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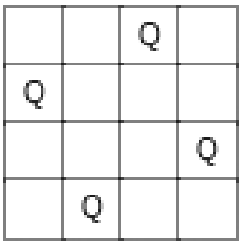
REPORT FOR LAB 1

The N Queens Problem

1. A visual representation of the solution on a chessboard. You are free to use any program to generate the visual representation and it may be in text format if required. No extra marks will be given for a good representation.

This is the applet we have used to generate the visual representation:
https://www.cs.usfca.edu/~galles/visualization/RecQueens.html




```
s SATISFIABLE
v -1 -2 3 -4 5 -6 -7 -8 -9 -10 -11 12 -13 14 -15 -16 0
```

As we can observe, the output of the SAT-Solver it's the same as in the visual representation.

2. Time to solve problem for n=10, 30, 50.

for n = 10

```
python nqueens.py 10
0.00713610649109
```

for n = 30

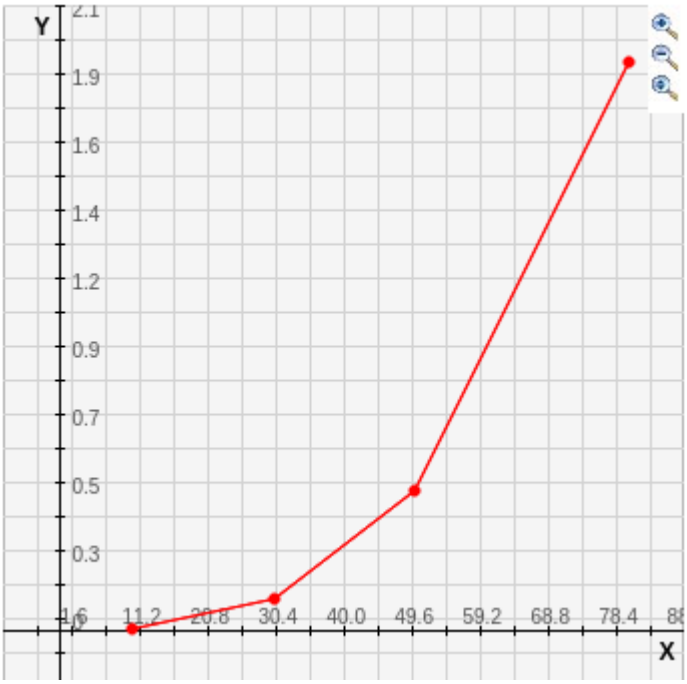
```
python nqueens.py 30
0.107936143875
```

for n = 50

```
python nqueens.py 50
0.466553926468
```

for n = 80

```
python nqueens.py 80
1.89221787453
```



So as far as we can see, the temporal computational cost seems to follow an exponential distribution throughout time.

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3. What is the largest n that can be solved in a few minutes?

For example, for an n equal to 300 the solution is returned after aproximately two minutes, so this is one of the largest n's that can be solved in a few minutes.

```
python nqueens.py 300
114.111539841
```

4. What is the number of propositional symbols required for 3?
The required number of propositional symbols for 3 is 9, because we have a board of 3x3 variables.

5. What is the number of clauses in 3?
The number of clauses in 3 are 34:

- **12** combinations in rows
- **12** combinations in columns
- **6** combinations in larger diagonals
- **4** combinations in shorter diagonals

- **34** clauses

```
p cnf 9 34
c rows
1 2 3 0
4 5 6 0
7 8 9 0
c columns
1 4 7 0
2 5 8 0
3 6 9 0
c rows
-1 -2 0
-1 -3 0
-2 -3 0
-4 -5 0
-4 -6 0
-5 -6 0
-7 -8 0
-7 -9 0
-8 -9 0
c columns
-1 -4 0
-1 -7 0
-4 -7 0
-2 -5 0
-2 -8 0
-5 -8 0
-3 -6 0
-3 -9 0
-6 -9 0
c larger diagonals
-3 -5 0
-3 -7 0
-5 -7 0

-1 -5 0
-1 -9 0
-5 -9 0
c shorter diagonals
-2 -4 0
-6 -8 0

-4 -8 0
-2 -6 0

```