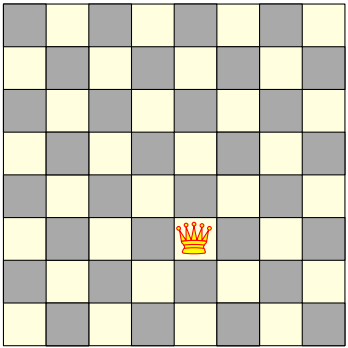
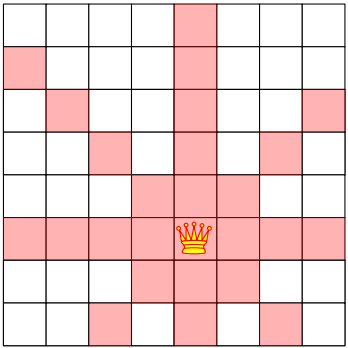
12.2
Search trees and backtracking

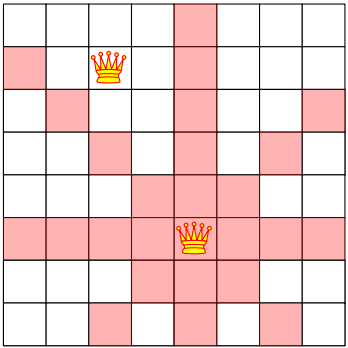
The queens problem



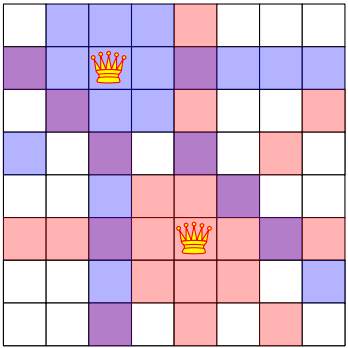
The queens problem



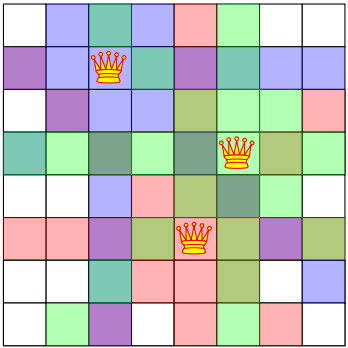
The queens problem



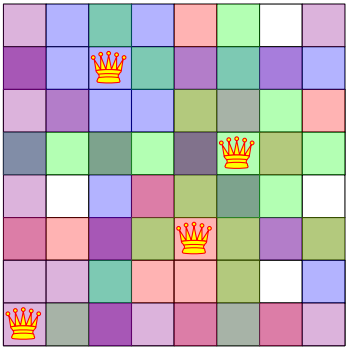
The queens problem



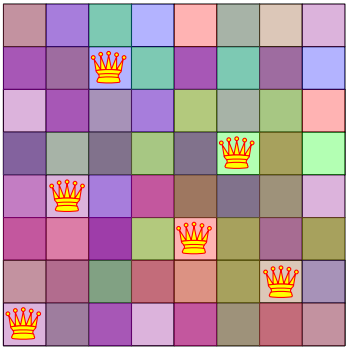
The queens problem



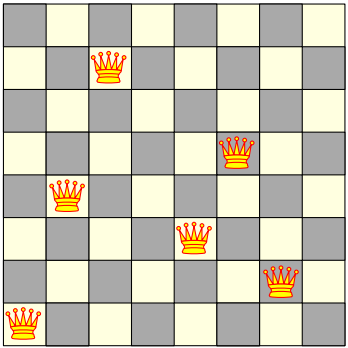
The queens problem



The queens problem



The queens problem

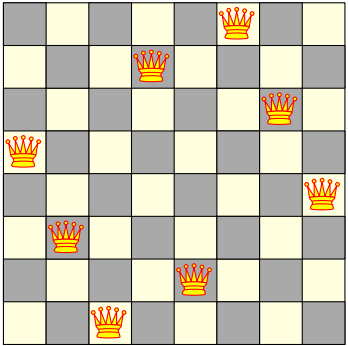


Q: How many queens can one place on the board?

Q: Can one place 8 queens on the board?

The eight queens puzzle

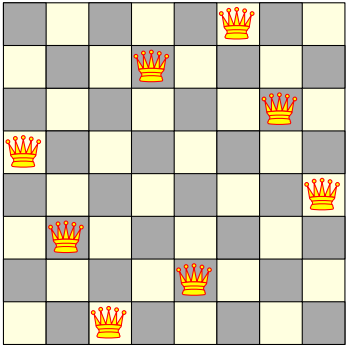
Problem published in 1848, solved in 1850.



Q: How to solve problem for general n?

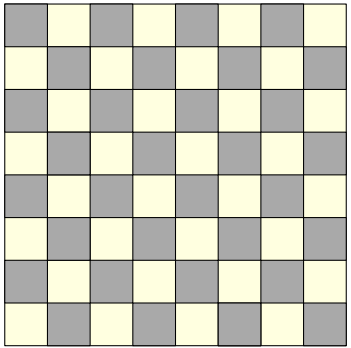
The eight queens puzzle

Problem published in 1848, solved in 1850.

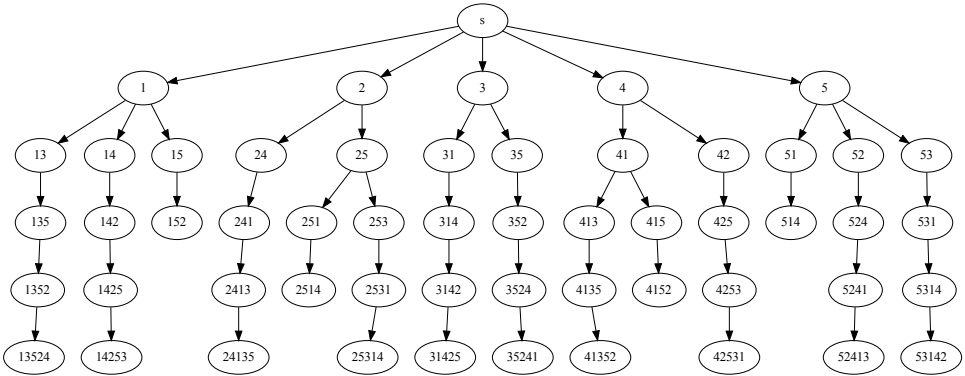


Q: How to solve problem for general n?

Strategy: Search tree



Search tree for 5 queens



Backtracking: Informal definition

Recursive search over an implicit tree, where we "backtrack" if certain possibilities do not work.

n queens C++ code

```
void  generate_permutations( int  * permut, int  row, int  n )
{
   if  ( row == n ) {
      print_board( permut, n );
      return;
   }

   for  ( int  val = 1; val <= n; val++ )
      if  ( isValid( permut, row, val ) ) {
         permut[ row ] = val;
         generate_permutations( permut, row + 1, n );
      }
}

generate_permutations( permut, 0, 8 );
```

THE END

...

(for now)