There are 1 questions for a total of 25 points.

(25) 1. The Tiling problem: There is an $n \times n$ grid ($1 \leq n \leq 500$) in which some cells are empty and some are filled. The empty/filled cells are given by an $n \times n$ matrix F. Cell (i, j) is empty iff $F[i, j] = 1$. You have unbounded supply of 2×1 tiles (called dominoes). Each domino could be placed on the empty cells of the grid in horizontal and vertical manner (note that you need two consecutive empty cells on the grid for doing this). The problem is to determine if placing these 2×1 dominos such that each empty cell is covered by exactly one domino can cover the grid. If such a tiling is possible, then you should also give a tiling.

Your programs should take input from a file named `input.txt` and should write the output in a file named `output.txt`. Your programs should produce an output within 2 minutes for this assignment. The format for input and output files are as follows.

INPUT: The first line in the input file is the value n. The next n lines define each row of the matrix F. Below we give an example input file (*there are no spaces between characters in a line*).

```
4
1111
1011
1111
0111
```

OUTPUT: The first line of the output file should be 1 if tiling is possible otherwise 0. If the first line is 1, then the subsequent lines should give the tiling. Each line should give the coordinates of the two adjacent cells on which a 2×1 tile is placed. Below is the output file corresponding to the above input file (*there are no spaces between characters in any line*).

```
1
(1,1)(2,1)
(1,2)(1,3)
(1,4)(2,4)
(3,1)(3,2)
(2,3)(3,3)
(4,2)(4,3)
(3,4)(4,4)
```

SUBMISSION INSTRUCTIONS: All your program files should be in a directory named ⟨Your entry no.⟩. You will be asked to create a zip of this directory and submit this zip file. In this directory, there should be a makefile that will compile your code (read about makefile on the net in case you do not know what it is). After running `make`, the directory should have executable called `tile`. This when executed, should read the input file (`input.txt`) and write the answer in the output file (`output.txt`).

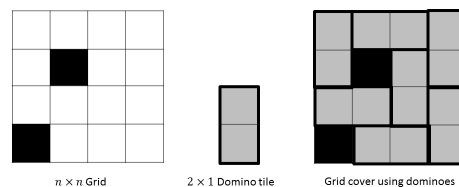$n \times n$ Grid 2×1 Domino tile   Grid cover using dominoes

Figure 1: The setting given in the example input and output.