CECS 451
Assignment 4
Total: 50 Points

General Instruction

- Submit your work in the Dropbox folder via BeachBoard (Not email or in class).

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1. (30 points) Implement a n-queens problem solver by using a **genetic algorithm**.

   i. Use `Python 3.7` and the name `n-queens.py`

   ii. I strongly recommend you can follow the object-oriented programming style.

   iii. Follow the specification

   - The program should take n value (# of queens) and k value (# of states) from `sys.argv`.
     ex) `python n-queens.py 19 8`
   - The program should start a local search from randomly located n-queens.
   - The program should use the as **the number of nonattacking pairs** as the **fitness function**.
   - The program should perform the three operations, i.e., **selection, crossover, mutation** to find a solution. (Please refer Figure 4.6 in the text book.)
   - You will be asked to report your strategy of three operations.
   - The program should track the number of the three operations (let's say steps) during a search.
   - The program should output a solution and be terminated.
   - An expected output format. (Assume $n = 4$)

     ```
     The number of the required steps: 3
     - - X -
     X - - -
     - - - X
     - X - -
     ```

   iv. Submit your `n-queens.py`.

2. (20 points) Evaluate your n-queens problem solver.

   i. Describe your strategy of the three operations.

   ii. Suggest the 4 best k values by

   - With some k value, repeat running your `n-queens.py` (set $n = 19$) $1,000$ times and record 'the number of the required steps'.
   - Draw a histogram and note descriptive statistics (i.e., average, median, min, max, etc).
   - Change the k value and repeat.

   iii. Include the histograms and the descriptive statistics of the 4 best k values in your report.

   iv. Submit your `n-queens_report.pdf`.