

HW 4

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CSP Problem: Cryptarithm

The solution is shown in Fig. 1. The *Step* column shows the action performed in that step and the values obtained for each variable after taking that action is tabulated in the subsequent columns. *Failure Detected* column shows if any inference results into any constraint violation, *Constraint violated* column shows which constraints cause the failure, *Backtrack to Step* column shows the step number where the solver backtracks if any failure happens. Once it backtracks, the solver tries other actions different from the one that resulted into the failure. Once we get the values for each variable satisfying all the constraints, we achieve a solution. *Is Solution* column dictates whether an action results into a solution.

Step No.	Step	C10	C100	O	E	V	N	D	Failure Detected	Constraint violated	Backtrack to Step	Is Solution
1	Initial setup	0,1	0,1	1,2,3,4,5,6,7,8,9	1	0, 1,2,3,4,5,6,7,8,9	0, 1,2,3,4,5,6,7,8,9	0, 1,2,3,4,5,6,7,8,9	NA	NA	NA	NA
2	Inference (AllDiff only)	0,1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	NA	NA	NA	NA
3	Choose variable C10, choose value 0	0	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	NA	NA	NA	NA
4	Inference (AllDiff+2+3)	0	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,4,6,8	-	Y		3	NA
5	Choose variable C10, choose value 1	1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	NA	NA	NA	NA
6	Inference (AllDiff+2+3)	1	1	2,3,4,6,7,8,9	1	2,3,4,6,7,8,9		0	5 NA	NA	NA	NA
7	Choose O, choose value 2	1	1		2	1, 0,2,3,4,5,6,7,8,9		0	5 NA	NA	NA	NA
8	Inference (AllDiff+2+3+4)	1	1		2	1		0	5 Y		4	3 NA
9	Choose variable C100, choose value 0	0,1	0	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9	NA	NA	NA	NA
10	Inference (AllDiff+3+4)	1	0	5,6,7,8,9	1	2,4,6,8	2,3,4,5,6,7,8,9		0 NA	NA	NA	NA
11	Choose variable O, choose value 5	1	0		5	1, 2,4,6,8	2,3,4,5,6,7,8,9		0 NA	NA	NA	NA
12	Inference (AllDiff+2+4)	1	0		5	1	-	-	0 Y	3,4		3 NA
13	Choose variable D, choose value 0	0,1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9		0 NA	NA	NA	NA
14	Inference (AllDiff+2+3)	0		2,3,4,5,6,7,8,9	1	-	-		0 Y	AllDiff+2		13 NA
15	Choose variable D, choose value 2	0,1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9		2 NA	NA	NA	NA
16	Inference (AllDiff+2+3)	0	-	3,5,6,7,8,9	1	0,3,5,6,7,8,9		4	2 Y		3	13 NA
17	Choose variable D, choose value 3	0,1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9		3 NA	NA	NA	NA
18	Inference (AllDiff+2+3)	0	-	2,4,5,7,8,9	1	0,2,4,5,7,8,9		6	3 Y		3	13 NA
19	Choose variable D, choose value 4	0,1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9		4 NA	NA	NA	NA
20	Inference (AllDiff+2+3)	0	-	2,3,5,6,7,9	1	0,2,3,5,6,7,9		8	4 Y		3	13 NA
21	Choose variable D, choose value 5	0,1	0,1	2,3,4,5,6,7,8,9	1	0,2,3,4,5,6,7,8,9	0,2,3,4,5,6,7,8,9		5 NA	NA	NA	NA
22	Inference (AllDiff+2+3)	1	1	2,3,4,6,7,8,9	1	2,3,4,6,7,8,9		0	5 NA	NA	NA	NA
23	Choose variable O, choose value 2	1	1		2	1, 2,3,4,6,7,8,9		0	5 NA	NA	NA	NA
24	Inference (AllDiff+4)	1	1		2	1	-	0	5 Y		4	23 NA
25	Choose variable O, choose value 3	1	1		3	1, 2,3,4,6,7,8,9		0	5 NA	NA	NA	NA
26	Inference (AllDiff+4)	1	1		3	1	-	0	5 Y		4	23 NA
27	Choose variable O, choose value 4	1	1		4	1, 2,3,4,6,7,8,9		0	5 NA	NA	NA	NA
28	Inference (AllDiff+4)	1	1		4	1	-	0	5 Y		4	23 NA
29	Choose variable O, choose value 6	1	1		6	1, 2,3,4,6,7,8,9		0	5 NA	NA	NA	NA
30	Inference (AllDiff+4)	1	1		6	1	3	0	5 NA	NA	NA	Y

Figure 1: CSP: Cryptarithm Solution Step

The solution I have achieved is:

Table 1: Solution

	6	6	5
+	6	6	5
	1	3	1
	0		