HW 2 n-Queen

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**編譯：**

make

**執行：**

./main n\_queen n\_times

n\_queen個皇后

執行n\_times次

**實作：**

實作了要求的兩個方法：Hill Climbing和Genetic Algorithm。

Hill Climbing:

狀態表示方式：

0~N-1的排列組合（共N個相異數字）組成長度為N的陣列A，  
陣列中第i個元素A[i] 代表在棋盤上地i個row的棋子在第A[i] column。

鄰居：

以目前狀態任選兩個相異棋子交換**一次**，可以到達的所有新狀態。  
以這樣的表示方式、鄰居選法，就可以只考慮斜向的Attack，效率較好。

GA:

狀態表示方式與Hill Climbing同。

|  |  |
| --- | --- |
| 參數 | 數值 |
| Representation | Permutation |
| Population size | 100 |
| Selection | 5-tournament |
| Crossover | Partially Mapped crossover (PMX) |
| Crossover rate | 0.95 |
| Mutation | swap |
| Mutation rate | 0.95 |
| Survivor | μ + 𝞴 |
| Termination | 800 generations |
| Runs | 1 run |

**8 Queen實驗結果：**

Hill Climbing執行30次：

|  |  |
| --- | --- |
| Solution | #attacks |
| 5 7 1 4 0 3 6 2 | 1 |
| 7 2 0 5 1 4 6 3 | 0 |
| 4 6 3 1 7 5 0 2 | 1 |
| 3 6 4 1 5 0 2 7 | 0 |
| 4 1 3 5 7 2 0 6 | 0 |
| 6 3 5 0 2 4 7 1 | 1 |
| 4 5 2 6 1 3 7 0 | 2 |
| 6 4 2 0 3 7 5 1 | 1 |
| 0 2 5 3 1 7 4 6 | 1 |
| 1 4 6 3 0 7 5 2 | 0 |
| 5 0 4 1 7 2 6 3 | 0 |
| 1 3 5 7 2 0 6 4 | 0 |
| 1 3 6 2 7 5 4 0 | 1 |
| 4 6 1 2 5 7 0 3 | 1 |
| 3 7 4 1 5 2 6 0 | 1 |
| 5 2 4 7 0 3 1 6 | 0 |
| 2 5 1 4 7 0 6 3 | 0 |
| 3 1 4 7 0 6 5 2 | 1 |
| 3 7 6 4 1 5 0 2 | 1 |
| 5 1 6 0 3 7 4 2 | 0 |
| 5 0 4 1 7 2 6 3 | 0 |
| 0 6 3 1 5 7 2 4 | 1 |
| 6 3 5 0 2 4 7 1 | 1 |
| 1 7 2 6 3 5 0 4 | 1 |
| 1 5 4 6 3 0 2 7 | 1 |
| 1 7 4 6 0 2 5 3 | 1 |
| 4 0 5 7 2 6 3 1 | 1 |
| 6 0 2 4 7 5 3 1 | 1 |
| 2 4 1 7 0 6 3 5 | 0 |
| 5 3 6 0 7 1 4 2 | 0 |
| Average #attacks | 0.6333 |
| Average running time | 27.97 us |
| Success rate | 0.4 |

GA執行30次：

|  |  |
| --- | --- |
| Solution | #attacks |
| 7 1 4 2 0 6 3 5 | 0 |
| 5 3 6 0 7 1 4 2 | 0 |
| 1 6 2 5 7 4 0 3 | 0 |
| 6 3 1 4 7 0 2 5 | 0 |
| 5 2 6 1 3 7 0 4 | 0 |
| 2 5 7 0 4 6 1 3 | 0 |
| 2 4 7 3 0 6 1 5 | 0 |
| 3 0 4 7 5 2 6 1 | 0 |
| 0 6 3 5 7 1 4 2 | 0 |
| 1 7 5 0 2 4 6 3 | 0 |
| 6 0 2 7 5 3 1 4 | 0 |
| 3 1 6 2 5 7 4 0 | 0 |
| 4 0 3 5 7 1 6 2 | 0 |
| 3 5 7 1 6 0 2 4 | 0 |
| 4 7 3 0 6 1 5 2 | 0 |
| 3 1 4 7 5 0 2 6 | 0 |
| 3 7 0 4 6 1 5 2 | 0 |
| 3 1 4 7 5 0 2 6 | 0 |
| 3 6 4 2 0 5 7 1 | 0 |
| 7 1 3 0 6 4 2 5 | 0 |
| 4 7 3 0 6 1 5 2 | 0 |
| 2 6 1 7 4 0 3 5 | 0 |
| 6 2 0 5 7 4 1 3 | 0 |
| 4 2 0 6 1 7 5 3 | 0 |
| 5 2 4 7 0 3 1 6 | 0 |
| 2 7 3 6 0 5 1 4 | 0 |
| 5 3 6 0 2 4 1 7 | 0 |
| 0 5 7 2 6 3 1 4 | 0 |
| 2 7 3 6 0 5 1 4 | 0 |
| 0 6 3 5 7 1 4 2 | 0 |
| Average #attacks | 0.0 |
| Average running time | 453,936 us |
| Success rate | 1.0 |

總結8 Queen問題：

|  |  |  |
| --- | --- | --- |
|  | Hill Climbing | GA |
| average #attack | 0.6333 | 0 |
| average running time | 27.97 us | 453,936 us |
| success rate | 0.4 | 1 |

**50 Queen實驗結果：**

解的字串至少50個字元，太長，所以就不一一列出，在這裡只列出最後結果(average #attack、average running time、success rate)

|  |  |  |
| --- | --- | --- |
|  | Hill Climbing | GA |
| average #attack | 0.8333 | 0 |
| average running time | 11,706.2 us | 1,783,540 us |
| success rate | 0.3333 | 1 |