Discrete Mathematics Sec. #02. HW#1

2019.10.09

< Puzzle. Number Cross >

1. Constraints of a solution

Number Cross is a puzzle consisting of a M \* N matrix. Cells in each row and each column have a number from 1 to 9. With that, each cell has a unique color , black or white. In addition, one M numbers of sequence and one N numbers of sequence are additionally given which represents M numbers of sequence for sum of black tiles of each column and N numbers of sequence for sum of white tiles of each row.

* 1. Number Cross consists of a M \* N matrix and the sum of each row and column are given.
  2. Each cell can have only two colors, black or white which represents 1 and 0.
  3. The sum of the number which has a black tile in each column should be equal to given sequence of sum numbers.
  4. The sum of the number which has a white tile in each row should be equal to given sequence of sum numbers.

1. Logic formula
   1. The C-language array was used to create a M\*N cells where only one number (0 or 1) could be contained in each cell.
   2. The numbers in each cell consist of number 0 or 1.
      1. is the number in the i-th row, j-th column.
   3. When the given sequence of sum of the numbers in each column is and row is , one of combination of numbers in each line should be equal to each or .
      1. the sum of numbers which has black tile in i-th column.  
           
          the sum of numbers which has white tile in j-th row.
      2. , the output value is satisfied below condition,  
           
         There is a set ,  
         satisfying .  
           
         Value of Index of members of can be written as .
2. Correctness of programs
   1. <Input 1> from program description.

A close up of a keyboard

Description automatically generated A close up of a keyboard

Description automatically generated  
 <Input> <Output>

* 1. Input which has no Solution

A black sign with white text

Description automatically generated   
  
<Input> <Output>

1. Discussion
   1. Through this puzzle, finding the exact sum of number in each column or row was not that easy. I used own function which calculates combinations of numbers recursively when the sum is given. I think it consumes lot of compile time. If there is a way without calculating all combinations, it will be much more faster than this solution.