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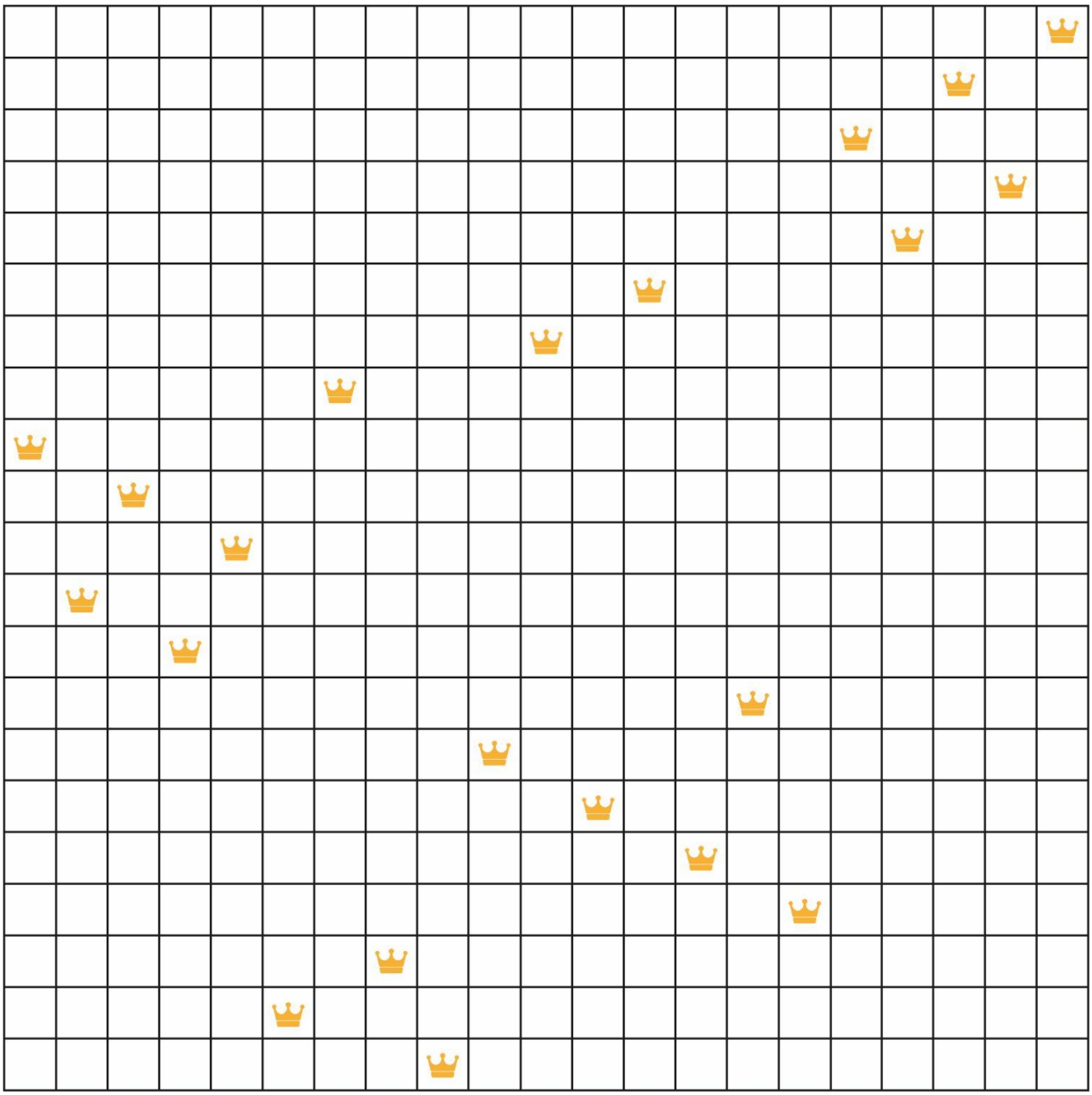
REPORT FOR LAB 1

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 markswill be given for a good representation.

With N = 21 we obtain:



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And the SAT-Solver resolution:

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

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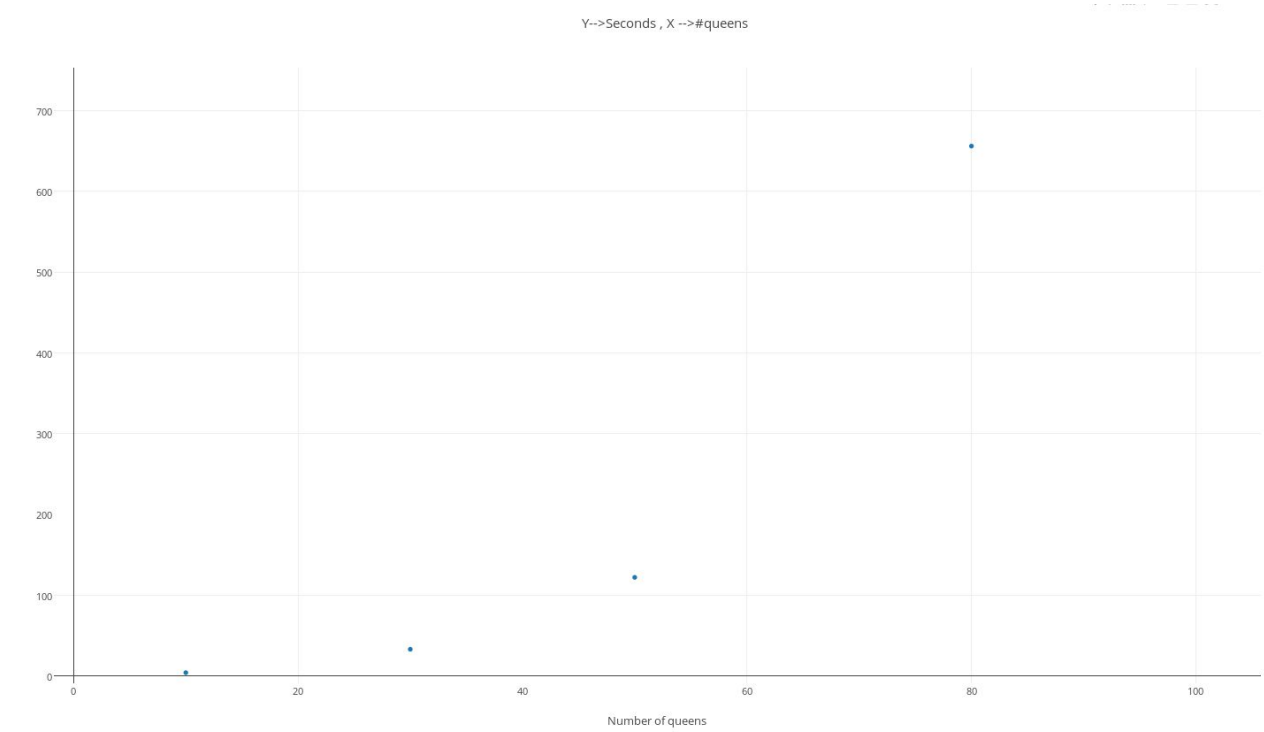
2. Time to solve problem for n=10, 30, 50.



Command used:

```
time ./picosat nqueens_sol.cnf
```

for n = 10

```
real    0m0,004s
user    0m0,000s
sys     0m0,000s
```

for n = 30

```
real    0m0,033s
user    0m0,032s
sys     0m0,000s
```

for n = 50

```
real    0m0,122s
user    0m0,116s
sys     0m0,000s
```

for n = 80

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```
real    0m0,656s
user    0m0,640s
```

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

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 21 is 441, because we have a board of 21x21 variables.

5. What is the number of clauses in 3?
The number of clauses in our grid of 21x21 are 14602:

- **4409** combinations in rows
- **4409** combinations in columns
- **5784** combinations in diagonals

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```
p cnf 441 14602

c rows clauses
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 0
22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 0
43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 0
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 0
85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 0
106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 0
127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 0
148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 0
169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 0
190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 0
211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 0
232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 0
253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 0
274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 0
295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 0
316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 0
337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 0
358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 0
379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 0
400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 0
421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 0

c cols clauses
1 22 43 64 85 106 127 148 169 190 211 232 253 274 295 316 337 358 379 400 421 0
2 23 44 65 86 107 128 149 170 191 212 233 254 275 296 317 338 359 380 401 422 0
3 24 45 66 87 108 129 150 171 192 213 234 255 276 297 318 339 360 381 402 423 0
4 25 46 67 88 109 130 151 172 193 214 235 256 277 298 319 340 361 382 403 424 0
5 26 47 68 89 110 131 152 173 194 215 236 257 278 299 320 341 362 383 404 425 0
6 27 48 69 90 111 132 153 174 195 216 237 258 279 300 321 342 363 384 405 426 0
7 28 49 70 91 112 133 154 175 196 217 238 259 280 301 322 343 364 385 406 427 0
8 29 50 71 92 113 134 155 176 197 218 239 260 281 302 323 344 365 386 407 428 0
9 30 51 72 93 114 135 156 177 198 219 240 261 282 303 324 345 366 387 408 429 0
10 31 52 73 94 115 136 157 178 199 220 241 262 283 304 325 346 367 388 409 430 0
11 32 53 74 95 116 137 158 179 200 221 242 263 284 305 326 347 368 389 410 431 0
12 33 54 75 96 117 138 159 180 201 222 243 264 285 306 327 348 369 390 411 432 0
13 34 55 76 97 118 139 160 181 202 223 244 265 286 307 328 349 370 391 412 433 0
14 35 56 77 98 119 140 161 182 203 224 245 266 287 308 329 350 371 392 413 434 0
15 36 57 78 99 120 141 162 183 204 225 246 267 288 309 330 351 372 393 414 435 0
16 37 58 79 100 121 142 163 184 205 226 247 268 289 310 331 352 373 394 415 436 0
17 38 59 80 101 122 143 164 185 206 227 248 269 290 311 332 353 374 395 416 437 0
18 39 60 81 102 123 144 165 186 207 228 249 270 291 312 333 354 375 396 417 438 0
19 40 61 82 103 124 145 166 187 208 229 250 271 292 313 334 355 376 397 418 439 0
20 41 62 83 104 125 146 167 188 209 230 251 272 293 314 335 356 377 398 419 440 0
21 42 63 84 105 126 147 168 189 210 231 252 273 294 315 336 357 378 399 420 441 0

c rows clauses
-1 -2 0
-1 -3 0
```