 3 4 9	3 6	1 4 7	3 4 9	3 8	1 5 6 4 5 9	1 3 7	1 3 7	3
1 3 5 6	3 9	1 2 3 4 5 7	2 3 4 5 6	2 3 4 6 7	1 2 3 1 5 6 4 5 7	3 8	1 5 6 7	3
1 5 8	3 7	7 6	4 5 6	2 4 5	1 2 5 9	1 4	2 5 8	1 5 8
2	7	1 3 4 9	3 8 9	5	1 3 1 6 4 9 8	3 4 9	1 2 6 9	3 6 8 9
3 5 6 8 9	2 5 6 8	2 3 5 9	2 3 7 8 9	2 3 1 2 3 5 9 7 9	3 5 7 8 9	2 6 7 9	3 6 7 8 9	3
1 3 5 8 9	1 2 5 8	1 2 3 5 9	2 3 7 8 9	2 3 1 2 3 5 9 7 9	6 1 2 7 9	1 2 6 9	4	6

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5	1	6 9 7 5 6
3 5 6 9	2 5 6 9	1	7	2 3 5 6 9 8	4 5	4	6 9 5 6	8 9
7	1 5 6 9	1 5 9	4 5 9	8	5 6 9	1 4 5	3	2
1	4	6	4 5 7 9	3 4 9	8	2	5	1 3 7 9
5	9	2	4 5 7	2 3 4 6 7	2 3 1 2 3 1 3	4 5	8	1 3 5 6 7
8	3	7	6	4 5	1 2 5	9	1 2 4	1 5 8
2	7	1 3 4 9	3 4 8 9	5	1 3 1 3 1 3	1 4 6 9 9	1 3 6 6 8 9	3
3 5 6 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	2 3 1 2 3 5 7 8 9	3 5 7 8 9	2 6 7 9 7 8 9	3 5 6 7 8 9	3
1	3	1 2	1 2 3	2 3	2 3 1 2 3 5 9 7 9	6	1 2 7 9	4

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# Propagation Steps (Bounds Consistency)

4	1 2 5 6	8	5	6	2 3 5 6 9 7	1 5 9 7	1 6 7 9	1 5 6 9 7
3 6 9	2 5 6 9	5	1	7	2 3 5 6 9 8	4 5 8	4 6 9	5 6 8 9
7	6 1 4 5 9	4	8	9	1 4 5	3	2	
1	4	6	3 7 9	3 9	8 2	5		3
5	9	2	3 4 7	3 4 6	1 4 7	3	8	6
8	3	7	6	2 5	9	4	1	
2	7	4	3 4 8 9	5	6	1 3 4 8	1 6 9	3 6 8 9
6	2 5 6 8	3 5 9	2 3 5 7 8 9	1	4	5 7 8	2 6 7 9	3 5 6 7 8 9
3 1 2	1 3 5 9	1 3 5 9	2 3 5 7 8 9	2 3 9	7	6	1 2 7 9	4

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# Propagation Steps (Bounds Consistency)

4	1 2	8	5	6	2 3	1	1		
3	2	3			7		7	9	7 9
9	5	9	1	7	2 3	4 5	6	5	
7	6	1 5	4	8	9	1 5	3	2	
1	4	6		3	3	8	2	5	3
5	9	2	7	4	3	1	4	8	6
8	3	7	6	2	5	9	4	1	
2	7	4		3	5	6	1 3 1		3
6	2	3	8 9	2 3	1	4	8	9	8 9
8	5	9 7 8 9			7 8	5	3 2	5	3
3	1 2	1	2		3	7	6	1 2	
9	8		8		9	7 6			4

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# Propagation Steps (Bounds Consistency)

4	1 2	8	5	6	2 3	1	1		
3	2	3			7		7	9	7 9
9	5	9	1	7	2 3	4 5	6	5	
8	1	5	4	8	9	1 5	9	8	9
7	6	4	8	9	3	3	2		
1	4	6	3	3	8	2	5		3
5	9	2	7	4	3	1	3	8	6
8	3	7	6	2	5	9	4	1	
2	7	4		3	5	6	1 3	1	3
6	2	3	8 9	2 3	1	4	8	9	8 9
8	5	9 7 8 9			7 8	5	3 2	5	3
3	1 2	1	2	3	7	6	1 2		
9	8	5	8	9	7	6		4	

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# Propagation Steps (Bounds Consistency)

4	1 2	8	5	6	2 3	1	1		
3	2	3			7		7	9	7 9
9	5	9	1	7	2 3	4 5	6	5	
7	6	1 5	4	8	9	1 5	3	2	
1	4	6		3	3	8	2	5	3
5	9	2	7	3	3	1	3	8	6
8	3	7	6	2	5	9	4	1	
2	7	4		3	5	6	1 3	1	3
6	5	8	3	2 3	8 9	8	9	8 9	
3 1	1	5	2		3	5	3	2	3
9	5	8	8		7	6	7	9	7 8 9
						1 2			

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# Propagation Steps (Bounds Consistency)

4	1 2	8	5	6	2 3	1	1		
3	2	3			7		7	9	7 9
9	5	9	1	7	2 3	4 5	6	5	
7	6	1 5	4	8	9	1 5	3	2	
1	4	6		3	3	8	2	5	3
5	9	2	7	4	3	1	3	8	6
8	3	7	6	2	5	9	4	1	
2	7	4		3	5	6	1 3 1		3
6	5	3	2 3	1	4	8	3 2	5	3
3 1	1	2		3	7	6	1 2		
9	5	8		9	7	6	4		

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# Propagation Steps (Bounds Consistency)

4	1 2	8	5	6	2 3	1	1		
3	2	3			7		7	9	7 9
9	5	9	1	7	2 3	4 5	6	5	
7	6	1 5	4	8	9	1 5	3	2	
1	4	6		3	3	8	2	5	3
5	9	2	7	4	3	1	3	8	6
8	3	7	6	2	5	9	4	1	
2	7	4		3	5	6	1 3	1	3
6	5	3	2 3	1	4	5	3	2	3
3 1	1	2		3	7	6	1 2		
9	5	8		9	7	6		4	

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# After Setup (Bounds Consistency)

4	1 2	8	5	6	2 3	1	1		
3	2	3	1	7	2 3	4 5	6	5	8 9
9	5	9			8	9	8	9	
7	6	1 5	4	8	9	1 5	3	2	
1	4	6	3	3	8	2	5		3
5	9	2	3	3	1	7	8	6	
8	3	7	6	2	5	9	4	1	
2	7	4	3	5	6	1 3	1		3
6	5	3	2 3	1	4	8	9	8 9	
3	1	1	2	3	7	6	1 2		3
9	5	5	8	9	7	6	7	8 9	
8	8								

# Propagation Steps (Domain Consistency)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	6	1 2 3	1 2 3	8	1 2 3	1 2 3	3	2
4 5 6	4 5 6	9	4 5 6	4 5 6	8	4 5 6	4 5 6	2	5
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	4 5 6	7 8 9
1 2 3	1 2 3	9	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	8	4 5 6
4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	7 8 9
1 2 3	1 2 3	3	7	6	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	7 8 9
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

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# Propagation Steps (Domain Consistency)

<b>4</b>	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	<b>1</b>	<b>7</b>	1 2 3	1 2 3	1 2 3	1 2 3
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	<b>8</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	<b>6</b>	4 5 6	4 5 6	<b>8</b>	<b>2</b>	<b>5</b>	4 5 6
1 2 3	1 2 3	<b>9</b>	4 5 6	4 5 6	<b>8</b>	<b>2</b>	<b>5</b>	7 8 9
4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	<b>8</b>	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	<b>3</b>	<b>7</b>	<b>6</b>	4 5 6	4 5 6	<b>9</b>	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	7 8 9	7 8 9	<b>5</b>	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	<b>1</b>	<b>4</b>	4 5 6	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	<b>6</b>	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	<b>4</b>	7 8 9

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# Propagation Steps (Domain Consistency)

<b>4</b>	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6		5 6	5 6	5 6	5 6	5 6	5 6	5 6
7 9	8	7 9 7	9 7	9 7	9 7	9 7	9 7	9 7
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	1	7	4 5 6	4 5 6	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	7 8 9	7 8 9	7 8 9	7 8 9
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	3	2	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	6	4 5 6	4 5 6	8	2	5
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	7 8 9	7 8 9	7 8 9	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	
7 8 9	7 8 9	7 8 9	9	4 5 6	4 5 6	8	4 5 6	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	7 8 9	7 8 9	7 8 9	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	
7 8 9	7 8 9	7 8 9	3	7	6	9	4 5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	7 8 9	7 8 9	7 8 9	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	
7 8 9	7 8 9	7 8 9	2	7	5	4	5 6	4 5 6
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	7 8 9	7 8 9	7 8 9	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	

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# Propagation Steps (Domain Consistency)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6	7 9	5 6	7 9 7	9 7	9 7	9 7	9 7	9 7 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	1	7	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	6	1 2 3	1 2 3	8	2	5	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	9	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	3	7	6	1 2 3	1 2 3	1 2 3	1 2 3
5 6	7 8 9	7 8 9	7 8 9	7 8 9	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
2	7	1 2 3	1 2 3	5	1 2 3	1 2 3	1 2 3	1 2 3
4 5 6	7 8 9	4 5 6	4 5 6	7 8 9	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	1 2 3	1 2 3
5 6 4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 3	8	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
	5 6		5 6	5 6	5 6	5 6	5 6	5 6
	7 9		7 9 7	9 7	9 7	9 7	9 7	9 7
3	2 3	2 3		2 3	2 3	2 3	2 3	
5 6	4 5 6	4 5 6	1	7	4 5 6	4 5 6	4 5 6	4 5 6
8 9	8 9	8 9			8 9	8 9	8 9	8 9
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	4 5 6	4 5 6	8	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9	7 8 9	3 2
1	3 1 2 3		1 2 3	1 2 3				
5 6	4 5 6	6	4 5 6	4 5 6	8	2	5	4 5 6
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9				7 8 9
1	3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	9	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	
1	3	3 7 6	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6			4 5 6	4 5 6	9	4 5 6	4 5 6	
7 8 9			7 8 9	7 8 9		7 8 9	7 8 9	
2	7		1 2 3	1 2 3	5	4 5 6	4 5 6	4 5 6
			4 5 6	4 5 6		7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	1	4	4 5 6	4 5 6
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	
5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9		7 8 9	7 8 9	7 8 9
1	3 1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	6	4 5 6	4 5 6
5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	7 8 9	7 8 9	7 8 9
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	1 2 3 5 6 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	1 8	7 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9	2 3 4 5 6 4 5 6 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	3 8	2 8	2 3
1	3 1 2 5 6 4 5 6 7 8 9	6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 8	5 8	2 8
1	3 1 2 5 6 4 5 6 7 8 9	9 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 8	5 8	2 8
1	3 1 2 5 6 4 5 6 7 8 9	3 7 6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 9	3 9	1 2 3 4 5 6 4 5 6 7 8 9
2	7 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	5 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 9	3 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	3 7 8 9	4 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	2 6	3 6	1 2 3 4 5 6 4 5 6 7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	1 2 3 5 6 5 6				
3	2 5 6 8 9	2 3 4 5 6 8 9	1	7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 7 9	8	1 4 5 6 7 9	1 4 5 6 7 9	3	2
1	3 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	8 2 5	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	8	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	3 7 6	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
2	7	1 2 3 4 5 6 7 8 9	5	1 2 3 4 5 6 7 8 9			
1	3 5 6 7 8 9	1 2 3 4 5 6 8	1	4	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 5 6 7 8 9	1 2 3 4 5 6 8	7 8 9	7 8 9	6	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	1 2 3 5 6 7	1 2 3 5 6 9	1 2 3 5 6 7	1 2 3 5 6 9	1 2 3 5 6 9	1 2 3 5 6 9
3	2 5 6 8 9	2 3 4 5 6 8	1 9	7 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 7 9	1 4 5 6 9 7 9	1 4 5 6 8	1 4 5 6 7 9 7	1 4 5 6 9 7 9	3 4 5 6 3	2 4 5 6 2	1 2 3 4 5 6 3
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 8	2 5 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 3
1	3 5 6 7 8 9	1 2 3 4 5 9	1 2 3 4 5 6 4 5 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 8	1 2 3 4 5 6 4 5 6 7 8 9	8 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 5 6 7 8 9	1 2 3 4 5 9	1 2 3 4 5 6 4 5 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
2	7 4 5 9 7 8 9	1 2 3 4 5 6 5	1 2 3 4 5 6 1	1 2 3 4 5 6 4	1 2 3 4 5 6 7 8 9			
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8	1 2 3 4 5 6 4 5 9 7 8 9	1 2 3 4 5 6 4 5 6 1	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 6 8	1 2 3 4 5 6 4 5 9 7 8 9	1 2 3 4 5 6 4 5 6 6	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 7 8 9	1 2 3 4 5 6 4 5 6 4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	1 2 3 5 6 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 8 9	2 3 4 5 6 8	1 9	7 1 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 7 9	1 5 6 4 5 6 9	1 4 5 6 9 7 9	1 8 7 9	1 8 7 9 7	1 8 7 9 7 9	3 8 7 9	2 4 7 9	1 3 4 7 9
1 7 9	3 1 4 9	1 3 1 3 4 4 7 9 7 9	1 8 7 9	1 3 1 3 8 7 9	2 8 7 9	5 8 7 9	2 4 7 9	1 3 4 7 9
1 7 9	3 4 5 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 8 7 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	8 8 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1 7 9	3 4 5 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 8 7 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	8 8 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
2 7	1 2 4 5 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9	5 1	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1 7 9	3 1 2 4 5 6 8	1 2 3 1 2 3 4 5 6 4 5 6 9 7 8 9	1 4	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1 7 9	3 1 2 4 5 6 8	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 9 7 8 9 7 8 9 7 8 9	6 1	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 5 6 9 7	1 2 3 5 6 5 6 9 7	1 2 3 5 6 5 6 9 7	1 2 3 5 6 5 6 9 7	1 2 3 5 6 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 4 5 6 8 9			
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 7 9 7	3 4 5 6 8 9	2 8 9
1	3 1 4 7 9	1 6 7 9 7 9	3 1 3 4 4 7 9 7 9	8 2 7 8 9 7 8 9	2 5 7 8 9 7 8 9	1 3 4 7 8 9	1 3 2 4 5 6 7 8 9
1	3 5 6 7 8 9	9 4 5 9 7 8 9	1 2 3 4 5 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 5 6 7 8 9	3 7 6 4 5 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	5	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	2 3 4 5 9 7 8 9	1 4	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 7 8 9	1 2 3 4 5 8	2 3 4 5 9 7 8 9	1 2 3 4 5 6 9 7 8 9	6	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6	1 2 3 5 6 5 6 5 6
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7 9	7 9 7 9 7 9 7	2 3 4 5 6 8 9 8 9	2 3 4 5 6 8 9 8 9	2 3 4 5 6 8 9 8 9
1	1 5 6 7 9	1 4 5 6 9 7 9	8	1 4 5 6 7 9 7 9	1 4 5 6 7 9 7 9	3 4 5 6 8	2 4 5 6 7 9
1	3 1 4 7 9	1 6 4 5 7 9 7 9	3 1 3 4 4 8	8	2 4 5 6 7 9 7 9	5 1 3 4 7 9	1 3 4 5 6 7 9
1	3 5 6 7	1 2 3 4 5 7	2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 7 7 7 7 7 7	1 2 3 4 5 6 4 5 6 4 5 6 7 7 7 7 7 7 7	1 2 3 4 5 6 4 5 6 4 5 6 7 7 7 7 7 7 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7 9
1	3 5 6 7 8 9	3 7 6 4 5 7 8 9 7 8 9	1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	9	1 2 3 1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9	1 2 3 4 5 6 4 5 6 4 5 6 7 8 9 7 8 9 7 8 9
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 5	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8 9 7 8 9	2 3 4 5 1 9 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 8 9 7 8 9	2 3 4 5 1 9 7 8 9	1 2 3 4 5 6 7 8 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 4 5 6 7 9 7	1 4 5 6 9 7 9	3 4 5 6 7 9	2 4 5 6 7 9	1 3 4 7 9
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 8	2 3 8	5 6 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7
1	3 5 6 9 7 8 9	1 2 3 4 5 7	2 3 4 7	2 3 6 4 5 6 7 7	1 2 3 6 4 5 6 7 7			
1	3 5 6 9 7 8 9	3 7 9	6 4 9 7 8 9	2 3 1 2 3 6 4 5 6 9 7 8 9	1 2 3 1 2 3 6 4 5 6 9 7 8 9	1 2 3 1 2 3 6 4 5 6 9 7 8 9	1 2 3 1 2 3 6 4 5 6 9 7 8 9	1 2 3 1 2 3 6 4 5 6 9 7 8 9
2	7	1 2 3 4 5 9 7 8 9	5	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	1	4 6 9 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3	1 2 3 4 5 6 9 7 8 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4 7 8 9	4 7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3	2 5 6 4 5 6 8 9	1	7	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	8	1 4 5 6 7 9 7	1 4 5 6 7 9 7	1 4 5 6 7 9 7	3	2	
1	3 1 4 7 9	6	3 4 5 7 9	3 4 5 7 9	8 2 4 5 6 7 9 7	2 5	1 3 4 7 9	
1	3 5 6 9 7	9	1 2 3 4 5 7	2 3 4 6 4 5 6 7 9 7	1 2 3 4 5 6 7 9 7	8	1 2 3 4 5 6 7	
1	5 8	3 7 6	2 4 5 8	2 1 2 4 5 8	9 4 5 8	1 2 4 5 8	1 2 4 5 8	
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	5 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	8	1 2 3 4 5 9 7 8 9	1 2 3 4 5 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9	1 2 3 4 5 6 7 8 9 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	8	1 2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 4 5 6 9 7 8 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4	

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7			
3	2 5 6 4 5 6 8 9	2 3 4 5 8	1 9	7	2 3 5 6 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 6 9 7 9	3	2	1 3
1	3 1 4 7 9	1 6 7 9	3 4 9	3 4 9	8 7 9 7	2 5	5	1 3 4 7 9
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 6	2 3 4 6 7	1 2 3 5 6 7	1 2 3 4 5 6 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1	5 8	3 7 9	7 6 4	2 1 2 5	9	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 2 3 4 5 9 7 8 9	2 3 4 5 8 9	5	1 2 3 5 6 7 9 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 4 5 6 7 8 9			
1	3 1 2 5 6 4 5 6 7 8 9	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 9	2 3 4 6 9 7 9	1 2 3 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3 5 6 8 9	2 4 5 6 8	2 3 1 9	7 1 9	2 3 5 6 4 5 6 9	2 3 5 6 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	1 8 3	1 8 7	1 5 6 4 5 6 7 9 7 9	1 5 6 4 5 6 7 9 7 9	3 2	1 3 4 7 9	2
1 5 6 7 9	3 1 4 9	6	3 4 7 9	3 8 7	2 8 7	5 2 7	1 3 4 7 9	1 3 4 7 9
1 5 6 7	1 2 3 4 5 7	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 4 5 6 7 7	1 2 3 8 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 8	3 7 9	7	6 4 9	2 4 5	1 2 5 9	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3 4 8 9	5	1 3 1 6 4 9 8 9	1 3 1 6 4 9 8 9	1 3 1 6 4 9 8 9	1 3 1 6 4 9 8 9
1 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 2 3 4 6 9 7 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1 5 6 7 8 9	1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	1 2 3 4 6 9 7 9	6	1 2 3 4 5 6 7 8 9	4	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 3 5 6 7 9	1 2 3 5 6 7 9
3	2 5 6 4 5 6 8 9	2 3 4 5 9	1 7	2 3 5 6 9 8	3 4 5 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 7 9	1 5 6 4 5 6 9 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 7	3 4 5 8	2 4 5 6 7 9	2 4 5 6 7 9
1 7 9	3 1 4 7 9	6	3 4 5 7 9	3 4 6 9	8 5 6 7 7	2 4 5 7	5 4 5 6 8	1 3 4 7 9
1 7 9	3 1 4 5 9 4 5 7	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 7	1 3 4 5 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 8	3 7 6	3 7 6	2 4 5	1 2 5 9	1 2 4 5 9	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2 7	1 3 4 9	1 3 4 9 8 9	3 5	1 6 4 9 8	1 3 6 4 9 8	1 3 4 6 4 8 9	1 3 4 6 4 8 9	1 3 4 6 4 8 9
1 5 6 7 8 9	3 1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
1 5 6 7 8 9	3 1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 4 6 9 7 9	1 2 3 5 6 7 8 9	1 6 7 8 9	1 2 3 4 5 6 7 8 9	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 3 5 7 9	1 2 3 5 6 9 7	1 2 3 5 6 9 7
3 5 6 8 9	2 4 5 6 8	2 3 1 9	7	2 3 5 6 9	3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	1 8	1 5 6 7 9 7	1 4 5 9 7	3 4 5 6 8 9	2 4 5 6 8 9	2 4 5 6 8 9	2 4 5 6 8 9
1 5 6 7 9	3 1 4	6	3 4 5 7 9	3 4 6 9	8 5 6 7 7	2 4 5 6 8 9	5 7 9	1 3 4 7 9
1 5 6 7	3 1 4 5 9	1 2 3 4 5 7	2 3 4 5 9	2 3 4 6 7	1 2 3 5 6 7 7	1 3 4 5 6 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 6 8	3 7	7	6	2 4 5	1 2 5 9	1 2 4 5 8	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3	5	1 3 6 4 9	1 2 4 6 8 9	3 1 3 5 6 7 8 9	1 3 4 6 4 8 9 8 9
3 5 6 7 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	1 4 4 6 9 7 9	3 5 6 7 8 9	2 3 5 6 7 8 9	2 3 5 6 7 8 9	2 3 5 6 7 8 9
1 5 6 7 8 9	3 1 2 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 5 6 9 7 9	6 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	4	1 2 3 4 5 6 7 8 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	3 7	1 2 6 7 9	1 2 3 5 6 7 9
3 5 6 8 9	2 4 5 6 8	1	7	2 3 5 6 9 8	3 4 5 9	2 4 6 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9	2 3 4 5 6 8 9
1 5 6 7 9	1 4 5 6 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 5 6 9 7	3 5	2 4 7 9	2 4 7 9	2 4 7 9
1 5 6 7 9	1 4 9 7 9	6	3 4 5 7 9 9	3 4 6 7 9	8 5 6 7 7	2 4 5 9	5 7 9	1 3 4 7 9	1 3 4 7 9
1 5 6 7	1 2 3 4 5 7	9	2 3 4 5 7	2 3 4 6 7	1 2 3 5 6 7	1 3 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
1 5 8	3 7 9	7	6	2 4 5	1 2 3 5	9	1 2 4 9	1 2 4 5 8	1 2 4 5 8
2	7	1 3 4 9	3	5	1 3 1 6 4 9 8	3 5 9	1 2 4 9	1 2 4 6 9	1 2 4 6 9
3 5 6 7 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	1 4 4 5 9 7 8 9	3 5 7 8	2 6 7 9	2 3 6 7 8 9	2 3 6 7 8 9	2 3 6 7 8 9
1 5 6 7 8 9	1 2 3 4 5 6 8	1 2 3 4 5 9 7 8 9	2 3 4 5 9 7 8 9	2 3 1 2 3 4 6 5 6 9 7 9	1 2 3 4 6 7 9	6 4 7	1 2 4 6 7 9	1 2 4 6 7 9	1 2 4 6 7 9

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 6 7 9	1 2 3 5 6 7 9
3	2 5 6 4 5 6 8 9	2 3 4 5 9	1 7	2 3 5 6 9 8	3 4 5 9	2 4 6 9	2 3 4 5 6 8 9	
1	1 5 6 4 5 6 7 9	1 4 5 9 7 9	8	1 5 6 7 9 7	1 4 5 9 7	3 5	2 4 7 9	
1	3 1 4 7 9	1 6 4 5 7 9	3 4 9	3 8	2 8 2 7 7	5 3	1 3 4 7 9	
1	3 5 6 9 7	1 2 3 4 5 7	2 3 4 5 9	2 3 1 2 3 1 6 5 6 4 5 7 7	3 1 3 4 5 9	8 7	1 2 3 4 5 6 7	
1	5 8	3 7 4 5 9	7 6 4 5	2 1 2 5	9 4	1 2 4 9	1 2 4 5 8	
2	7	1 3 4 9	3 4 8 9	5	1 3 1 3 6 4 9 8	1 4 9	1 3 4 6 9 8 9	
3	2 5 6 8 7 8 9	2 3 5 9 7 8 9	2 3 5 9 7 9	2 3 1 2 3 5 9 7 9	3 2 5 7 8 9	1 2 6 7 9	2 3 5 6 7 8 9	
1	3 1 2 5 5 7 8 9	1 2 3 5 5 9 7 8 9	2 3 5 9 7 9	2 3 1 2 3 5 9 7 9	6 1 2 7 9	4 4		

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# Propagation Steps (Domain Consistency)

4	1 2	5 6	8	2 3	2 3	1 2 3	1	3	1 2	1 3
3	2	2 3		5	6	5 6	5	6	5 6	5 6
5 6	4 5 6	4 5	1	7	2 3	4 5	4	6	5 6	5 6
8 9	8	9			5 6	4 5	9	8	9	8 9
7	1	1			1	1	3	2	3	2
4 5 6	4 5	4 5	8	1	5 6	4 5	3	4	6	5 6
9 7 9	9 7	9		7	9 7	9 7	7	9	9	8 9
1 3	4	6			8	2	5	1	3	
7 9										7 9
1 3	9	1 2 3		2 3	2 3	1 2 3	1	3	1 3	
5 6	4 5	4 5		4 6	5 6	4 5	8	5 6	7	
7		7			7	7	7			
1	3	7	6	2	1 2	9	1 2	1	3	
5 8	3	7	6	4	5	9	4	5	8	
2	7	1 3	3	5	1	3 1	3	1	3	
4	4	9	8 9		6 4	9 8	4	6	6	
9					9	8	9	9	8 9	
3	2	2 3	2 3			3	2	3		
5 6	5 6	5	5			5	6	5 6		
7 8 9	8	9	7 8 9	1	4	7 8	7	9	7 8 9	
1 3	1 2	1 2 3	2 3	2 3	1 2 3	5	1 2			
5	5	5	5		5	6				
7 8 9	8	9	7 8 9	9 7	9	6	7	9		
1	2	3	4	5	6	7	8	9	10	11

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 7 9	2 3 6 9 7	1 2 3 5 6 9 7	1 5	1 2 6 7 9	1 3 5 6 7 9
3 5 6 9	2 5 6 9	2 3 5 9	1 7	2 3 5 6 4 5 9 8	3	2 4 6 9	3 5 6 8 9	3
7	1 5 6 9	1 5 9	4 8	1 5 6 4 5 9	3	2 5	3 7 9	2
1 3 9	4 6		3 7 9	3 9	8 2	5 7 9	1 3 7 9	3
1 3 5 6	9	1 2 3 4 5 7	2 3 4 5 7	2 3 1 2 3 1 6 5 6 4 5 7 7	3 8	1 2 5 7 5 6 7	1 3 5 6 7	3
1 5 8	3 7	7 6	4	2 1 2 5	9 4	1 2 5 4 6 7 9	1 5 8	1
2	7	1 3 4 9	3 8 9	5 1	1 3 1 3 6 4 9 8	1 4 6 4 6 9 9	1 3 6 5 6 8 9	6
3 5 6 8 9	2 5 6 8	2 3 5 9 7 8 9	2 3 5 9 7 8 9	2 3 1 2 3 5 7 8 9	3 5 7 8 9	2 6 7 9	3 5 6 7 8 9	3
1 3 5 8 9	1 2 5 8	1 2 3 5 9 7 8 9	2 3 5 9 7 9	2 3 1 2 3 5 9 7 9	6 1 2 7 9	1 2 6 7 9	4	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5	3	1 2 6 7	1 3 5 6 9
3 5 6 9	2 5 6 9	2 3 5 9	1 7	2 3 5 6 9 8	3 4 5 8	2 4 9	6 5 6 9	2 6 9	3 8 9
7	1 5 6 9	1 5 9	4 8	5 6 9	1 5	3 2	3 2	2 5	1 3 7 9
1 3 9	4 6	3 7 9	3 9	8 2	2 3 1 2 3 1 3	5 4 5	1 3 8	1 3 7 9	1 3 5 6
1 3 5 6	9	1 2 3 4 5	2 3 5	2 3 4 6	1 2 3 1 3	5 6 4 5 7 7	1 3 8	1 3 7	1 3 5 6
1 5 8	3 7	7 6	4 5	2 1 2 5	1 2 3 1 3	4 9	1 2 4	1 5 8	1 3 6 9
2	7	1 3 4 9	3 8 9	5	1 3 1 3 6 4 9 8	1 3 5 7 8	1 3 4 6 9	1 3 6 9	1 3 6 8 9
3 5 6 8 9	2 5 6 8	2 3 5 9	2 3 7 8 9	1 5 9 7 9	3 5 7 8	2 6 7 9	3 6 7 8 9	2 6 5 6 7 8 9	3 6 5 6
1 3 5 8 9	1 2 5 8	1 2 3 5 9	2 3 7 8 9	2 3 1 2 3 5 9 7 9	1 2 3 1 3 6 9	1 2 6 7 9	1 2 6 7 9	1 2 6 7 9	4

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# Propagation Steps (Domain Consistency)

4	1 2 5 6	8	2 3 5 9	2 3 6 9	2 3 5 6 9 7	1 5	1	6 9 7 5 6
3 5 6 9	2 5 6 9	2 3 5 9	1	7	2 3 5 6 9 8	4 5	4 6 9	5 6 8 9
7	1 5 6 9	1 5	4	8	5 6 9	1 5	3	2
1	4	6	7 9	3 9	8	2	5	1 3 7 9
5	9	2	7 5	2 3 4 6	2 3 5 6 7 7	1 2 3 4 5 1 3	8	1 3 5 6 7
8	3	7	6	4 2	1 2 5	9	1 2 4	1 5 8
2	7	4	8 9	3 8 9	5	1 6 9	3 4 1 6 9	1 3 6 8 9
3 5 6 8 9	2 5 6 8	2 3 5 9 7 8 9	1	4	2 3 5 7 8	1 6 7 9	2 6 7 8 9	3 5 6 7 8 9
1 5 8 9	3 5 8	1 2 5 9 7 8 9	2 3 2 3 9 7 9	2 3 1 2 3 5 9	6	1 2 7 9	4	

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# Propagation Steps (Domain Consistency)



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# Propagation Steps (Domain Consistency)



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# Propagation Steps (Domain Consistency)



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# Propagation Steps (Domain Consistency)



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# Propagation Steps (Domain Consistency)



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# Propagation Steps (Domain Consistency)

4	2	8	5	6	3	1	7	9	7	9
3 9	5	3 9	1	7	2	4	6	8		
7	6	1	4	8	9	5	3	2		
1	4	6	7 9	3 9	3 9	8	2	5	7 9	
5	9	2	7 9	4	1	7 9	8	6		
8	3	7	6	2	5	9	4	1		
2	7	4		3 9	5	6	8	1		3 9
6	8		3 9	2	1	4		3 7 9	5	
3 9	1	5	8		3 9	7	6	2	4	

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# After Setup (Domain Consistency)

4	2	8	5	6	3	1	7	9	7	9
3 9	5	3 9	1	7	2	4	6	8		
7	6	1	4	8	9	5	3	2		
1	4	6	7 9	3 9	8	2	5		3 7	
5	9	2	7 3	4	1	7 3	8	6		
8	3	7	6	2	5	9	4	1		
2	7	4		3 9	5	6	8	1		3 9
6	8		3 9	2	1	4	7 3	7 9	5	
3 9	1	5	8	3 9	7	6	2	4		

# Comparison

Forward Checking

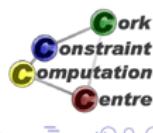
4	1 2	8	2 3	3	2 3 1	1	6	5 6
3	2	5	3	8	6	7	9	7 8 9
6	5	6	5	1	7	4	5	6 5 6
9	8	9	9	9	8	9	8	8 9
1	6	5	6	4 5	6	4 5	6	5 6
7	5	8	5	8	6	4 5	3	2
9	8	9	9	9	7	8	9	8 9
1	4	6	3	3	8	2	5	7
5	9	2	4	4	7	7	8	7 6
8	3	7	6	2	5	9	4	1
2	7	4	3	3	9	1	2	3
9	8	9	8	9	8	9	8	9
3	6	5	3	2 3	1	5	2	7 8 9
8	5	6	5	9	8	7	5	7 8 9
9	8	9	9	7 8 9	9	7	8	7 8 9
3	1	5	3	2 3	3	2 3	1	2
9	8	9	9	7	9	6	7	8 9

Bounds Consistency

4	1 2	8	5	6	2 3 1	1	6	5 6
3	2	5	3	8	6	7	9	7 8 9
9	8	9	9	9	8	9	8	8 9
7	6	1	5	4	8	9	3	2
9	8	7	6	7	5	3	2	3
1	4	6	3	3	8	2	5	7
5	9	2	4	4	1	7	8	6
8	3	7	6	2	5	9	4	1
2	7	4	3	3	5	6	1	3
9	8	9	8	9	8	9	8	9
6	5	6	5	6	7	8	5	3
3	1	5	3	2 3	1	4	2	3
9	8	9	9	9	7	8	7	8 9

Domain Consistency

4	2	8	5	6	3	1	7	3 7 9
5	3	1	7	2	4	6	8	3
7	6	1	4	8	9	5	3	2
1	4	6	3	3	8	2	5	7
5	9	2	4	1	7	8	6	3
8	3	7	6	2	5	9	4	1
2	7	4	3	5	6	8	1	9
6	8	2	1	4	7	7	5	5
3	1	5	8	9	7	6	2	4



# Instrumented indomain

```
tree_indomain_generic(Term,Handle,Handle,Type) :-  
    Handle = visualization{ignore_fixed:IgnoreFixed,  
                          var_arg:VarArg,  
                          name_arg:NameArg,  
                          focus_arg:FocusArg},  
    arg(VarArg,Term,X),  
    ((integer(X), IgnoreFixed = yes) ->  
        true  
    ;  
        arg(NameArg,Term,Name),  
        arg(FocusArg,Term,Focus),  
        get_domain_as_list(X,L),  
        get_domain_size(X,Size),  
        reorganize_domain(X,L,Type,K),  
        try_value(Handle,X,K,Name,Size,Focus)  
    ).
```

# Instrumented indomain

```
try_value(Handle, X, [V|_], Name, Size, Focus) :-  
  ((X = V, true) ->  
   try(Handle, Name, Size, V),  
   focus_option(Focus, FocusOption),  
   draw_visualization(Handle, FocusOption)  
 ;  
   failure(Handle, Name, Size, V),  
   fail_option(Focus, V, FailOption),  
   draw_visualization(Handle, FailOption),  
   fail  
 ).  
try_value(Handle, X, [_|R], Name, Size, Focus) :-  
  try_value(Handle, X, R, Name, Size, Focus).
```

# Outline

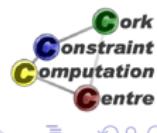
1 Introduction

2 Visualization by Annotation

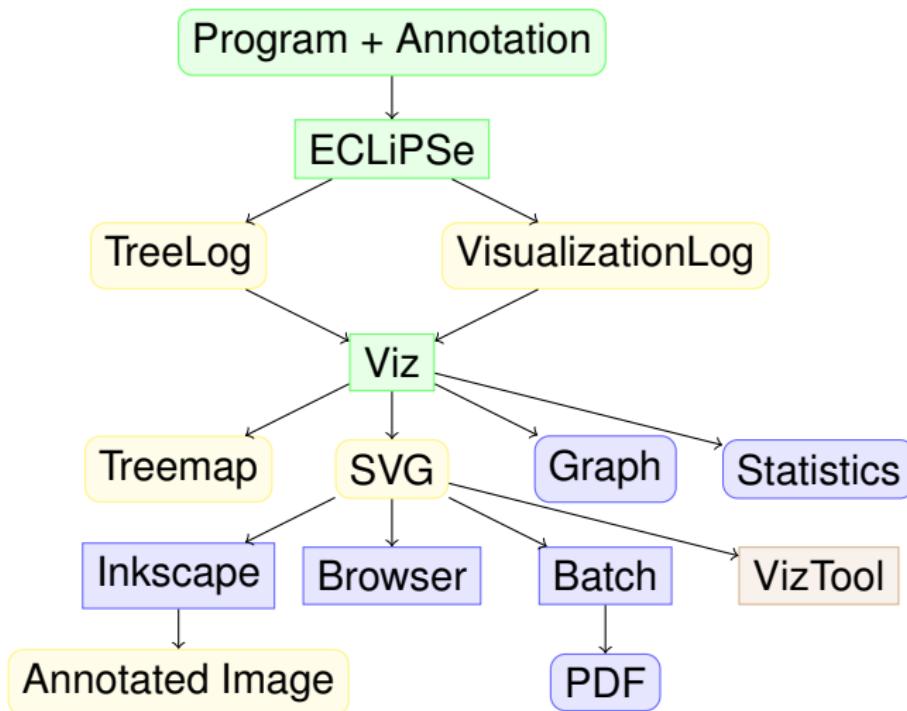
3 **Visualization Interface**

- TreeLog Format
- VisualizerLog Format

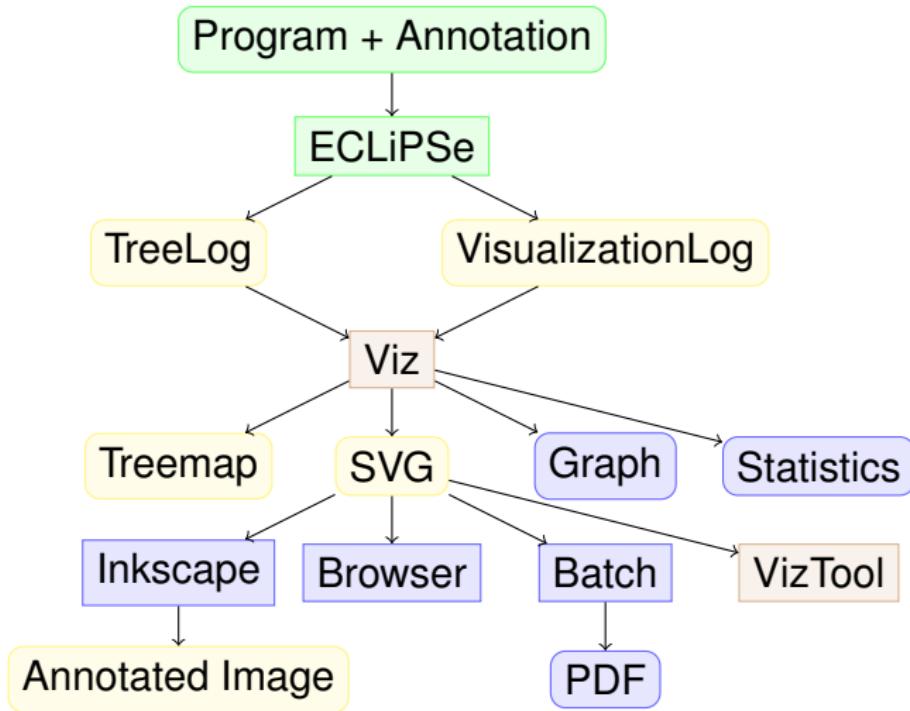
4 Conclusions



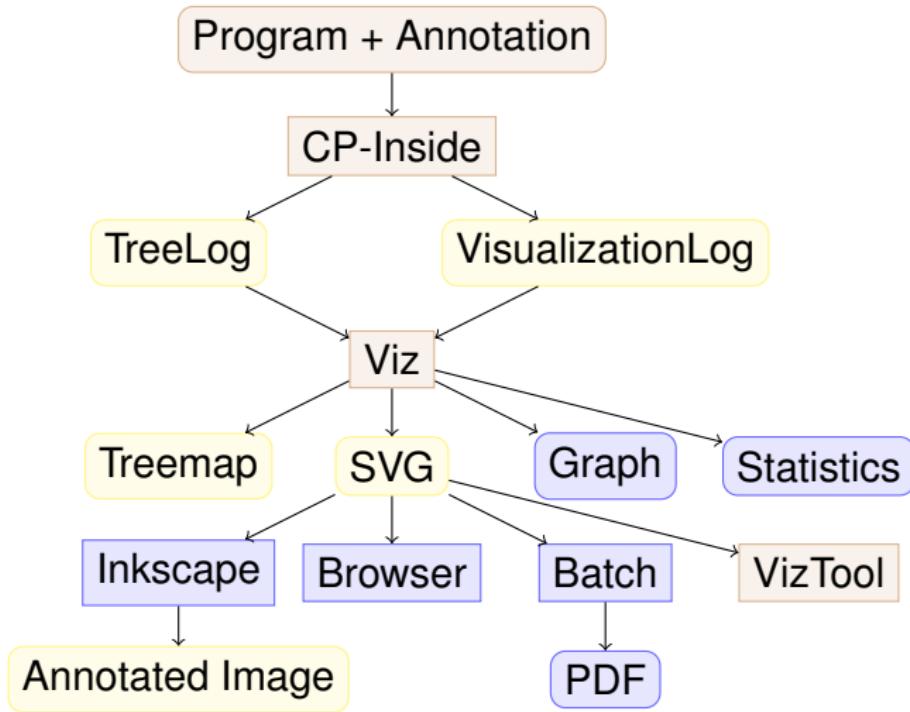
# Architecture (Current)



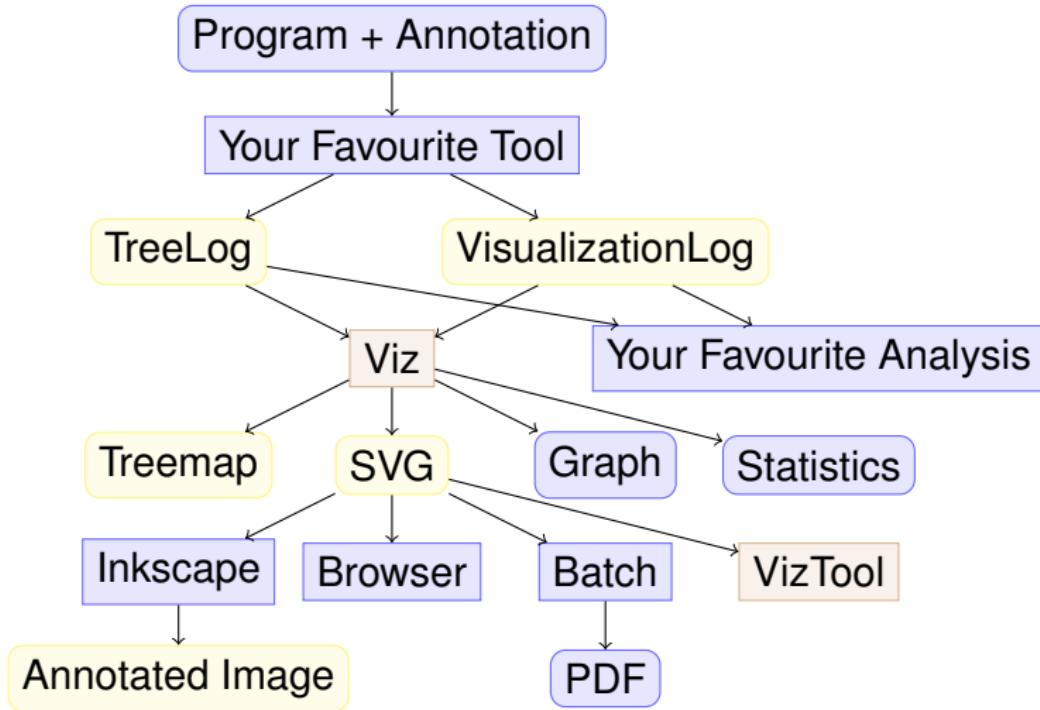
# Architecture (Planned)



# CP-Inside

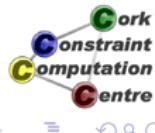


# Generic Tool



# TreeLog Format

- XML based description
- Record information about nodes in search tree
  - Choices
  - Failures
  - Success
- Redundant information to ease generation

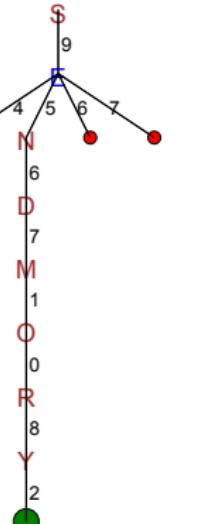


# TreeLog Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<tree version="1.0" >
<root id="0"/>
<try id="1" parent="0" name="S" size="1" value="9" />
<fail id="2" parent="1" name="E" size="4" value="4" />
<try id="3" parent="1" name="E" size="4" value="5" />
<try id="4" parent="3" name="N" size="1" value="6" />
<try id="5" parent="4" name="D" size="1" value="7" />
<try id="6" parent="5" name="M" size="1" value="1" />
<try id="7" parent="6" name="O" size="1" value="0" />
<try id="8" parent="7" name="R" size="1" value="8" />
<try id="9" parent="8" name="Y" size="1" value="2" />
<succ id="9"/>
<fail id="10" parent="1" name="E" size="4" value="6" />
<fail id="11" parent="1" name="E" size="4" value="7" />
</tree>
```

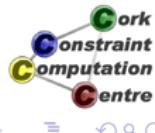
# TreeLog Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<tree version="1.0" >
<root id="0"/>
<try id="1" parent="0" name="S" size="1" value="9" />
<fail id="2" parent="1" name="E" size="4" value="4" />
<try id="3" parent="1" name="E" size="4" value="5" />
<try id="4" parent="3" name="N" size="1" value="6" />
<try id="5" parent="4" name="D" size="1" value="7" />
<try id="6" parent="5" name="M" size="1" value="1" />
<try id="7" parent="6" name="O" size="1" value="0" />
<try id="8" parent="7" name="R" size="1" value="8" />
<try id="9" parent="8" name="Y" size="1" value="2" />
<succ id="9"/>
<fail id="10" parent="1" name="E" size="4" value="6" />
<fail id="11" parent="1" name="E" size="4" value="7" />
</tree>
```



# VisualizerLog Format

- XML based description
- Describe state of variables and/or constraints at specific stages
  - Where annotated in program
  - For every node in tree
- Linked to search tree log



# VisualizerLog Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<visualization version="1.0" >
<visualizer id="1" type="vector" display="expanded" x="0" y="0"
    width="8" height="10" group="1" min="0"   max="9" />
<state id="1" tree_node="-1" >
<visualizer_state id="1" >
<dvar index="1" domain="0 .. 9" />
<dvar index="2" domain="0 .. 9" />
<dvar index="3" domain="0 .. 9" />
<dvar index="4" domain="0 .. 9" />
<dvar index="5" domain="0 .. 9" />
<dvar index="6" domain="0 .. 9" />
<dvar index="7" domain="0 .. 9" />
<dvar index="8" domain="0 .. 9" />
</visualizer_state>
</state>
...

```

# VisualizerLog Example

```
...
<state id="2" tree_node="-1" >
<visualizer_state id="1" >
<dvar index="1" domain="1 .. 9" />
<dvar index="2" domain="0 .. 9" />
<dvar index="3" domain="0 .. 9" />
<dvar index="4" domain="0 .. 9" />
<dvar index="5" domain="0 .. 9" />
<dvar index="6" domain="0 .. 9" />
<dvar index="7" domain="0 .. 9" />
<dvar index="8" domain="0 .. 9" />
</visualizer_state>
</state>
...
```

# VisualizerLog Example

```
...
<state id="5" tree_node="1" >
<visualizer_state id="1" >
<integer index="1" value="9" />
<dvar index="2" domain="4 .. 7" />
<dvar index="3" domain="5 .. 8" />
<dvar index="4" domain="2 .. 8" />
<integer index="5" value="1" />
<integer index="6" value="0" />
<dvar index="7" domain="2 .. 8" />
<dvar index="8" domain="2 .. 8" />
<focus group="-" index="1" />
</visualizer_state>
</state>
...

```

# VisualizerLog Example

```
...
<state id="6" tree_node="2" >
<visualizer_state id="1" >
<integer index="1" value="9" />
<dvar index="2" domain="4 .. 7" />
<dvar index="3" domain="5 .. 8" />
<dvar index="4" domain="2 .. 8" />
<integer index="5" value="1" />
<integer index="6" value="0" />
<dvar index="7" domain="2 .. 8" />
<dvar index="8" domain="2 .. 8" />
<failed group="-" index="2" value="4" />
</visualizer_state>
</state>
...

```

# VisualizerLog Example

```
...
<state id="14" tree_node="9" >
<visualizer_state id="1" >
<integer index="1" value="9" />
<integer index="2" value="5" />
<integer index="3" value="6" />
<integer index="4" value="7" />
<integer index="5" value="1" />
<integer index="6" value="0" />
<integer index="7" value="8" />
<integer index="8" value="2" />
</visualizer_state>
</state>
...
</visualization>
```

# Outline

1 Introduction

2 Visualization by Annotation

3 Visualization Interface

4 Conclusions



# Conclusions

- New ELearning course for ECLiPSe
- Open source material, Creative Commons BY-NC-SA license
  - Application driven
  - Modelling with global constraints
  - Customizing search
- Effort only justifiable through Cisco grant

# Visualization

- Design choice: System independent
- Provide enough information to user of system, not to tool developer
- Relatively few primitives, extensible for specific global constraints
- XML intermediate format, open for specific analysis

