Algorithms and Programming
Laboratory number 08

Exercise 01

Write a C program solving the "magic square" problem.

A "magic square" of size equal to n is a (n x n) matrix of
integers containing only integer numbers from 1 to (n x n),
such that the sum of those values on all rows, on all columns,
and on the two diagonals is the same.

The program has to receive two parameters on the command line:
* an integer value n
* a name of a file

and it has to store one magic square of size n on the file.

Example

If we suppose to run the program with the following two parameters
3 square.txt
it has to store in the file the following matrix:

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

which includes all numbers from 1 to 9 (3x3) and satisfy the requested
criteria (all the above mentioned sums are equal to 15).

Exercise 02

The reflected binary code, also known as Gray code after Frank Gray,
is a binary numeral system where two successive values differ in only
one bit (binary digit).

The code list for n bits can be generated recursively from the list

for n−1 bits by reflecting the list (i.e. listing the entries in reverse order), concatenating the original list with the reversed list, prefixing the entries in the original list with a binary 0, and then prefixing the entries in the reflected list with a binary 1.

Example

The two codes of length equal to 1 are made-up of one 0 and one 1:

```
   0
   1
```

To move from 1 to 2 bits, the list is firstly reflected (-- indicates a mirror), and then 0s are added above and 1s below the reflection point.

```
   0        0       00
   1        1       01
---      ---      ---
            1       11
            0       10
```

The process in then repeated to move from 2 to 3 bits (reflection and then 0s and 1s addition):

```
  00       00      000
  01       01      001
  11       11      011
  10       10      010
---      ---      ---
           10      110
           11      111
           01      101
           00      100
           00      100
```

Write a recursive program that:
- Receives n as a parameter
- Generates all Gray code on n bits, and stores the code in a dynamic
  matrix with n rows and 2^n columns
- Prints out the resulting matrix.