ARTIFICIAL INTELLIGENCE

LAB ASSIGNMENT – 2

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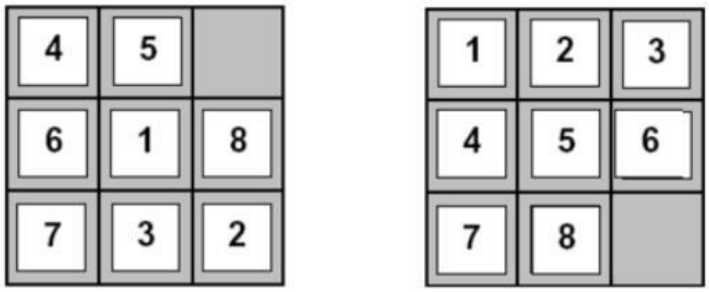
Find the sequence of the empty tile moves from the initial game position to the designated target position

Initial position **Goal position**



CODE :

```
import java.util.*;
class Main
{
 public int dimension = 3;
int[] row = { 1, 0, -1, 0 };
int[] col = { 0, -1, 0, 1 };
public int calculateCost(int[][] initial, int[][] goal)
{
```

```
 int count = 0;
 int n = initial.length;
 for (int i = 0; i < n; i++) {
     for (int j = 0; j < n; j++)
{
if (initial[i][j] != 0 && initial[i][j] != goal[i][j])
{
    count++;
}
}

 }
return count;
}
public void printMatrix(int[][] matrix)
 {
for (int i = 0; i < matrix.length; i++)
{
for (int j = 0; j < matrix.length; j++)
{
System.out.print(matrix[i][j] + " ");
}
System.out.println();
}
}
```

```
public boolean isSafe(int x, int y)
{
 return (x >= 0 && x < dimension && y >= 0 && y <dimension);
}
public void printPath(Node root)
{
if (root == null)
{
return;
 }
 printPath(root.parent); printMatrix(root.matrix);
System.out.println();
}
public boolean isSolvable(int[][] matrix)
{
int count = 0;
List<Integer> array = new ArrayList<Integer>();
for (int i = 0; i < matrix.length; i++) {
    for (int j = 0; j < matrix.length; j++)
{
array.add(matrix[i][j]);
}
}
Integer[] anotherArray = new Integer[array.size()];
array.toArray(anotherArray);
```

```
 for (int i = 0; i < anotherArray.length - 1; i++)
{
for (int j = i + 1; j < anotherArray.length; j++)
{
if (anotherArray[i] != 0 && anotherArray[j] != 0 && anotherArray[i] > anotherArray[j])
{
count++;
}
}
}
return count % 2 == 0;
}
public void solve(int[][] initial, int[][] goal, int x, int y)
 {
PriorityQueue<Node> pq = new PriorityQueue<Node>(1000, (a, b) -> (a.cost + a.level) - (b.cost + b.level));
Node root = new Node(initial, x, y, x, y, 0, null); root.cost = calculateCost(initial, goal); pq.add(root);
while (!pq.isEmpty())
 {
Node min = pq.poll();
if (min.cost == 0)
{
printPath(min);
return;
```

```
}
 for (int i = 0; i < 4; i++)
{
if (isSafe(min.x + row[i], min.y + col[i]))
{
Node child = new Node(min.matrix, min.x, min.y, min.x + row[i], min.y + col[i],
min.level + 1, min); child.cost = calculateCost(child.matrix, goal); pq.add(child);
}
}
}
}
public static void main(String[] args)
{
Scanner sc=new Scanner(System.in);
System.out.println("Enter number of rows in puzzle:");
int r=sc.nextInt();
System.out.println("Enter number of columns in puzzle:");
int c=sc.nextInt();
int[][] initial = new int[r][c];
int[][] goal =new int[r][c];
System.out.println("Enter your initial puzzle:");
for(int i=0;i<r;i++)
{
for (int j=0;j<c;j++)
{
 initial[i][j]=sc.nextInt();
```

```
}
}
System.out.println();
System.out.println("Enter your Goal puzzle:");
for(int i=0;i<r;i++)
{
for (int j=0;j<c;j++)
{
goal[i][j]=sc.nextInt();
} }
int x = 1, y = 0;
Main puzzle = new Main();
if (puzzle.isSolvable(initial))
{
puzzle.solve(initial, goal, x, y);
}
else {
System.out.println("The given initial is possible to solve");
}
}

}
 class Node
{
public Node parent;
```

```
public int[][] matrix;
public int x, y;
public int cost;
public int level;
Node(int[][] initial, int x, int y, int x0, int y0, int i, Object object)
{
throw new UnsupportedOperationException("Not supported yet.");
}
public Node(int[][] matrix, int x, int y, int newX, int newY, int level, Node parent)
{
this.parent = parent;
this.matrix = new int[matrix.length][];
for (int i = 0; i < matrix.length; i++)
 {
 this.matrix[i] = matrix[i].clone();
}
this.matrix[x][y] = this.matrix[x][y] + this.matrix[newX][newY];
this.matrix[newX][newY] = this.matrix[x][y] - this.matrix[newX][newY];
this.matrix[x][y] = this.matrix[x][y] - this.matrix[newX][newY];
this.cost = Integer.MAX_VALUE;
this.level = level;
this.x = newX;
this.y = newY;
}
}
```

OUTPUT :

```
Enter number of rows in puzzle:
3
Enter number of columns in puzzle:
3
Enter your initial puzzle:
4 5 0
6 1 8
7 3 2
Enter your Goal puzzle:
1 2 3
4 5 6
7 8 0
The given initial is possible to solve
```