Name of Group   :
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Class   : DAA-F

Title of the game : 8-puzzle with BFS (search how many of the expands node)

```python
def find_index_0(num):
        if len(str(num))==8:
                return 0
        for i in range(9):
                x = num % 10
                num = int(num/10)
                if x==0:
                        break
        return 8-i

def swap(strr, a, b):
        t = list(strr)
        temp = t[a]
        t[a] = t[b]
        t[b] = temp

        return ''.join(t)

def make_move(num):
        ind = find_index_0(num)

        operate = str(num)

        moved_list = []

        if len(operate)==8:
                operate = '0' + operate

        if ind==0:
                final = swap(operate, ind, 1)
                moved_list.append([int(final),num])

                final = swap(operate, ind, 3)
                moved_list.append([int(final),num])

        elif ind==1:
                final = swap(operate, ind, 0)
                final = final[1:]
                moved_list.append([int(final),num])

                final = swap(operate, ind, 2)
```

```python
            moved_list.append([int(final),num])

            final = swap(operate, ind, 4)
            moved_list.append([int(final),num])

    elif ind==2:
            final = swap(operate, ind, 1)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 5)
            moved_list.append([int(final),num])

    elif ind==3:
            final = swap(operate, ind, 0)
            final = final[1:]
            moved_list.append([int(final),num])

            final = swap(operate, ind, 4)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 6)
            moved_list.append([int(final),num])

    elif ind==4:
            final = swap(operate, ind, 1)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 3)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 5)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 7)
            moved_list.append([int(final),num])

    elif ind==5:
            final = swap(operate, ind, 2)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 4)
            moved_list.append([int(final),num])

            final = swap(operate, ind, 8)
            moved_list.append([int(final),num])

    elif ind==6:
            final = swap(operate, ind, 3)
```

```python
                moved_list.append([int(final),num])

                final = swap(operate, ind, 7)
                moved_list.append([int(final),num])


        elif ind==7:
                final = swap(operate, ind, 4)
                moved_list.append([int(final),num])

                final = swap(operate, ind, 6)
                moved_list.append([int(final),num])

                final = swap(operate, ind, 8)
                moved_list.append([int(final),num])


        elif ind==8:
                final = swap(operate, ind, 5)
                moved_list.append([int(final),num])

                final = swap(operate, ind, 7)
                moved_list.append([int(final),num])

        return moved_list


print("\nMasukkan 9 digit angka yang akan diselesaikan dalam 8-puzzle (1 baris tanpa spasi)")
number = int(input())
print("\nNode yang telah dikunjungi:\n")

Q = []
Q.append([number,111111111])
moves = 0
nodes = 0
last = number

while Q:
        x = Q.pop(0)
        nodes+=1
        if x[0]==last:
                moves+=1
        listing = make_move(x[0])
        for i in listing:
                if i[0]==x[1]:
                        listing.remove(i)
                        break
        if listing[len(listing)-1][1]==last:
```
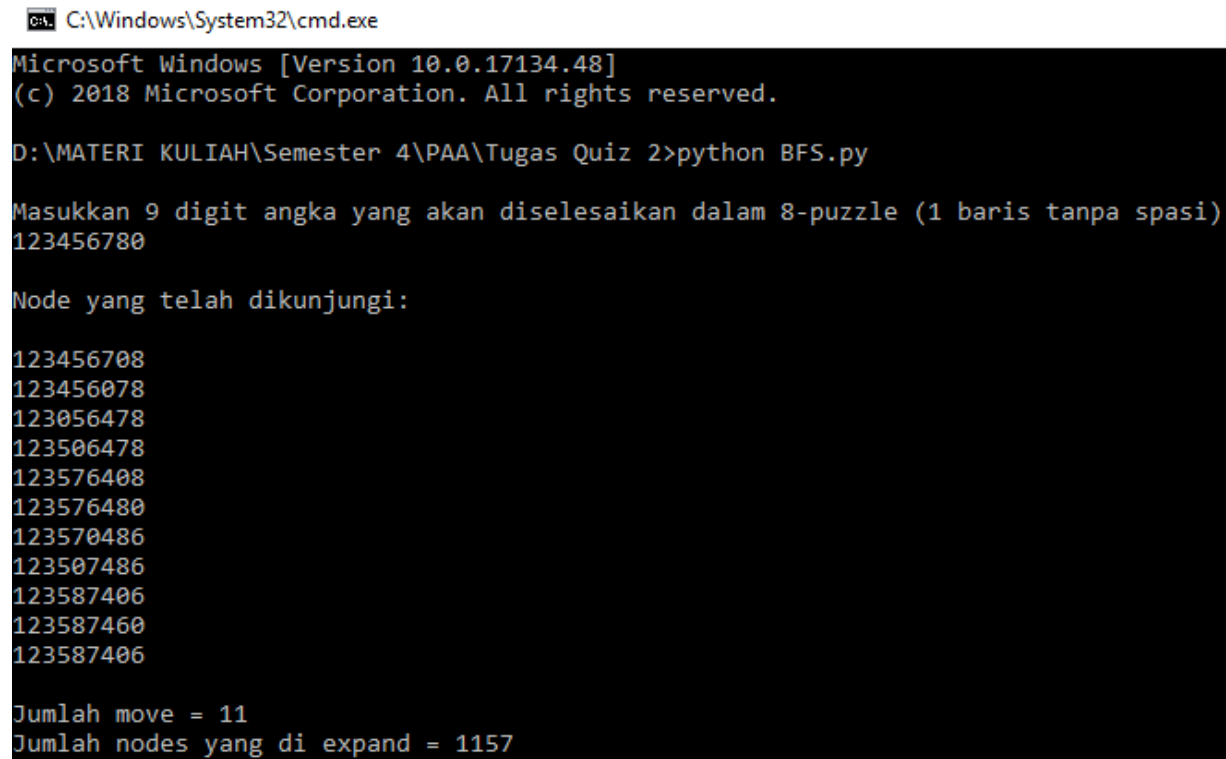
```
        last = listing[len(listing)-1][0]
        print(last)
    for i in listing:
        if i[0] == 123456780:
            print("\nJumlah move = " + str(moves))
            print("Jumlah nodes yang di expand = " + str(nodes))
            exit(0)
        Q.append(i)
```

Output :

```
C:\Windows\System32\cmd.exe

Microsoft Windows [Version 10.0.17134.48]
(c) 2018 Microsoft Corporation. All rights reserved.

D:\MATERI KULIAH\Semester 4\PAA\Tugas Quiz 2>python BFS.py

Masukkan 9 digit angka yang akan diselesaikan dalam 8-puzzle (1 baris tanpa spasi)
123456780

Node yang telah dikunjungi:

123456708
123456078
123056478
123506478
123576408
123576480
123570486
123507486
123587406
123587460
123587406

Jumlah move = 11
Jumlah nodes yang di expand = 1157
```
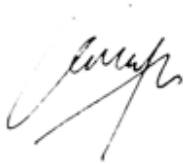
We use BFS with Python for solve this problem. so in this game there are 9 boxes containing 8 numbers. The 8 digits will be loaded randomly, using this code, we will determine the depth he is looking for the node being expanded, and, how many times he moves. And at this code, we will look for how many times he expands the node, and in that code uses half brute force. For the example, we input di number is 123456780 (we input with sequential number). And we will found of the number of move it's 11, start from 0, we compare 0 as an empty number. So, 0 will search the position where he can do to move, if 0 returns to the position he has explored, he will look for the latest position to find the next step untill it end.

"By the name of Allah (God) Almighty, herewith we pledge and truly declare that we have solved quiz 2 by ourselves, didn't do any cheating by any means, didn't do any plagiarism, and didn't accept anybody's help by any means. We are going to accept all of the consequences by any means if it has proven that we have been done any cheating and/or plagiarism."

Surabaya, 30 March 2019

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