Course C^{++} , Exercise Number 8

Deadline: 12.05.2017

The Fifteen Puzzle

The fifteen puzzle http://en.wikipedia.org/wiki/15_puzzle) was invented by Noyes Palmer Chapman in 1875. In the beginning of 1880, the puzzle became a craze, that lasted approximately half a year. (In 1981, Rubik's cube had a similar effect.)

We will solve the 15-puzzle by the search algorithm that is described in the slides.

We implement the function F by an unordered_map, and the set U by a priority_queue.

1. Download the files in directory fifteen from the course homepage. Write the two constructors of fifteen, and operator << . This last operator must be made friend.

You can use std::setw(), defined in iomanip to format the output.

- 2. Complete the missing members of class fifteen. These are solvedposition(), hashvalue(), equals(), makemove(), issolved(), distance().
- 3. Complete the function

which constructs a path towards ${\tt f},$ assuming that ${\tt levels}$ contains ${\tt f}$ at level ${\tt level}.$

P.S. Half of the states of the fifteen puzzle has no solution. This may be a problem if you randomly generate a state, and try to solve it.