

CS007A: Sam Lloyd's Fifteen Puzzle



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 Sam Lloyd, America's greatest puzzle-expert, "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 templates and definitions for the functions in the following template to accomplish this.

```
// include the necessary file
using namespace std;

// Prototype descriptions (enter a prototype that fits this.

// Display() takes a board and shows it on the console
// For instance, take
// board[] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16}
// and display,
// 1 2 3 4
// 5 6 7 8
// 9 10 11 12
// 13 14 15

//shuffle() takes a board and mixes it up
//After shuffling the board, a call to the function dispaly will produce a
```

```

shuffled board like this:
/*
 14  5  4 11
 12  9  6  7
    13  8 10
 15  1  3  2 */

// won() returns true if the game board is in the form, otherwise false
// 1  2  3  4
// 5  6  7  8
// 9 10 11 12
// 13 14 15

// getMove() prompts the use to enter u, d, l, r
// moves the pieces on the board accordingly

int main()
{
    // Initialize board with blank tile (16) in the lower right corner:
    const int size = 16; // The dimension of an array must be constant
    int board[size] = {1,  2,  3,  4,
                      5,  6,  7,  8,
                      9, 10, 11, 12,
                      13, 14, 15, 16 }; // added white space for clarity

    srand(time(0));
    setiosflags(ios::right); // redundant?
    //initialize
    shuffle(board);
    display(board);
    //game loop
    while(!won(board))
    {
        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[]
    return 0;
}

//define display()

//define shuffle()

// define won()

// define getMove()

```

The play might look like this:

```

Play the amazing 15 puzzle!

Your initial game board looks like this:

  7  5 10  2
14  3  9 13
15    1 11
  6  8  4 12

```

Enter u, d, r, or l to move the game piece into the blank: u

```
7 5 10 2
14 3 9 13
15 8 1 11
6 4 12
```

Enter u, d, r, or l to move the game piece into the blank: u

You can't do that.

```
7 5 10 2
14 3 9 13
15 8 1 11
6 4 12
```

Enter u, d, r, or l to move the game piece into the blank: r

```
7 5 10 2
14 3 9 13
15 8 1 11
6 4 12
```

Enter u, d, r, or l to move the game piece into the blank: d

```
7 5 10 2
14 3 9 13
8 1 11
15 6 4 12
```

Enter u, d, r, or l to move the game piece into the blank: d

```
7 5 10 2
3 9 13
14 8 1 11
15 6 4 12
```

Enter u, d, r, or l to move the game piece into the blank:
