Write the python program to solve 8-Puzzle problem

AIM

To implement **Breadth-First Search (BFS)** algorithm to solve the 8-Puzzle Problem and find the shortest sequence of moves from the start state to the goal state.

ALGORITHM

1. Start with the **initial state** of the 8-puzzle.
2. Use a **queue (FIFO)** to explore puzzle states level by level.
3. Insert the start state into the queue and mark it as visited.
4. Repeat until the queue is empty:
5. Dequeue the front state.
6. If this state is the **goal state**, return the solution path.
7. Otherwise, generate all valid next states by moving the blank tile (0) up, down, left, or right.
8. If a new state is not visited, enqueue it and mark as visited.
9. Continue until the goal state is reached.
10. Print the sequence of states from start to goal.

8 PUZZLE AI.py - C:/Users/gayathri/Downloads/8 PUZZLE AI.py (3.8.2)

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```
from collections import deque

def bfs(start, goal):
    moves = [(1,0),(-1,0),(0,1),(0,-1)]  # down, up, right, left
    q = deque([(start, [])])
    visited = {tuple(start)}

    while q:
        state, path = q.popleft()
        if state == goal:
            return path + [state]

        i = state.index(0)
        x, y = divmod(i, 3)
        for dx, dy in moves:
            nx, ny = x+dx, y+dy
            if 0 <= nx < 3 and 0 <= ny < 3:
                j = nx*3+ny
                new = state[:]
                new[i], new[j] = new[j], new[i]
                if tuple(new) not in visited:
                    visited.add(tuple(new))
                    q.append((new, path+[state]))
    return None

start = [1,2,3,4,0,6,7,5,8]
goal  = [1,2,3,4,5,6,7,8,0]

solution = bfs(start, goal)
for s in solution:
    for i in range(0,9,3): print(s[i:i+3])
    print()
```

OUTUT:

Python 3.8.2 Shell

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```
Python 3.8.2 (tags/v3.8.2:7b3ab59, Feb 25 2020, 23:03:10) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/gayathri/Downloads/
[1, 2, 3]
[4, 0, 6]
[7, 5, 8]

[1, 2, 3]
[4, 5, 6]
[7, 0, 8]

[1, 2, 3]
[4, 5, 6]
[7, 8, 0]

>>>
```

RESULT: The 8-Puzzle problem was successfully solved using BFS, reaching the goal state in 2 moves.