

CECS 451  
Assignment 3  
Total: 60 Points

---

General Instruction

- Submit uncompressed file(s) in the Dropbox folder via BeachBoard (Not email).
  - Use Python 3, any other programming language is not acceptable.
  - You can import modules in the Python Standard Library (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.
- 

1. Implement 5-queens problem solvers using the **hill-climbing algorithm** and the **genetic algorithm**.
  - (a) (30 points) Implement a program that performs the **hill-Climbing algorithm** to find a solution.
  - (b) (30 points) Implement a program that performs the **genetic algorithm** with 8 states including the three operations, i.e., **selection**, **crossover**, **mutation** to find a solution.

Program specification.

- i. You can use `numpy` library.
- ii. Find the `board.py`, and please do not modify it.
- iii. An initial state locates a queen per each row. Please use an appropriate and simple local search strategy.
- iv. 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.
- v. The hill-climbing algorithms can stuck in local minima. Please implement the random restart procedure when they stuck.
- vi. Please report running time and a solution.

Running time: 200ms

```
1 0 0 0 0
0 0 0 1 0
0 1 0 0 0
0 0 0 0 1
0 0 1 0 0
```

- vii. Submit `hill.py` and `genetic.py`.