Q1. Recall the 8-queen problem discussed in class and reduce it to a 4-queen problem and consider the following:

- **State**: 4 queens on the board. One queen per column.
    - **Variables**: $x_0; x_1; x_2; x_3$ where x_i is the row position of the queen in column i. Assume that there is one queen per column.
    - **Domain** for each variable: $x_i \in \{0, 1, 2, 3\}, \forall i.$
- Initial state: a random state.
- Goal state: 4 queens on the board. No pair of queens are attacking each other.
- Neighbour relation:
    - Version A: Move a single queen to another square in the same column.
    - Version B: Swap the row positions of two queens.
- Cost function: The number of pairs of queens attacking each other, directly or indirectly.

For the following questions, consider **version B** of the neighbour relation: ***swap the row positions of two queens***.

i. [2 pts] How many neighbors are there for a state?

ii. [10 pts] Start with the initial state $x_0 = 3; x_1 = 1; x_2 = 2; x_3 = 0$. Show the steps of executing the hill climbing algorithm until it terminates. State the cost at the current state and then compute cost at each step.

			Q
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Note, if multiple neighbours have the same cost, choose the neighbour where the pair of queens swapped has the smallest subscript/column number. For example, when we can swap either ($x_0; x_4$) or ($x_2; x_3$), we will swap ($x_0; x_4$). When we can swap either ($x_2; x_3$) or ($x_2; x_4$) we will swap ($x_2; x_3$).

iii. [5 pts] Consider the following configuration and let the current state be $x_0 = 0; x_1 = 0; x_2 = 0; x_3 = 0$. What is the cost of this state? Is this a local optimum?

Q	Q	Q	Q