Programming Project-2

Solving N-queens problem by hill-climbing and its variants

Problem Formulation:

The goal of the n-queen problem is to place n queens on a chess board so that no queen attacks any other. Local search algorithms typically use a **complete-state formulation**, where each state has 8 queens on the board, one per column. The successors of a state are all possible states generated by moving a single queen to another square in the same column (so each state has 8×7=56 successors). The heuristic cost function h is the number of pairs of queens that are attacking each other, either directly or indirectly. The global minimum of this function is zero, which occurs only at perfect solutions.

Local maxima: a local maximum is a peak that is higher than each of its neighboring states but lower than the global maximum.

Plateaux: a plateau is a flat area of the state-space landscape. It can be a flat local maximum, from which no uphill exit exists, or a **shoulder**, from which progress is possible. A hill-climbing search might get lost on the plateau.

a) Steepest Ascent: It is simply a loop that continually moves in the direction of increasing value, that is, uphill. It terminates when it reaches a "peak" where no neighbor has a higher value. The algorithm does not maintain a search tree, so the data structure for the current node need only record the state and the value of the objective function. Hill climbing does not look ahead beyond the immediate neighbors of the current state. Starting from a randomly generated 8-queens state, steepest-ascent hill climbing gets stuck 86% of the time, solving only 14% of problem instances. It works quickly, taking just 4 steps on average when it succeeds and 3 when it gets stuck.

b) Steepest Ascent with Side Way moves: The algorithm above halts if it reaches a plateau where the best successor has the same value as the current state. Might it not be a good idea to keep going to allow a **sideways move** in the hope that the plateau is really a shoulder? The answer is usually yes, but we must take care. If we always allow sideways moves when there are no uphill moves, an infinite loop will occur whenever the algorithm reaches a flat local maximum that is not a shoulder. One common solution is to put a limit on the number of consecutive sideways moves allowed. For example, we could allow up to, say, 100 consecutive sideways moves in the 8-queens problem. This raises the percentage of problem instances solved by hill climbing from 14% to 94%. Success comes at a cost: the algorithm averages roughly 21 steps for each successful instance and 64 for each failure.

c) Random Restart Hill Climbing: The hill-climbing algorithms described above are incomplete. They often fail to find a goal when one exists because they can get stuck on local maxima. **Random-restart hill climbing** adopts the well-known adage, "If at first you don't succeed, try, try again." It conducts a series of hill-climbing searches from randomly generated initial states, until a goal is found. It is trivially complete with probability approaching 1, because it will eventually generate a goal state as the initial state. If each hill-climbing search has a probability p of success, then the expected number of restarts required is 1/p.

Program Structure:

The program contains five classes.

1) EightQueens.java
2) HillClimbing.java
3) Node.java
4) Queen.java
5) RandomRestart.java

EightQueens: This class contains the main method which takes the number of queens and the number of runs as the input and calls all the algorithms. It calculates and displays the average success steps, failure steps, success probability and failure probability for all the algorithms.

HillClimbing: This class implements the steepest ascent hill climbing with and without sideways moves. It first stores all the best children for a given node and choose one best children out of them randomly if children have the same heuristic value.

Node: The node class has the code to generate the neighbours for a given state and an another method which returns a random neighbour out of all the generated neighbours.

Queen: The queen class has a method to check if it is attacking any other queen on the board. Another method allows us to move the queen down by 1 position within the same column in which the queen actually present.

RandomRestart: This class implements the random restart hill climbing algorithm with and without sideways moves.

Global Variables and Methods:

EightQueens:

N: This variables stores the number of queens.
getN( ): This method returns the N value.
numberOfRuns: Contains the number of times the code got run

The below variables contains the number of moves, success steps, failure steps for all the algorithms.

hillClimbSideWaysSuccesses, successStepsSideWays, failureStepsSideWays

successStepsSteepest, hillClimbingSteepest_Successes, failureStepsSteepest

RandomRestartsSteepest, RandomStepsSteepest, randomRestartSuccessesSteepest

RandomRestartsSideWays, RandomStepsSideWays, randomRestartSuccesses

HillClimbing:

HillClimbing( ): This method initializes an empty Node and a state.
getMoves( ): This method returns the number of moves made by a particular queen.

HillClimbing(Queen[] s): This method accepts a queen configuration as arugument and assigns that configuration to startState. This state is assigned to a node which calls computeHeuristic( ).

startState( ): This method generates a random queen configuration and assigns it to a node. This node calls the computeHeuristic( ).

getSuccessSteps and getFailureSteps methods return the success and failure steps.

getLeastHeurCost( ): This method takes the successors as argument and returns the least possible heurstic value out of all the successors.

storeBestChildren( ): This method takes the successors as the argument and returns the ArrayList of all the successors with the least heuristic value.

chooseBestChildren( ): This method takes the best children array list and randomly selects and returns one best children.

hillClimbing_Steepest( ): This method implements the steepest ascent hill climbing. It considers the start node as current node. It computes the least heuristic value out of all the successors and if current node heuristic is less than or equal to the least heuristic, it is considered as a failure move. Otherwise, it passes the successors and least heuristic value to generate bestChildren. If the random node generated with minimum heristic, it is a successful move and it returns the current node. Else, the moves are incremented and we clear the bestChildren list.

hillClimbing_SideWays( ): It works similar to steepest ascent mentioned above except for one case. If the current node heuristic value is equal to the least heuristic value, we don't consider it as a failure step directly. We maintain a counter and if the counter reaches 100 i.e., current node heuristic value is equal to the least heuristic value for 100 times, we consider it as a failure move.

getStartNode( ): returns the start node.

Node:

Node(Node n): Constructor method which creates copy of a node's state.
generateNeighbours(Node startState): Generates neighbours for a given state.
computeHeuristic( ): Computes the heuristic value.
getHeuristic( ): Returns the heuristic value.
compareTo(Node n): Compare the given node heuristic with the current heuristic and returns a value accordingly.
toString( ): Print the state of the node.

Queen:

Queen(int r, int c): Constructor which assigns row and column for given queen.
collisions(Queen q): Determine whether this queen can attack another queen on the board.
moveQueen(int spaces): move the queen by the number of specified spaces.

RandomRestart:

randomRestart( ): This method use the steepest ascent hill climbing methods to determine the solution. Even, if we get a solution(considered as local maxima), we again continue the process of generating the nodes until we obtain the global maxima.

CODE:

EightQueens.java

```
import java.sql.SQLOutput;
import java.util.*;
import java.text.NumberFormat;

public class EightQueens {
   public static int N;

    public int getN() {
        return N;
    }

    public static void main(String[] args){
      System.out.println("enter number of queens");
```

```
        Scanner sc = new Scanner(System.in);
        N=sc.nextInt();
        EightQueens board = new EightQueens();
        System.out.println("Enter the number of runs");
        int numberOfRuns = sc.nextInt();
        int hillClimbSideWaysSuccesses=0, randomRestartSuccesses=0;
        int hillClimbingSteepest_Successes = 0,randomRestartSuccessesSteepest =0;
        int successStepsSideWays = 0, failureStepsSideWays = 0;
        int successStepsSteepest =0, failureStepsSteepest = 0;
        int RandomRestartsSideWays =0, RandomStepsSideWays=0;
        int RandomRestartsSteepest =0, RandomStepsSteepest=0;


        for(int i=0; i<numberOfRuns; i++){
           Queen[] startBoard = board.generateBoard();

           HillClimbing hillClimber = new HillClimbing(startBoard);
           HillClimbing hillClimberSteepest = new HillClimbing(startBoard);
           RandomRestart randomRestart = new RandomRestart(startBoard);
           RandomRestart randomRestartSteepest = new RandomRestart(startBoard);
           Node hillSolvedSteepest =
hillClimberSteepest.hillClimbing_Steepest("NoPrint");
           Node hillSolved = hillClimber.hillClimbing_SideWays("NoPrint");
           Node randomSolved = randomRestart.randomRestart();
           Node randomSolvedSteepest = randomRestartSteepest.randomRestartSteepest();

           //if heristic=0 increment the success cost of the steepest hill climbing
           if(hillSolvedSteepest.getHeuristic()==0){
              successStepsSteepest += hillClimberSteepest.getSuccessSteps();
              hillClimbingSteepest_Successes++;
           }

           //if heristic!=0 increment the failure cost of the steepest hill climbing
           else
           {
              failureStepsSteepest += hillClimberSteepest.getFailureSteps();
           }

           //if heristic=0 increment the success cost of the sideways steepest ascent
hill climbing
           if(hillSolved.getHeuristic()==0){
              successStepsSideWays += hillClimber.getSuccessSteps();
              hillClimbSideWaysSuccesses++;
           }

           //if heristic!=0 increment the failure cost of the sideways steepest
ascent hill climbing
           else
              {
              failureStepsSideWays += hillClimber.getFailureSteps();
              }

           //if heristic=0 increment the success cost of the random restart hill
climbing with sideways
           if(randomSolved.getHeuristic()==0){
              RandomRestartsSideWays += randomRestart.getRandomRestartSteps();
              RandomStepsSideWays += randomRestart.getSuccessSteps();
              randomRestartSuccesses++;
           }

           //if heristic=0 increment the success cost of the random restart hill
climbing without sideways
           if(randomSolvedSteepest.getHeuristic()==0)
           {
              RandomRestartsSteepest +=
randomRestartSteepest.getRandomRestartSteps();
              RandomStepsSteepest +=randomRestartSteepest.getSuccessSteps();
              randomRestartSuccessesSteepest++;
```

```
            }
        }
        NumberFormat fmt = NumberFormat.getPercentInstance();
        System.out.println("Hill climb Steepest successes:
"+hillClimbingSteepest_Successes);
        double hillClimbSteepestPercent =
(double)hillClimbingSteepest_Successes/(double)numberOfRuns;
        double hillClimbSteepestPercentFailure = (double)(numberOfRuns-
hillClimbingSteepest_Successes)/(double)numberOfRuns;
        System.out.println("Percent successes:
"+fmt.format(hillClimbSteepestPercent));
        System.out.println("Percent Failures:
"+fmt.format(hillClimbSteepestPercentFailure));
        System.out.println("Average Success Steps for Steepest Hill Climbing: "+
(successStepsSteepest)/hillClimbingSteepest_Successes);
        System.out.println("Average Failure Steps for Steepest Hill Climbing: " +
(failureStepsSteepest)/(numberOfRuns-hillClimbingSteepest_Successes));
        System.out.println();

        System.out.println("Hill climb Side Ways successes:
"+hillClimbSideWaysSuccesses);
        double hillClimbPercent =
(double)hillClimbSideWaysSuccesses/(double)numberOfRuns;
        double hillClimbPercentFailure = (double)(numberOfRuns-
hillClimbSideWaysSuccesses)/(double)numberOfRuns;
        System.out.println("Percent successes: "+fmt.format(hillClimbPercent));
        System.out.println("Percent Failures: "+fmt.format(hillClimbPercentFailure));
        System.out.println("Average Success Steps for Side Ways: "+
Math.round((successStepsSideWays)/hillClimbSideWaysSuccesses));
        if(failureStepsSideWays!=0)
        System.out.println("Avearage Failure Steps for Side Ways: " +
Math.round((failureStepsSideWays)/(numberOfRuns-hillClimbSideWaysSuccesses)));
        System.out.println();

        double randomRestartPercent = (double)(randomRestartSuccesses/numberOfRuns);
          System.out.println("Number of random restarts for side ways: " +
Math.round(RandomRestartsSideWays)/(numberOfRuns-hillClimbSideWaysSuccesses));
        System.out.println("Average number of steps for random restart for side ways:
"+ RandomStepsSideWays/numberOfRuns);
        System.out.println();

        double randomRestartPercentSteepest =
(double)(randomRestartSuccessesSteepest/numberOfRuns);
        System.out.println("Number of random restarts without side ways moves: " +
Math.round(RandomRestartsSteepest/numberOfRuns));
        System.out.println("Average number of steps for random restarts without side
ways moves: "+ RandomStepsSteepest/numberOfRuns);
        System.out.println();

        // Printing Sequences
        System.out.println();
        System.out.println();

        //printing the three random initial configurations for steepest ascent hill
climbing
        for(int i=1;i<=3;i++) {
            Queen[] startBoardPrint = board.generateBoard();
            HillClimbing hillClimberSteepestPrint = new HillClimbing(startBoardPrint);
            System.out.println("Printing Sequence "+i+" for the Steepest Ascent Hill
Climbing");
            Node hillSolvedSteepestPrint =
hillClimberSteepestPrint.hillClimbing_Steepest("Print");
            System.out.print(hillClimberSteepestPrint.getCurrentNode());
            System.out.println("heuristic Value of above board is " +
hillSolvedSteepestPrint.getHeuristic());
            if(hillSolvedSteepestPrint.getHeuristic()==0)
            {
                System.out.println(i + " random Input Queen Board(s) is solved");
```

```
         }
         else
         {
            System.out.println(i + " random Input Queen Board(s) is Failed");
         }
         System.out.println();
         System.out.println();
      }

      //printing the three random initial configurations for steepest ascent hill
climbing with sideways moves
      for(int i=1;i<=3;i++) {
         Queen[] startBoardPrint = board.generateBoard();
         HillClimbing hillClimbingSideWaysPrint = new
HillClimbing(startBoardPrint);
         System.out.println("Printing the Sequence "+i+" for Side Ways Hill
Climbing");
         Node hillSolvedSideWaysPrint =
hillClimbingSideWaysPrint.hillClimbing_SideWays("Print");
         System.out.print(hillClimbingSideWaysPrint.getCurrentNode());
         System.out.println("heuristic Value of above board is " +
hillSolvedSideWaysPrint.getHeuristic());
         if(hillSolvedSideWaysPrint.getHeuristic()==0)
         {
            System.out.println(i + " random Input Queen Board(s) is solved");
         }
         else
         {
            System.out.println(i + " random Input Queen Board(s) is Failed");
         }
         System.out.println();
         System.out.println();
      }


   }

   //generate the random queen board
   public Queen[] generateBoard(){
      Queen[] start = new Queen[N];
      Random gen = new Random();

      for(int i=0; i<N; i++){
         start[i] = new Queen(gen.nextInt(N),i);
      }
      return start;
   }
}
```

HillClimbing.java

```
import java.util.*;

public class HillClimbing {
    EightQueens QueensClass = new EightQueens();
    int N = QueensClass.getN();
    private Queen[] startState;
    private Node start; //start state
    private Node currentNode;
    private int steps;
    private int successSteps;
    private int failureSteps;
    private int moves;
    private int printCount;

    public HillClimbing() {
        start = new Node(); //empty start node
```

```
        startState = new Queen[N]; //empty start state
        startState();
    }

    public int getMoves() {
        return moves;
    }

    // Constructs HillClimbing with a starting board and it computes the heuristic
of the given board
    public HillClimbing(Queen[] s) {
        start = new Node();
        startState = new Queen[N];
        for (int i = 0; i < s.length; i++) {
            startState[i] = new Queen(s[i].getRow(), s[i].getColumn());
        }
        start.setState(startState);
        start.computeHeuristic();
    }

    // Sets the starting state
    public void startState() {
        //sets up a pseudo random start state
        Random gen = new Random();
        for (int i = 0; i < N; i++) {
            startState[i] = new Queen(gen.nextInt(N), i);
        }
        start.setState(startState);
        start.computeHeuristic();
    }

    public int getSuccessSteps() {
        return successSteps;
    }

    public int getFailureSteps() {
        return failureSteps;
    }

    //Gives the least heuristic cost among the successors
    public int getLeastHeurCost(ArrayList<Node> successors, int LeastHeur) {
        for (int i = 0; i < successors.size(); i++) {
            if (successors.get(i).getHeuristic() < LeastHeur) {
                LeastHeur = successors.get(i).getHeuristic();
            }
        }
        return LeastHeur;
    }

    //stores all the children with least heuristic into bestChildren arraylist
    public ArrayList<Node> storeBestChildren(ArrayList<Node> successors, int
leastHeur) {
        ArrayList<Node> bestChildren = new ArrayList<Node>();
        for (int i = 0; i < successors.size(); i++) {
            if (successors.get(i).getHeuristic() == leastHeur) {
                bestChildren.add(successors.get(i));
            }
        }
        return bestChildren;
    }

    //selects random best children from bestChildren arraylist
    public boolean chooseBestChild(ArrayList<Node> bestChildren) {
        Random gen = new Random();
        int randInteger = 0;

        if (bestChildren.size() != 0) {
            randInteger = gen.nextInt(bestChildren.size());
```

```
            currentNode = bestChildren.get(randInteger);

            if (currentNode.getHeuristic() == 0) {
                return true;
            }
        }
        return false;
    }


    // The hill climbing Steepest algorithm
    public Node hillClimbing_Steepest(String print) {
        currentNode = start;
        ArrayList<Node> bestChildren;
        while (true){
            ArrayList<Node> successors =
currentNode.generateNeighbours(currentNode);
            int leastHeur = getLeastHeurCost(successors,
currentNode.getHeuristic());
            if (leastHeur >= currentNode.getHeuristic()) {
                failureSteps = moves;
                return currentNode;
            }
            bestChildren = storeBestChildren(successors, leastHeur);
            if (chooseBestChild(bestChildren)) {
                successSteps = moves;
                return currentNode;
            }
            else {
                moves++;
                bestChildren.clear();
            }
            if(print.equals("Print"))
            {
                System.out.println(currentNode);
                System.out.println("heuristic Value of above board is
"+currentNode.getHeuristic());
            }
        }
    }

    public Node getCurrentNode() {
        return currentNode;
    }

    // Hill Climbing Side Ways algorithm
    public Node hillClimbing_SideWays(String print) {
        currentNode = start;
        int counter = 0;
        ArrayList<Node> bestChildren;
        while (true) {
            ArrayList<Node> successors =
currentNode.generateNeighbours(currentNode);
            int leastHeur = getLeastHeurCost(successors,
currentNode.getHeuristic());
            if (leastHeur == currentNode.getHeuristic()) {
                counter++;
                if (counter == 100) {
                    failureSteps = moves;
                    return currentNode;
                }
            } else if (leastHeur > currentNode.getHeuristic()) {
                failureSteps = moves;
                return currentNode;
            } else {
                counter = 0;
            }
            bestChildren = storeBestChildren(successors, leastHeur);
```

```
            if (chooseBestChild(bestChildren)) {
                successSteps = moves;
                return currentNode;
            } else {
                bestChildren.clear();
                moves++;
            }
            if(print.equals("Print"))
            {
                System.out.println(currentNode);
                System.out.println("heuristic Value of above board is
"+currentNode.getHeuristic());
            }
        }
    }
    //Returns the Node's state
    public Node getStartNode() {
        return start;
    }
}
```

RandomRestart.java

```
public class RandomRestart {
   private HillClimbing hillClimber;
   private int nodesGenerated;
   private Node start;
    private int randomRestartSteps;
    private int moves;
    private int successSteps;
   int successStepsSteepest=0,hillClibingSteepest_Successes=0,failureSteepest=0;
   /**
    * Constructor
    */
   public RandomRestart(Queen[] startBoard){
      hillClimber = new HillClimbing(startBoard);
      nodesGenerated = 0;
   }

    public int getRandomRestartSteps() {
        return randomRestartSteps;
    }

   public int getSuccessSteps() {
      return successSteps;
   }

   //random restart algorithm for sideways moves
   public Node randomRestart(){
      Node currentNode = hillClimber.getStartNode();
      setStartNode(currentNode);
      int heuristic = currentNode.getHeuristic();

      while(heuristic!=0){
         Node nextNode = hillClimber.hillClimbing_SideWays("NoPrint");
         successSteps += hillClimber.getSuccessSteps();
         heuristic = nextNode.getHeuristic();

         if(heuristic != 0){ //restart
             randomRestartSteps++;
            successSteps += hillClimber.getFailureSteps();
            moves++;
            hillClimber = new HillClimbing();
         }else {
            currentNode = nextNode;
         }
      }
```

```
        return currentNode;
    }

    public int getHillClimbingSteepest_Successes() {
        return successStepsSteepest;
    }

    //random restart algorithm for without sideways moves
    public Node randomRestartSteepest(){
        Node currentNode = hillClimber.getStartNode();
        setStartNode(currentNode);
        int heuristic = currentNode.getHeuristic();
        while(heuristic!=0){
            Node nextNode = hillClimber.hillClimbing_Steepest("NoPrint");
            successSteps += hillClimber.getSuccessSteps();
            heuristic = nextNode.getHeuristic();
            if(heuristic!=0){ //restart
                randomRestartSteps++;
                successSteps += hillClimber.getFailureSteps();
                hillClimber = new HillClimbing();
            }else {
                currentNode = nextNode;
            }
        }
        return currentNode;
    }


    //Sets the initial board
    public void setStartNode(Node n){
        start = n;
    }

    //get initial board
    public Node getStartNode(){
        return start;
    }

    //returns the number of nodes generated
    public int getNodesGenerated(){
        return nodesGenerated;
    }
}
```

Node.java

```
import java.util.*;

public class Node implements Comparable<Node>{

     EightQueens QueensClass = new EightQueens();
     int N = QueensClass.getN();
    public Queen[] state; //the node's state
    private ArrayList<Node> neighbours;
    private int hn; //heuristic score

    public Node(){
        state = new Queen[N]; //empty state
        neighbours = new ArrayList<Node>(); //empty neighbour list
    }

    //Constructor which creates a copy of a node's state
    public Node(Node n){
        state = new Queen[N];
        neighbours = new ArrayList<Node>();
        for(int i=0; i<N; i++)
            state[i] = new Queen(n.state[i].getRow(), n.state[i].getColumn());
```

```
   hn=0;
}

//Generates neighbours for a given state
public ArrayList<Node> generateNeighbours(Node startState){
   int count=0;

   if(startState==null)
      System.out.println("warning");

   for(int i=0; i<N; i++){
      for(int j=1; j<N; j++){
         neighbours.add(count, new Node(startState));
         neighbours.get(count).state[i].moveQueen(j);
         neighbours.get(count).computeHeuristic();

         count++;
      }
   }
   return neighbours;
}

//calculate the heuristic
public int computeHeuristic(){

   for(int i=0; i<N-1; i++){
      for(int j=i+1; j<N; j++){
         if(state[i].collisions(state[j])){
               hn++;
         }
      }
   }

   return hn;
}

public int getHeuristic(){
   return hn;
}

//compare the heuristic of two queen boards
public int compareTo(Node n){
   if(this.hn < n.getHeuristic())
      return -1;
   else if(this.hn > n.getHeuristic()) {

         return 1;
     }
   else if(this.hn == n.getHeuristic()) {
      return 0;
   }
   else {
      return 0;
   }
}

//Getters and setters for the State
public void setState(Queen[] s){
   for(int i=0; i<N; i++){
      state[i]= new Queen(s[i].getRow(), s[i].getColumn());
   }
}

public Queen[] getState(){
   return state;
}

//toString method print the state of the node
```

```
   public String toString(){
      String result="";
      String[][] board = new String[N][N];
      //initialise board with X's to indicate empty spaces
      for(int i=0; i<N; i++)
         for(int j=0; j<N; j++)
            board[i][j]="X ";
         //place the queens on the board
      for(int i=0; i<N; i++){
         board[state[i].getRow()][state[i].getColumn()]="Q ";
      }

      for(int i=0; i<N; i++){
         for(int j=0; j<N; j++){
            result+=board[i][j];
         }
         result+="\n";
      }

      return result;
   }
}
```

Queen.java

```
public class Queen {
   private int row;
   private int column;
   EightQueens QueensClass = new EightQueens();
   int N = QueensClass.getN();

   //constructor which assigns the row and column for a queen
   public Queen(int r, int c){
      row = r;
      column  = c;
   }

   //Determines whether this queen can attack another

   public boolean collisions(Queen q){
      boolean collision=false;

      //test rows and columns
      if(row==q.getRow() || column==q.getColumn())
         collision=true;
      //test diagonal
      else if(Math.abs(column-q.getColumn()) == Math.abs(row-q.getRow()))
         collision=true;

      return collision;
   }

   //move the queen in the same column
   public void moveQueen(int spaces){
      row+=spaces;
      if(row>(N-1) && row%(N-1)!=0){
         row=(row%(N-1))-1;
      }
      else if(row>(N-1) && row%(N-1)==0){
         row=(N-1);
      }
   }

   //Getters and setters for the row
   public void setRow(int r){
      row = r;
   }
```

```
    public int getRow(){
        return row;
    }

    //Getters and setters for the column
    public void setColumn(int c){
        column = c;
    }

    public int getColumn(){
        return column;
    }

    // It is used to print the Queen board
    public String toString(){
        return "("+row+", "+column+")";
    }
}
```

EXECUTION RESULTS:

Input 100: Page 13

Input 200: Page 30

Input 300: Page 46

Input 400: Page 66

Input 500: Page 90

For input size 100:

enter number of queens
8
Enter the number of runs
100
Hill climb Steepest successes: 14
Percent successes: 14%
Percent Failures: 86%
Average Success Steps for Steepest Hill Climbing: 3
Average Failure Steps for Steepest Hill Climbing: 2

Hill climb Side Ways successes: 92
Percent successes: 92%
Percent Failures: 8%
Average Success Steps for Side Ways: 18
Avearage Failure Steps for Side Ways: 102

Number of random restarts for side ways: 1
Average number of steps for random restart for side ways: 28

Number of random restarts without side ways moves: 6
Average number of steps for random restarts without side ways moves: 23

Printing Sequence 1 for the Steepest Ascent Hill Climbing

X X X X X X X X
X X X X X Q X X
X X Q Q X X X X
X Q X X X X X X
X X X X X X Q Q
X X X X Q X X X
X X X X X X X X
Q X X X X X X X

heuristic Value of above board is 3
X X X X X X X X
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X Q Q
X X X X Q X X X
X X Q X X X X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X Q Q
X X X X Q X X X
X X Q X X X X X
Q X X X X X X X
heuristic Value of above board is 1
1 random Input Queen Board(s) is Failed

Printing Sequence 2 for the Steepest Ascent Hill Climbing

X X X X X Q X X
X X X X X X X Q
X Q X X Q X X X
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X X X X X

heuristic Value of above board is 4
X X X X X Q X X
X X X X X X X Q
X Q X X Q X X X
X X X X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X Q X X X X X

heuristic Value of above board is 2
X X X X X Q X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X Q X X X X X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X Q X X X X X
heuristic Value of above board is 1
2 random Input Queen Board(s) is Failed

Printing Sequence 3 for the Steepest Ascent Hill Climbing

X Q Q X X X X X
X X X X Q X Q X
X X X X X X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 4
X Q Q X X X X X
X X X X X X Q X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 3
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 2
X Q X X X X X X

X X X X X X Q X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X Q X X
X X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X Q X X
X X X X X X X X
X X Q X X X X X
heuristic Value of above board is 1
3 random Input Queen Board(s) is Failed

Printing the Sequence 1 for Side Ways Hill Climbing

X Q X X X X X X
X X X X X X Q X
X X X X X X X Q
X X X X X X X X
X X X X Q X X X
Q X X Q X X X X
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 5
X Q X X X X X X
X X X X X X Q X
X X X X X X X X
X X X X X X X Q
X X X X Q X X X
Q X X Q X X X X
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 3
X Q X X X X X X
X X X Q X X Q X
X X X X X X X X
X X X X X X X Q
X X X X Q X X X
Q X X X X X X X
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 2
X Q X X X X X X
X X X Q X X Q X

Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X Q X X X X X X
X X X Q X X Q X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X X Q X X Q X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
heuristic Value of above board is 0
1 random Input Queen Board(s) is solved

Printing the Sequence 2 for Side Ways Hill Climbing

X Q X X X X X X
X X Q X X X X Q
X X X X Q X X X
X X X X X X X X
X X X X X X Q X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X

heuristic Value of above board is 4
X Q X X X X X X
X X X X X X X Q
X X X X Q X X X
X X Q X X X X X

X X X X X X Q X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X

heuristic Value of above board is 2
X Q X X Q X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X Q X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X

heuristic Value of above board is 2
X Q X X Q X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X X X Q X X X X
Q X X X X Q X X

heuristic Value of above board is 2
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
Q X X X X Q X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
Q X X X X Q X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
Q X X X X Q X X

heuristic Value of above board is 1
Q X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
Q X X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X

X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X Q Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X Q Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X Q Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X Q Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X Q X X X X
Q X X X X X X Q
X X Q X X X X X
X X X X Q X X X

X X X X X X Q X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X

X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X Q X X X Q X
Q X X X X X X X
X X X X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X Q X X

heuristic Value of above board is 1
X X X X X Q Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X

X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q Q X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X X X X X X X Q
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X X X X X X X Q
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X Q Q
X X X X X X X X
X X X Q X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X Q Q
X Q X X X X X X
X X X Q X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X Q X X X

X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X X
Q X Q X X X X X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X
X X X X X X X X
X X X X Q X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X
heuristic Value of above board is 0
2 random Input Queen Board(s) is solved

Printing the Sequence 3 for Side Ways Hill Climbing

X Q X X X Q X X
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X X X

X X X X X X X Q
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 5
X Q X X X Q X X
X X X X X X X X
X X Q X X X Q X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 3
X X X X X Q X X
X Q X X X X X X
X X Q X X X Q X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 2
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1

X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X X X X X
X X X X X X X Q
X X Q X Q X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X Q X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X Q
X X Q X Q X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X Q
X X X X Q X X X
Q X X X X X X X
X X X Q X X X X
heuristic Value of above board is 0
3 random Input Queen Board(s) is solved

For Input size 200:

enter number of queens
8
Enter the number of runs
200
Hill climb Steepest successes: 31
Percent successes: 16%
Percent Failures: 84%
Average Success Steps for Steepest Hill Climbing: 3
Average Failure Steps for Steepest Hill Climbing: 3

Hill climb Side Ways successes: 184
Percent successes: 92%

Percent Failures: 8%
Average Success Steps for Side Ways: 20
Avearage Failure Steps for Side Ways: 103

Number of random restarts for side ways: 1
Average number of steps for random restart for side ways: 29

Number of random restarts without side ways moves: 5
Average number of steps for random restarts without side ways moves: 20

Printing Sequence 1 for the Steepest Ascent Hill Climbing

X X X X X X X X
X X Q Q X Q X X
X X X X X X X X
X X X X Q X X Q
X X X X X X X X
Q X X X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 6
X X Q X X X X X
X X X Q X Q X X
X X X X X X X X
X X X X Q X X Q
X X X X X X X X
Q X X X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 4
X X Q X X X X X
X X X Q X Q X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
Q X X X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 2
X X Q Q X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
Q X X X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X Q Q X X X X
X X X X X Q X X
X X X X X X X Q

X X X X Q X X X
X X X X X X X X
Q X X X X X X X
X X X X X X Q X
X Q X X X X X X
heuristic Value of above board is 1
1 random Input Queen Board(s) is Failed

Printing Sequence 2 for the Steepest Ascent Hill Climbing

X X Q X X X X X
Q X X X X X X Q
X X X Q X Q X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X X X X

heuristic Value of above board is 4
X X Q X X X X X
Q X X X X X X Q
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 2
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X
heuristic Value of above board is 1
2 random Input Queen Board(s) is Failed

Printing Sequence 3 for the Steepest Ascent Hill Climbing

X X X X X X X Q
X X X X X X X X

X X X Q X X X X
X X X X X Q Q X
X X X X X X X X
X X X X X X X X
Q Q Q X X X X X
X X X X Q X X X

heuristic Value of above board is 6
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q Q X
X X X X X X X X
X X X X X X X X
Q X Q X X X X X
X X X X Q X X X

heuristic Value of above board is 3
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X X X X X X X
Q X Q X X X X X
X X X X Q Q X X

heuristic Value of above board is 2
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X X X X X X X
Q X Q X X X X X
X X X X Q Q X X
heuristic Value of above board is 2
3 random Input Queen Board(s) is Failed

Printing the Sequence 1 for Side Ways Hill Climbing

X X X X X X X Q
Q X X X X X X X
X X X Q Q Q X X
X Q X X X X X X
X X X X X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X X X X

heuristic Value of above board is 5
X X X X X X X Q
Q X X X X X X X
X X X X Q Q X X
X Q X X X X X X

X X X X X X X X
X X X X X X Q X
X X Q X X X X X
X X X Q X X X X

heuristic Value of above board is 3
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X Q X
X X Q X X X X X
X X X Q X X X X

heuristic Value of above board is 2
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X Q X
X X Q X X X X X
X X X Q X X X X

heuristic Value of above board is 2
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X X
X X Q X X X Q X
X X X Q X X X X

heuristic Value of above board is 2
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

X X X X X Q X X
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X Q X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X Q X X
Q X X X X X X X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X
heuristic Value of above board is 0

1 random Input Queen Board(s) is solved

Printing the Sequence 2 for Side Ways Hill Climbing

X X X X X X Q X
X X Q X Q X X X
X X X Q X X X Q
X X X X X X X X
X X X X X X X X
X X X X X Q X X
X X X X X X X X
Q Q X X X X X X

heuristic Value of above board is 5
X X X X X X Q X
X X Q X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X X
Q Q X X X X X X

heuristic Value of above board is 3
X X X X X X Q X
X X Q X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X X
Q X X X X X X X

heuristic Value of above board is 2
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X

X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X X X X Q X X

X X Q X X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X Q X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X

X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X Q X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X Q X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X

X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X Q X X X Q X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X Q X X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X Q Q X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X Q Q X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
heuristic Value of above board is 0
2 random Input Queen Board(s) is solved

Printing the Sequence 3 for Side Ways Hill Climbing

X X X X X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X X
Q X X X Q X X X
X Q X Q X X X Q

heuristic Value of above board is 6
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X X
Q X X X Q X X X
X Q X X X X X Q

heuristic Value of above board is 3
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
Q X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 2
Q X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
Q X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X

X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X Q Q X
X X X X X X X X
X X Q X X X X X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X Q Q X
X X X X X X X X
X X Q X X X X X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X Q Q X
X X X X X X X X
X X Q X X X X X
Q X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X

X X Q X X X X X
Q X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
Q X X Q X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
X Q X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
X Q X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
X Q X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X Q
X X X X X X X X
X X X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q Q
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X X X X X
X X X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X X Q
Q X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
heuristic Value of above board is 0
3 random Input Queen Board(s) is solved

For input size 300:

enter number of queens
8
Enter the number of runs
300
Hill climb Steepest successes: 41
Percent successes: 14%
Percent Failures: 86%
Average Success Steps for Steepest Hill Climbing: 3
Average Failure Steps for Steepest Hill Climbing: 3

Hill climb Side Ways successes: 271
Percent successes: 90%
Percent Failures: 10%
Average Success Steps for Side Ways: 23
Avearage Failure Steps for Side Ways: 104

Number of random restarts for side ways: 1
Average number of steps for random restart for side ways: 31

Number of random restarts without side ways moves: 6
Average number of steps for random restarts without side ways moves: 24

Printing Sequence 1 for the Steepest Ascent Hill Climbing

X X X X X Q X Q
Q X X X X X X X
X X Q X X X X X
X Q X X X X Q X
X X X X Q X X X
X X X X X X X X
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 4
X X X X X Q X Q
Q X Q X X X X X
X X X X X X X X
X Q X X X X Q X
X X X X Q X X X
X X X X X X X X
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 3
X X X X X Q X X
Q X Q X X X X X
X X X X X X X X
X Q X X X X Q X
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 2
X X X X X Q X X
Q X Q X X X X X
X X X X X X X X
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X Q X X

X X Q X X X X X
Q X X X X X X X
X X X X X X Q X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
heuristic Value of above board is 0
1 random Input Queen Board(s) is solved

Printing Sequence 2 for the Steepest Ascent Hill Climbing

X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
Q X X X X X X X

heuristic Value of above board is 3
X X Q X X X X X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
Q X X X X X Q X

heuristic Value of above board is 2
X X Q X X X X X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
Q X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X Q X X X X X
X X X X Q X X X
X X X X X X X X
X X X X X X X Q
Q X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X Q X
heuristic Value of above board is 1
2 random Input Queen Board(s) is Failed

Printing Sequence 3 for the Steepest Ascent Hill Climbing

X X X X X X X X
X X X X X X X Q
X X X Q X X X X
X Q X X X Q X X
X X X X X X X X
Q X Q X X X X X
X X X X Q X X X
X X X X X X Q X

heuristic Value of above board is 5
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X
X Q X X X Q X X
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X

heuristic Value of above board is 3
Q X X X X X X X
X X X X X Q X Q
X X X Q X X X X
X Q X X X X X X
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X

heuristic Value of above board is 2
Q X X X X X X X
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X

heuristic Value of above board is 1
Q X X X X X X X
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
heuristic Value of above board is 1
3 random Input Queen Board(s) is Failed

Printing the Sequence 1 for Side Ways Hill Climbing

X X X X X X Q X

X X Q Q Q X X X
Q X X X X X X X
X X X X X X X X
X X X X X X X X
X X X X X X X X
X X X X X Q X X
X Q X X X X X Q

heuristic Value of above board is 4
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X Q

heuristic Value of above board is 2
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X

X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X

X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X X X X
X X Q X X X X X

X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X X X X
X X Q X X X X X
X X X X X Q X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X Q X X X X X X

heuristic Value of above board is 1
X X X X X X X X

X X X Q Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X X X
Q X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X

heuristic Value of above board is 1
X X X Q X X X X
Q X X X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
heuristic Value of above board is 0
1 random Input Queen Board(s) is solved

Printing the Sequence 2 for Side Ways Hill Climbing

X X X X Q X X X
X X X X X X Q X
X Q Q X X X X X

Q X X X X Q X X
X X X X X X X Q
X X X X X X X X
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 4
X X X X Q X X X
X X X X X X Q X
X Q Q X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 2
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X Q X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X X
X X X X X X X Q
X X X Q X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X X
X X X X X X X Q
X X X Q X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X X
X X X X X X X Q
X X X Q X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X

X X X X X X X X
X X X X X X X Q
X X X Q X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X X
X X X X X X X Q
X X X Q X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X Q X X X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X X X X X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X

X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X

X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X X X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X X X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X Q X X X X X X

X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
Q X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X X
Q Q X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X Q X X Q X X X
X X X X X X X X
Q X X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X Q X X Q X X X
X X X X X X X X
Q X X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X Q X X X X X X
X X X X X X X X
Q X X X X X X X
X X X X X Q X X
X X X X X X X Q
X X Q X Q X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X Q X X X X X X
X X Q X X X X X
Q X X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X X X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
Q X X X X X X X
X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X Q X
X X X Q X X X X

heuristic Value of above board is 1
X X X X X X Q X
X X Q X X X X X
Q X X X X X X X

X X X X X Q X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X Q X X X X
heuristic Value of above board is 0
2 random Input Queen Board(s) is solved

Printing the Sequence 3 for Side Ways Hill Climbing

X X X X X X X Q
X X X X X X X X
X X X X Q X X X
Q X X X X X Q X
X X X X X X X X
X X X Q X X X X
X Q Q X X X X X
X X X X X Q X X

heuristic Value of above board is 5
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
Q X X X X X Q X
X X X X X X X X
X X X Q X X X X
X X Q X X X X X
X X X X X Q X X

heuristic Value of above board is 3
X X X X X X X Q
X Q X X X X X X
X X X Q Q X X X
Q X X X X X Q X
X X X X X X X X
X X X X X X X X
X X Q X X X X X
X X X X X Q X X

heuristic Value of above board is 2
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
Q X X X X X Q X
X X X X X X X X
X X X X Q X X X
X X Q X X X X X
X X X X X Q X X

heuristic Value of above board is 2
X X X X X X X Q
X Q X X X X X X
X X X Q X X X X
Q X X X X X X X
X X X X X X Q X

X X X X Q X X X
X X Q X X X X X
X X X X X Q X X
heuristic Value of above board is 0
3 random Input Queen Board(s) is solved

For input size 400:

enter number of queens
8
Enter the number of runs
400
Hill climb Steepest successes: 61
Percent successes: 15%
Percent Failures: 85%
Average Success Steps for Steepest Hill Climbing: 3
Average Failure Steps for Steepest Hill Climbing: 2

Hill climb Side Ways successes: 362
Percent successes: 90%
Percent Failures: 10%
Average Success Steps for Side Ways: 22
Avearage Failure Steps for Side Ways: 103

Number of random restarts for side ways: 1
Average number of steps for random restart for side ways: 30

Number of random restarts without side ways moves: 6
Average number of steps for random restarts without side ways moves: 22
Printing Sequence 1 for the Steepest Ascent Hill Climbing

X X X X X X Q Q
Q X X X X X X X
X X X X X X X X
X X X Q X X X X
X X X X X X X X
X X X X X X X X
X Q Q X X X X X
X X X X Q Q X X

heuristic Value of above board is 5
X X X X X X Q X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X
X X X X X X X X
X X X X X X X X
X Q Q X X X X X
X X X X Q Q X X

heuristic Value of above board is 3
X X X X X X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

X X X X X X Q X
X X X X X X X X
X Q Q X X X X X
X X X X Q Q X X

heuristic Value of above board is 2
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X Q Q X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X Q Q X X X X X
X X X X X Q X X
heuristic Value of above board is 1
1 random Input Queen Board(s) is Failed

Printing Sequence 2 for the Steepest Ascent Hill Climbing

X X Q X X X X X
X X X X X X X X
X X X X X Q X X
X X X X X X X X
Q X X X Q X X X
X X X X X X X Q
X Q X Q X X X X
X X X X X X Q X

heuristic Value of above board is 4
X X Q X X X X X
X X X X X Q X X
X X X X X X X X
X X X X X X X X
Q X X X Q X X X
X X X X X X X Q
X Q X Q X X X X
X X X X X X Q X

heuristic Value of above board is 3
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
X X X X X X X X
Q X X X Q X X X
X X X X X X X Q

X Q X X X X X X
X X X X X X Q X

heuristic Value of above board is 2
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X X X X Q X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X
X X X X Q X X X
X X X X X X X Q
X Q X X X X X X
X X X X X X Q X
heuristic Value of above board is 1
2 random Input Queen Board(s) is Failed

Printing Sequence 3 for the Steepest Ascent Hill Climbing

X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
X X X X X X X X
X X X X X X X Q
X Q X X Q X X X
X X X X X X X X
Q X X X X X Q X

heuristic Value of above board is 4
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
X X X X X X X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
Q X X X X X Q X

heuristic Value of above board is 2
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
X X X X X X Q X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
Q X X X X X X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
X X X X X X Q X
heuristic Value of above board is 1
3 random Input Queen Board(s) is Failed

Printing the Sequence 1 for Side Ways Hill Climbing

X Q Q X X X X Q
X X X X X X X X
X X X X X X X X
Q X X X X X Q X
X X X X Q X X X
X X X X X X X X
X X X X X X X X
X X X Q X Q X X

heuristic Value of above board is 5
X X Q X X X X Q
X X X X X X X X
X X X X X X X X
Q X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X Q X Q X X

heuristic Value of above board is 4
X X Q X X X X Q
X X X X X X X X
X X X Q X X X X
Q X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 2
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1

X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X Q X X X

X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X Q Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1

X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X

X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1

X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X Q Q X
X X X X Q X X X

X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1

X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X

X X X X X X Q X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X Q X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X X X X Q X X

heuristic Value of above board is 1

X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X Q
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X Q Q
X X X X Q X X X

X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X Q X
X X X Q X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X X X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
Q X X X X X Q X
X X X X X X X X
X X X X X X X Q
X X X X Q X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X X X X X X X Q
X X X X Q X X X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X X X X X Q
X X X X Q X X X
Q X X X X X X X
X X X Q X X X X
X X X X X Q X X
heuristic Value of above board is 0
1 random Input Queen Board(s) is solved

Printing the Sequence 2 for Side Ways Hill Climbing

X X X Q X X X X
X X X X X X X Q
Q X X X X X X X
X X X X X Q X X
X X X X X X X X
X Q X X Q X X X
X X X X X X X X

X X Q X X X Q X

heuristic Value of above board is 5
X X X Q Q X X X
X X X X X X X Q
Q X X X X X X X
X X X X X Q X X
X X X X X X X X
X Q X X X X X X
X X X X X X X X
X X Q X X X Q X

heuristic Value of above board is 3
X X X Q Q X X X
X X X X X X X Q
Q X X X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X X X X X
X X X X X X X X
X X Q X X X Q X

heuristic Value of above board is 3
X X X Q Q X X X
X X X X X X X Q
Q X X X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
X X X X X X X X
X X Q X X X X X

heuristic Value of above board is 2
X X X Q Q X X X
X X X X X X X Q
X X X X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 2
X X X X Q X X X
X X X X X X X Q
X X X X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 2
X X X X Q X X X
X X X X X X X Q

X X X X X Q X X
X X X X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X

X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q

X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X Q Q X X X X

heuristic Value of above board is 1
X X Q X Q X X X
X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X

X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X Q X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q Q
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q Q
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X Q X Q
X X Q X X X X X
X X X X X X X X
X X X X X Q X X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X

X X X X X Q X Q
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X Q X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X Q X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X Q X Q
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X Q X Q
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X

X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X Q X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X Q X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X Q X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X X Q X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X Q X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X

X X X X X X X Q
X X X X X Q X X
X X X X X X X X
X X Q X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X Q X X Q X X
X X X X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
X Q X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q Q X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X X X Q X X X X

heuristic Value of above board is 1
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
heuristic Value of above board is 0
2 random Input Queen Board(s) is solved

Printing the Sequence 3 for Side Ways Hill Climbing

X X X X X X X Q
X X X X X X Q X
X X X Q X X X X
X X X X X X X X

X X X X Q X X X
X X X X X Q X X
Q X Q X X X X X
X Q X X X X X X

heuristic Value of above board is 7
X X X X X X X Q
X X X X X X Q X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X Q X X
Q X Q X X X X X
X X X X X X X X

heuristic Value of above board is 4
X X X X X X X Q
X X X X X X Q X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 2
X X X X X X X Q
X X X X X X X X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X Q X X
Q X X X X X X X
X X Q X X X Q X

heuristic Value of above board is 2
X X X X X X X Q
X X X X X X Q X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 2
X X X X X X X Q
X X X X X X Q X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X Q X X
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 2
X X X X X X X X
X X X X X X Q X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X Q X Q
Q X X X X X X X
X X Q X X X X X

heuristic Value of above board is 2
X X X X X X X X
X X X X X X Q X
X X X Q X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X X X Q
Q X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
X X X X X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X X X Q
Q X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X Q X X X X X X
X X X X Q X X X
X X X X X X X Q
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X X X X X X X
X X X X Q X X X
X Q X X X X X Q
X X X X X Q X X
X X Q X X X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X Q X
Q X X X X X X X
X X X X X X X Q

X X X X Q X X X
X Q X X X X X X
X X X X X Q X X
X X Q X X X X X
heuristic Value of above board is 0
3 random Input Queen Board(s) is solved

For input size 500

enter number of queens
8
Enter the number of runs
500
Hill climb Steepest successes: 63
Percent successes: 13%
Percent Failures: 87%
Average Success Steps for Steepest Hill Climbing: 3
Average Failure Steps for Steepest Hill Climbing: 3

Hill climb Side Ways successes: 461
Percent successes: 92%
Percent Failures: 8%
Average Success Steps for Side Ways: 22
Avearage Failure Steps for Side Ways: 103

Number of random restarts for side ways: 1
Average number of steps for random restart for side ways: 28

Number of random restarts without side ways moves: 6
Average number of steps for random restarts without side ways moves: 23

Printing Sequence 1 for the Steepest Ascent Hill Climbing

X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X X Q
X X X X X X X X
X X X X Q X Q X
Q X X X X X X X

heuristic Value of above board is 2
X X Q X X X X X
X X X X X Q X X
X X X Q X X X X
X Q X X X X X X
X X X X X X X Q
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
heuristic Value of above board is 0
1 random Input Queen Board(s) is solved

Printing Sequence 2 for the Steepest Ascent Hill Climbing

X X X X X X X X
X X X X Q Q X X
X Q X X X X X X
Q X X X X X X Q
X X X Q X X X X
X X X X X X X X
X X X X X X Q X
X X Q X X X X X

heuristic Value of above board is 5
X Q X X X X X X
X X X X Q Q X X
X X X X X X X X
Q X X X X X X Q
X X X Q X X X X
X X X X X X X X
X X X X X X Q X
X X Q X X X X X

heuristic Value of above board is 3
X Q X X X X X X
X X X X Q Q X X
X X X X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X X X Q X
X X Q X X X X X

heuristic Value of above board is 2
X Q X X X X X X
X X X X Q Q X X
X X X X X X X X
Q X X X X X X X
X X X Q X X X X
X X X X X X X Q
X X X X X X Q X
X X Q X X X X X
heuristic Value of above board is 2
2 random Input Queen Board(s) is Failed

Printing Sequence 3 for the Steepest Ascent Hill Climbing

X X X X X X X Q
X X X X X X X X
X X X X X X X X
X Q X X X X X X
X X Q X X Q X X
X X X X X X X X
Q X X X X X X X
X X X Q Q X Q X

heuristic Value of above board is 6

X X X X X X X Q
X X X X Q X X X
X X X X X X X X
X Q X X X X X X
X X Q X X Q X X
X X X X X X X X
Q X X X X X X X
X X X Q X X Q X

heuristic Value of above board is 4
X X X X X X X Q
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X X
Q X X X X X X X
X X X Q X X Q X

heuristic Value of above board is 2
X X X X X X X Q
X X X X Q X X X
X X Q X X X X X
X Q X X X X X X
X X X X X Q X X
X X X X X X X X
Q X X X X X X X
X X X Q X X Q X
heuristic Value of above board is 2
3 random Input Queen Board(s) is Failed

Printing the Sequence 1 for Side Ways Hill Climbing
X X Q X X X X X
X X X X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X Q X

heuristic Value of above board is 2
X X Q X X X X X
X X X X X X Q X
X X X X X Q X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X

X X X X X Q X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X Q X
X X X X X X X X
X X X X X Q X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X Q X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X Q X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X Q X X
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X Q X Q

X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X Q X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X Q X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X X Q X
X X X X X X X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X Q X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X Q Q X
X X X X X X X X
X Q X X X X X X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X Q X X
X X X X X X X X
X Q X X X X Q X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X

heuristic Value of above board is 1
X X Q X X X X X
X X X X X Q X X

X Q X X X X X X
X X X X X X Q X
X X X X Q X X X
Q X X X X X X X
X X X X X X X Q
X X X Q X X X X
heuristic Value of above board is 0
1 random Input Queen Board(s) is solved

Printing the Sequence 2 for Side Ways Hill Climbing

X X X X X X X Q
X X Q X X X X X
X X X X X X Q X
X X X X Q X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 5
X X X X X X X Q
X X Q X X X X X
X X X X Q X Q X
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 3
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X Q X X

X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X

X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
Q X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
Q X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X Q
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X Q
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q Q X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X Q X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X Q X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X

X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X Q X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X Q
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X Q
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X Q X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X Q X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X Q X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X Q
X X X X X X X X
X Q X X X X X X
X X X Q X X X X
X X X X X Q Q X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X Q
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X Q X X X
X X Q X X X X X
X X X X X X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X

X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
Q X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X X

heuristic Value of above board is 1
X X X X X X X Q
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X X

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
X Q X X X X X X
X X X Q X X X X
X X X X X Q X X
Q X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q Q X X X X X X
X X X Q X X X X
X X X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X X X X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X

Q X X X X X X X
X X X Q X X X X
X Q X X X Q X X
X X X X X X X Q

heuristic Value of above board is 1
X X X X X Q X X
X X Q X X X X X
X X X X Q X X X
X X X X X X Q X
Q X X X X X X X
X X X Q X X X X
X Q X X X X X X
X X X X X X X Q
heuristic Value of above board is 0
2 random Input Queen Board(s) is solved

Printing the Sequence 3 for Side Ways Hill Climbing

X X X X X X X X
X X X X X X X X
X X X X X Q Q X
Q X Q X X X X X
X X X X X X X X
X X X Q X X X Q
X Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 6
Q X X X X X X X
X X X X X X X X
X X X X X Q Q X
X X Q X X X X X
X X X X X X X X
X X X Q X X X Q
X Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 4
Q X X X X X X X
X X X X X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X Q X X
X X X Q X X X Q
X Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 2
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q

X Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 1
Q X X X X X X X
X X X Q X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 1
Q X X Q X X X X
X X X X X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
X Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X X X X X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
Q Q X X X X X X
X X X X Q X X X

heuristic Value of above board is 1
X X X Q X X X X
X Q X X X X X X
X X X X X X Q X
X X Q X X X X X
X X X X X Q X X
X X X X X X X Q
Q X X X X X X X
X X X X Q X X X
heuristic Value of above board is 0
3 random Input Queen Board(s) is solved

Submitted by
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