Épreuve de section européenne

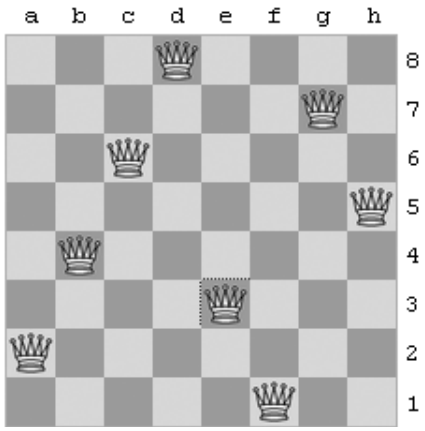
The eight queens puzzle

The eight queens puzzle is the problem of putting eight chess queens on an 8×8 chessboard such that none of them is able to capture any other using the standard chess queen's moves. The color of the queens is meaningless in this puzzle, and any queen is assumed to be able to attack any other. Thus, a solution requires that no two queens share the same row, column, or diagonal. The eight queens puzzle is an example of the more general n queens puzzle of placing n queens on an $n \times n$ chessboard.

There is a simple algorithm yielding a solution to the n queens puzzle for $n = 1$ or any $n \geqslant 4$:

1. Divide n by 12. Remember the remainder (it's 8 for the eight queens puzzle).
2. Write a list of the even numbers from 2 to n in order.
3. If the remainder is 3 or 9, move 2 to the end of the list.
4. Write the odd numbers from 1 to n in order, but, if the remainder is 8, switch pairs (i.e. 3, 1, 7, 5, 11, 9, ...).
5. If the remainder is 2, switch the places of 1 and 3, then move 5 to the end of the list.
6. If the remainder is 3 or 9, move 1 and 3 to the end of the list.
7. Place the first-column queen in the row with the first number in the list, place the second-column queen in the row with the second number in the list, etc.

For $n = 8$ this results in the solution shown below.



From *Wikipedia*, the Free Encyclopedia.

Questions

1. Check that the solution given for the eight queens puzzle is correct.
2. Use the algorithm to give a solution for $n = 5$.
3. Solve the puzzle for $n = 1$ and $n = 3$.
4. Find a different solution for $n = 8$.