CS 7A - Fall 2016 - Sam Lloyd's 14-15 Puzzle. Due 11/8/16

Background Theory

For a long time it was not clear when the first slide puzzle was invented or made. But it was thought to be a well-known fact that in 1878 the American Puzzler, Sam Lloyd "drove the whole world crazy" (his words) with his 14-15 puzzle. This was a variation on the "Puzzle of 15" which was made and sold by the Embossing Company from New York about 10 years earlier. This puzzle consisted of 15 numbered square pieces that could be slid around in a square box that was big enough to contain 16 pieces. The pieces should be placed at random in the box and you should sort the pieces in ascending order without taking the pieces out of the box (so the only thing that is allowed is to slide the pieces). Not every randomly placed pattern of pieces can be sorted by just shuffling and Sam Lloyd cleverly made use of this fact.

Your task is to write code to simulate play with the 15 puzzle. Write definitions for the functions in the following template to accomplish this.

1. Write code to meet these specifications:
   Precondition: A randomly shuffled 15 puzzle, which may be solvable or not and an interface for the user to make legal moves.
   Postcondition: A record of the sequence of moves the user made, the number of moves and the total time taken to solve the puzzle or declare it unsolvable. A "move" should be thought of as moving the empty space either up, down, left or right (U,D,L,R). In fact, moving the space up is equivalent to moving the tile above it down.

```
#include "std_lib_facilities.h" //include cstdlib, ctime and iomanip
// Prototype descriptions (enter a prototype that fits.)

// display() shows it on the console.  For example, if
// board = {1, 2, 3, 4, 5, 16, 7, 8, 9, 10, 11, 12, 13, 14, 15, 6}
// then display shows
//  1  2  3  4
//  5     7  8
//  9 10 11 12
// 13 14 15  6

//shuffle() Use the \href{http://en.wikipedia.org/wiki/Fisher Yates_shuffle}{Fi
//After shuffling the board, a call to the function disply will produce a
shuffled board like this:
/* 14  5  4 11
   12  9  6  7
      13  8 10
   15  1  3  2 */
//
//  1  2  3  4
//  5  6  7  8
//  9 10 11 12
// 13 14 15

class Board {
public:
    int size = 4; // The dimension of the square board
    vector<int> tiles;
        void getMove(tiles);  // prompts the use to enter u, d, l, r
                                                  // (or some other scheme)
    void shuffle(tiles);
        void display(tiles);
        bool won(); //returns true if the game board is as below, otherwise false
        Board(); //     constructor
};
int main()
{   // Initialize board with blank tiles in the lower right corner:
    // create a Board, b
    //game loop
    while(!b.won())
    {   // construct a board with size*size tiles
        getMove(board, size); // function calls     size is const int,
        display(board, size); // board is the address in memory of the
    }                          // first element of the array, board[]
}
// define display()
// define shuffle()
// define won()
// define getMove()
```

Submit the code using your initials in the usual format: say XX_fifteen.cpp