ECE 175 Computer Programming for Engineering Applications

Fall 2017

Lab Assignment #6

Wednesday March 14

Relevant Programming Concepts:

- **Two-D Arrays**
- **Functions**

1 Parity

You are given a two-dimensional array of size 5x5 that contains only binary values. You are to compute the "parity" values of this array. For a given row (column) of the array, the corresponding parity bit is equal to 1 if the number of ones in that row (column) is odd, and 0 otherwise.

Develop a program that:

- Reads a 5x5 two-dimensional array from file *array.txt* (create that file). Use the following function prototype for reading the array

```
void read_ar(FILE *in, int x[ ][5]);
```

- Computes the horizontal and vertical parity words
- Computes the total parity bit. The total parity bit is 1 if the number of ones in the entire matrix is odd, and 0 otherwise.
- Prints the result to the screen

Example:

$$A = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix} \begin{matrix} 1 \\ 0 \\ 1 \\ 0 \\ 0 \end{matrix}$$

$$\begin{matrix} 1 & 0 & 0 & 0 & 1 \end{matrix}$$

```
Horizontal parity word: 1 0 1 0 0
Vertical parity word: 1 0 0 0 1
Total parity bit: 0
```

2 Four in a Diagonal Line

You are given a two-dimensional array of size 6x7 that contains *1's*, *2's*, and *3's*. Write a function that determines if there are four *1's* or *2's* in a diagonal line. Your function should ignore *3's*. Also, do not check the reverse-diagonals.

Develop a program that:

- Reads a 6x7 two-dimensional array from file *test_diagonals.txt* (create that file). Modify the function *read_ar* from problem 1 to create

```
void read_mat(FILE *in, int x[][7]);
```

- Checks if there is a diagonal line of four *1's*, or four *2's*. Pass back *true* (1) if a diagonal is found, *false* (0) otherwise. Use the function prototype

```
int CheckDiagonals(int x[][7], int TestInt);
```

  TestInt is either 1 or 2 since the function is to decide whether a diagonal of four 1's or 2's exists.

- Prints the result to the screen

Example 1:

$$B = \begin{bmatrix} 1 & 3 & 3 & 3 & 3 & 3 & 3 \\ 3 & 1 & 1 & 1 & 1 & 1 & 3 \\ 1 & 3 & 3 & 3 & 2 & 3 & 3 \\ 3 & 3 & 1 & 2 & 3 & 3 & 3 \\ 3 & 3 & 2 & 1 & 3 & 3 & 3 \\ 3 & 2 & 3 & 3 & 3 & 2 & 3 \end{bmatrix}$$

```
No diagonals found in the matrix
```

Example 2:

$$B = \begin{bmatrix} 1 & 3 & 3 & 3 & 3 & 3 & 3 \\ 1 & 1 & 1 & 1 & 1 & 1 & 3 \\ 1 & 1 & 3 & 3 & 2 & 3 & 3 \\ 3 & 3 & 1 & 2 & 3 & 3 & 3 \\ 3 & 3 & 2 & 1 & 3 & 3 & 3 \\ 3 & 2 & 3 & 3 & 3 & 2 & 3 \end{bmatrix}$$

```
At least one diagonal of four 1's exists in the matrix
```

Example 3:

$$B = \begin{bmatrix} 1 & 3 & 3 & 3 & 3 & 3 & 3 \\ 1 & 1 & 1 & 1 & 1 & 1 & 3 \\ 1 & 1 & 2 & 3 & 2 & 3 & 3 \\ 3 & 3 & 1 & 2 & 3 & 3 & 3 \\ 3 & 3 & 2 & 1 & 2 & 3 & 3 \\ 3 & 2 & 3 & 3 & 3 & 2 & 3 \end{bmatrix}$$

```
At least one diagonal of four 1's exists in the matrix
At least one diagonal of four 2's exists in the matrix
```