CS6023 GPU Course Project

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1 Problem statement and Results

- So , the problem is sudoku solver using knuth's algorithm X , by converting sudoku problem as an exact cover problem and solving it using algorithm x.
- So given a 9X9 matrix as input sudoku in input.txt file , an empty entry is given as zero , we generate the exact cover matrix , and solve it by using algorithm x , then using results obtained we fill missing elements in the given input sudoku.
- for the input below ,
  0 0 0 0 0 0 2 0 0
  0 8 0 0 0 7 0 9 0
  6 0 2 0 0 0 5 0 0
  0 7 0 0 6 0 0 0 0
  0 0 0 9 0 1 0 0 0
  0 0 0 0 2 0 0 4 0
  0 0 5 0 0 0 6 0 3
  0 9 0 4 0 0 0 7 0
  0 0 6 0 0 0 0 0 0
  we got output ,
  9 5 7 6 1 3 2 8 4
  4 8 3 2 5 7 1 9 6
  6 1 2 8 4 9 5 3 7
  1 7 8 3 6 4 9 5 2
  5 2 4 9 7 1 3 6 8
  3 6 9 5 2 8 7 4 1
  8 4 5 7 9 2 6 1 3
  2 9 1 4 3 6 8 7 5
  7 3 6 1 8 5 4 2 9

  and time taken by cpu execution is 991 milliseconds in one instance.
  And time taken by gpu execution is 189 milliseconds in the same instance.

2 Challanges Faced

- I couldn't model 9X9 sudoku as an exact cover problem , so I modelled 4X4 sudoku as an exact cover problem and generated it's exact cover matrix , using that I could Model 9X9 Sudoku as an exact cover problem and generate the exact cover matrix for it.
- Filling the entries of exact cover matrix was very tough as the position of 1's varies with a lot of different patterns , i used 4x4 sudoku exact cover matrix for recognizing the patterns and then filled 1's in 9x9 sudoku exact cover matrix.
- I couldn't use first coloumn to store name of the coloumn and first element in row for row name , as it is a 729 X 324 matrix.So i used a structure with 3 integer entries one for matrix entry (either 1 or 0) , row number and coloumn number , had to make row number and coloumn

number values to be distinct and representing the names they would have if we are using string to name them.

- The normal algorithm x gives the desired output directly but here , The soln we get directly doesn't give the output sudoku , we need to go through the soln matrix and fill the missing sudoku entries based where the 1 entries present.