CECS 451
Assignment 2
Total: 60 Points

General Instruction

- Submit uncompressed file(s) in the Dropbox folder via Canvas (Not email).
- Use `Python 3`, any other programming language is not acceptable.
- You can import modules in the following list of libraries (please check the full list *here*). If you want to use any other library, please consult with the instructor.
- Your submission may be evaluated automatically using a script file, so if you would not follow the output format, you may receive zero point even though your program outputs correct answers.

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1. Develop algorithms to solve the 5-queens problem, employing both the **hill-climbing** and **genetic algorithm** methodologies.
   (a) (30 points) Develop a software application that executes the hill-climbing algorithm to identify an optimal solution.
   (b) (30 points) Construct a program that employs the genetic algorithm, incorporating a set of **eight distinct states** and integrating the three fundamental operations: **selection, crossover, and mutation**.

   Program specification.

   i. Locate the file named `board.py` within the project directory and ensure that its contents remain unaltered during the implementation process.
   ii. `board.py` initializes the problem state with a configuration that places one queen in each row. Employ a straightforward and effective local search algorithm to navigate towards a solution.
   iii. The function `get_fitness` in the `board.py` returns **the number of attacking pairs**. It assumes a queen per each row, which means it checks only columns and diagonals not rows.
   iv. The `get_fitness`, as defined in the `board.py`, calculates the **total number of pairs of queens that are in a position to attack each other**. This calculation is computed on the assumption that each row contains exactly one queen.
   v. Given the propensity of hill-climbing algorithms to converge upon local optima from which no further progress toward the global optimum is possible, it is recommended to incorporate a random restart mechanism. This approach facilitates the algorithm's escape from such local minima by initiating a new search from a different, randomly selected starting point.

vi. Please report running time and a solution.

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Running time: 5ms
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vii. Submit `hill.py` and `genetic.py`.