Introduction to Programming

The Eight Queens Puzzle

The Eight Queens Puzzle asks you to discover all possible ways that eight queens could be placed on a chessboard so that no queen could “capture” any other on the next move.

In class, we discussed a “dumb” algorithm for solving this problem. We saw that we could represent each board configuration where there is one queen in each column by an 8 digit base 8 integer. The algorithm goes as follows:

0. If we have not checked all $8^8$ configurations, do the following steps. Otherwise we are done.

1. generate an 8-digit base 8 non-negative integer, using eight positions

2. check for queens occupying the same “row” by seeing if there are any duplicate digits in the number, and

3. check to see if any of the queens lie on the same diagonal.

If the answer to both questions 2 and 3 is “no”, we have a good configuration, so print it.

If the answer to either question 2 or question 3 is “yes”, then this number does not represent a valid configuration, so we skip it.

4. go back to step 0.
I coded it using three helper functions:

```python
from math import sqrt

def get_next(n):
    Generate and return a list with eight digits representing the base 8 representation of the base 10 number n. Return that list as the value of this function.

def duplicates(q):
    if list q contains duplicate digits:
        return True
    else:
        return False

def diagonal_threat(q):
    if there is a diagonal “threat” (2 queens occupying the same diagonal):
        return True
    else:
        return False
```

# here is the “main” program.

```python
num=-1  # count up to 8**8 – each value will represent a potential configuration
count=0  # increment by 1 each time a solution is found
while num<8**8:
    num=num+1  # get the next value
    q=get_next(num)  # convert it to a list which represents the base 8 of num
    if duplicates(q):
        continue  # if there are any duplicate digits, reject this one and “continue” with the next iteration of the loop
    if diagonal_threat(q):  # if there are any 2 queens lie on the same diagonal, reject this one and “continue” with the next iteration of the loop
        continue
    count+=1  # if we got here, we have a solution. So increment count and
    print('Solution number ', count, 'is :',q)  # print count and the list q, and continue on
```

Assignment:

Write a program to generate and print all the solutions to the Eight Queens Puzzle. Print each solution on its own line. Here are the first 35 (out of 92) solutions that my program printed.