

CS251 Data Structures – Fall 2009
Program 2 – Sudoku Generator
50 points
Due: Nov. 10

By now we're all familiar with Sudoku puzzles, like the one below:

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

The object of this puzzle is to fill in the rest of the grid with numbers such that each row, column and 3 by 3 square contains the digits 1 through 9. The values above are chosen so that there is only one unique solution. The object of this project is to generate such puzzles.

Input : Input will consist of a single integer r which specifies how many digits should be in the puzzle when it is finished. The maximum value for r is obviously 81 (i.e., a fully filled grid), and we'll use 25 as the lowest allowed value – any lower value entered should be set to 25 (you can actually go lower than 25, but it sometimes takes a while to generate a puzzle for r less than 25).

Algorithm : You should use a backtracking algorithm to solve this problem, in two different capacities. First, you should write a backtracking method which when given a sudoku grid returns a boolean value indicating whether or not there is a unique solution. You may want to modify your input to first read in such puzzles to check this portion of your project.

Once you have the checker working, you then must write another backtracking method which, along with a random number generator, completely fills in a grid. Once you have a grid, you can start removing values from it and then check to see if you still have a puzzle with a unique solution. If you remove a value and find that there are more than two solutions, then you must put it back and try removing another one.

(over)

Output : Your program should output two items. The puzzle should be output to standard output using the format below:

```

+--+--+--+--+--+--+
|4| | | | | | | |
+--+--+--+--+--+--+
| | | | |1| |8|
+--+--+--+--+--+--+
|1|2| |3| |7|9|
+--+--+--+--+--+--+
| | |8| |4| | |
+--+--+--+--+--+--+
|9| | | | | | |
+--+--+--+--+--+--+
| | |6| |5|7|
+--+--+--+--+--+--+
|8| | | |6| |
+--+--+--+--+--+--+
| |5| |4|3| |
+--+--+--+--+--+--+
| |3|1| | | |
+--+--+--+--+--+--+

```

In addition, you should output the solution to your puzzle to the file XXX.ans, where XXX are the first three letters of you last name. Use the same format for the solution. You can open a file for output in C++ as follows:

```

#include <fstream>
...
int main() {
...
    ofstream fout("XXX.ans");
    ...
    fout << ....           // you can then use fout like you would cout

```

You may work in groups of 2 for this project.