Ch.5:Backtracking

5.1. Backtracking :General method

- Backtracking is a **systematic way** to go through all the possible configurations of a search space.
- In the general case, we assume our **solution** is a vector

  a = (a[1], a[2], …, a[n])

  where each element a[i] is selected from a **finite ordered set** S[i].

. Backtracking : General Method

- We build a **partial solution** of length *k*

  a = (a[1], a[2], …, a[k])

  and try to **extend** it by adding another element.
- After extending it, we will **test** whether what we have so far is still possible as a partial solution.

Backtracking

If it is still a **candidate solution**, great.

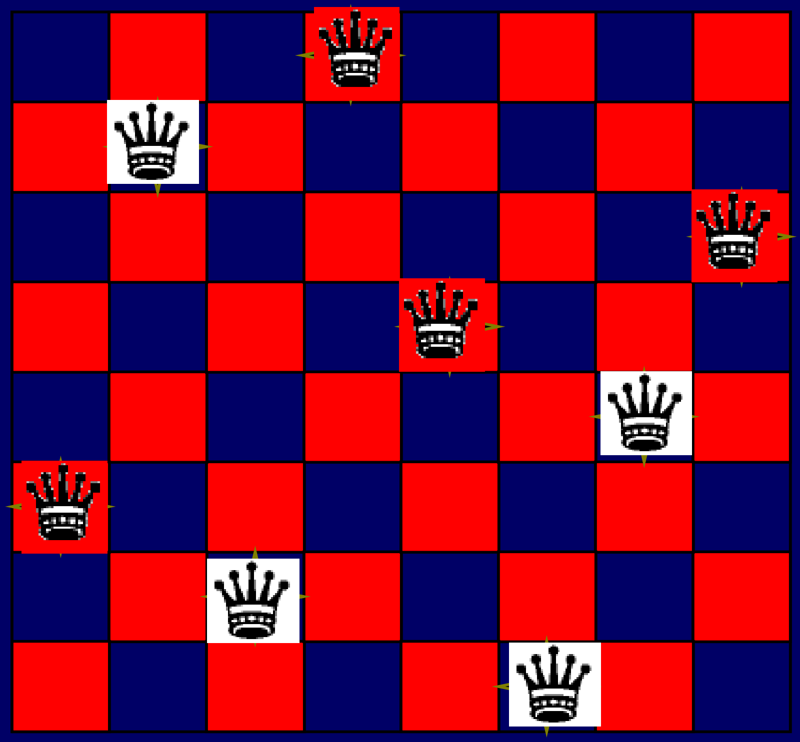
If not, we **delete** a[k] and **try the next element** from S[k].

Backtracking Concept

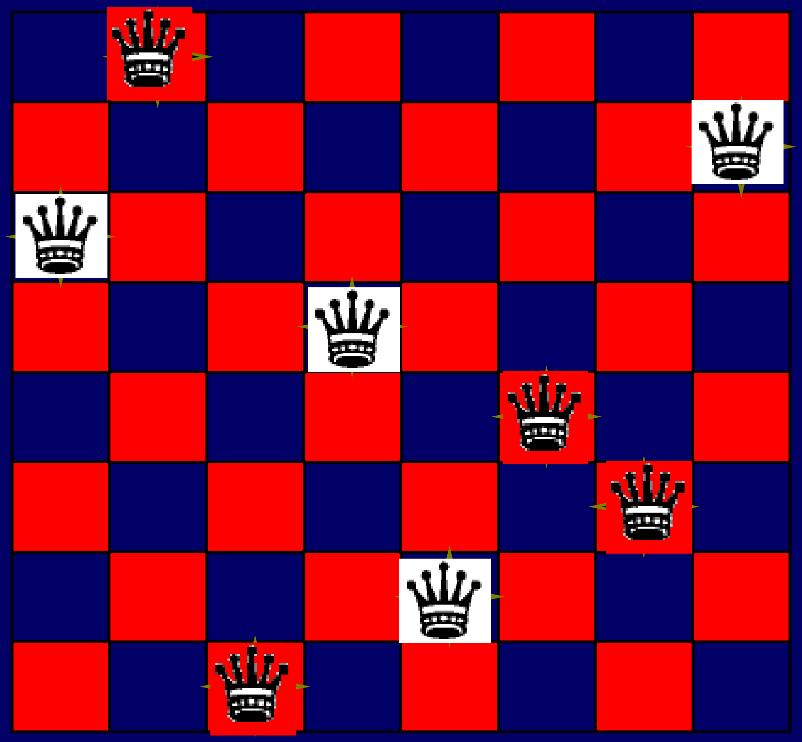
- **Recursion** can be used for elegant and easy implementation of backtracking.
- Backtracking can easily be used to **iterate** through all subsets or permutations of a set.
- Backtracking ensures correctness by enumerating **all possibilities**.
- For backtracking to be efficient, we must **prune** the search space.

4.2. Eight Queen Problem (1/7)

Place **8 queens** in a chessboard so that no two queens are in the same row, column, or diagonal.

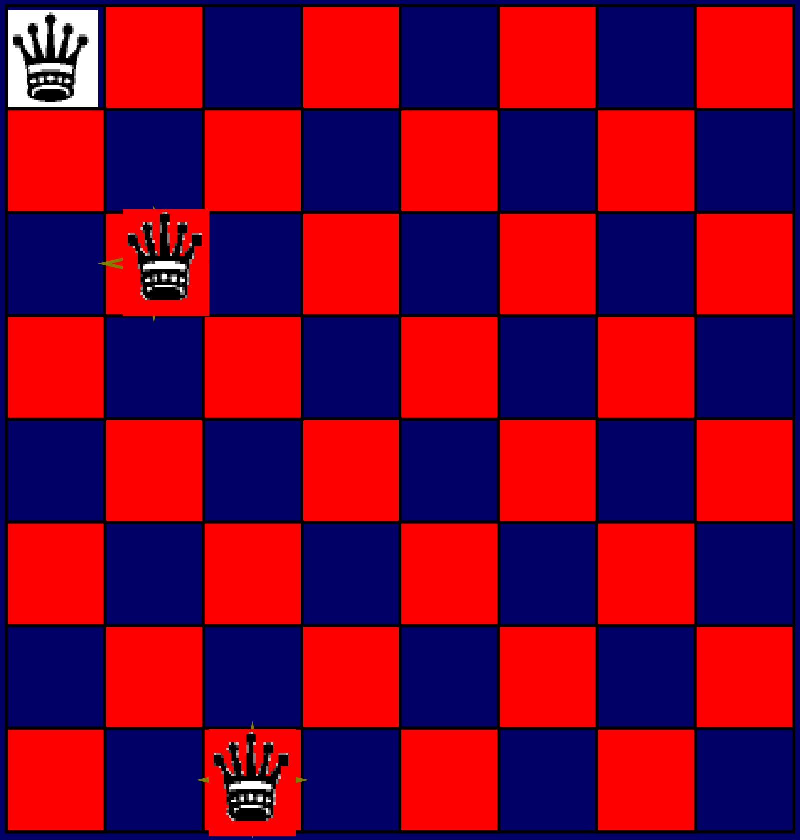


A solution



Not a solution

4.2. Eight Queen Problem (2/7)

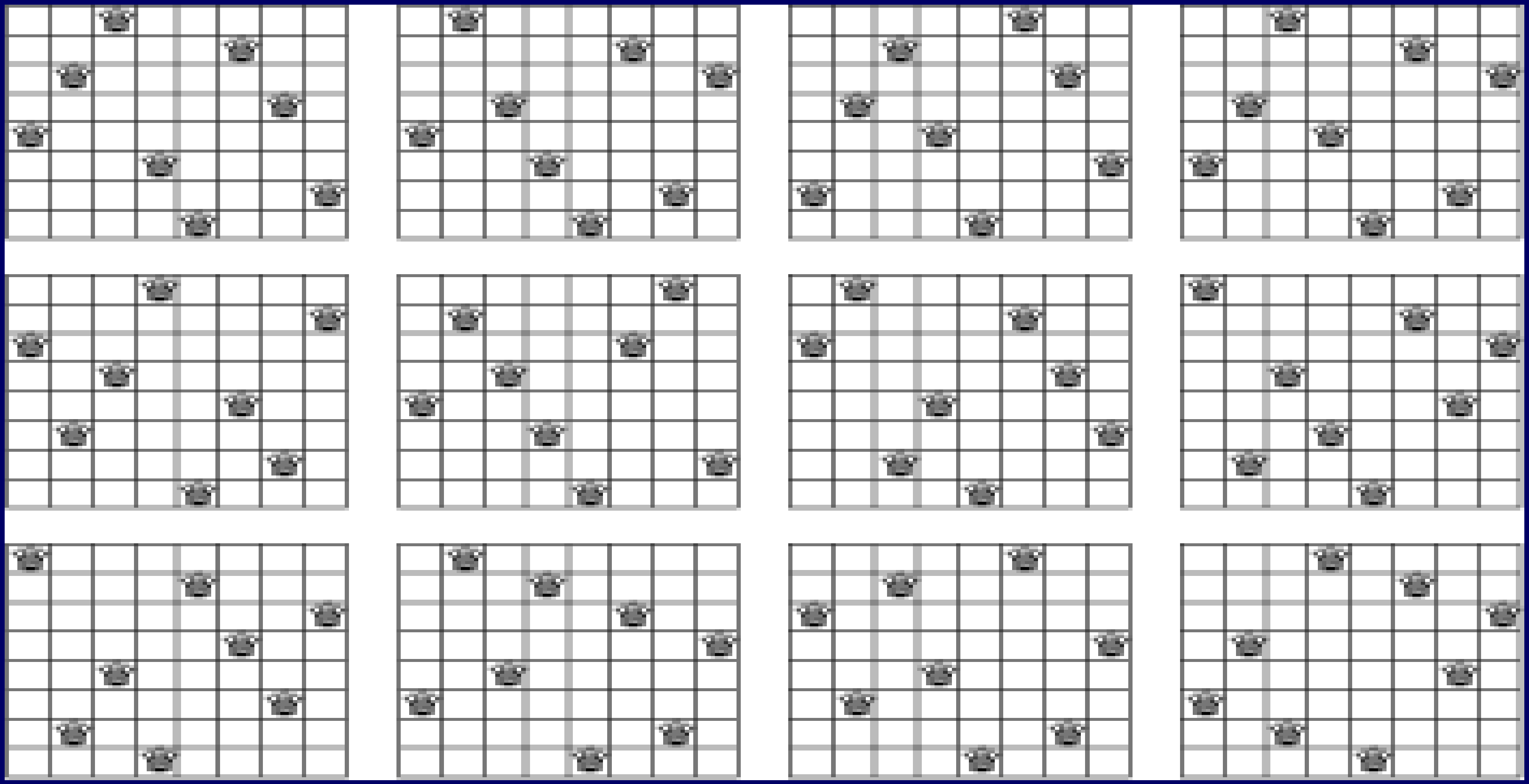


Suppose two queens are placed at position (i,j) &(k,l) .Two queen will attack each other if
i-j=k-l or i+j=k+l
Which is same as
j-l=i-k & j-l=k-i

→ 64^8 states with 8 queens

4.2. Eight Queen Problem ()

Some solutions from 92 Solutions



Can a new queen be placed?

```
Algorithm Place(k,i)
{
for j=1 to k-1 do
   if((x[j==)or (Abs x[j]-i)=Abs(j-k))
        then return false;
   return true;
}
```

All solution to the n-queen problem

```
Algorithm NQueen(k, n)
{
  for i= 1 to n do
  {
   if Place(k,i) then
   {
          x[k]:=i;
          if(k=n) then write(x[1:n]);
          else Nqueen(k+1,n);
   }
  }
}
```

Analysis of 8-Queen problem

If we consider 64 position & reject illegal configuration, no. of configuration will be

864=4,426,165,368

If we place one queen in one row then

88=16,777,216

If we reject the position of column, row, diagonal position whose position are guarded then no. of configuration 8!=40320

Application & scope of research

- To develop such an algorithm for eight queen problem whose complexity is less than 8!

Assignment

Q.1)Explain N queen problem.

Q.2)What is attacking position of two queen?

Q.3)What is efficiency of 8-Queen problem?