TUGAS KECIL III [IF2211] STRATEGI ALGORITMA
IMPLEMENTASI ALGORITMA BFS DAN A* PADA PERSOALAN LABIRIN (*MAZE PROBLEM*)

Dibuat oleh:

Leonardo / 13517048

Vinsen Marselino Andreas / 13517054

PROGRAM STUDI TEKNIK INFORMATIKA

SEKOLAH TEKNIK ELEKTRO DAN INFORMATIKA

INSTITUT TEKNOLOGI BANDUNG

2019

BAB I
KODE PROGRAM

Pada tugas besar kali ini kami menggunakan 5 buah kode sumber dengan bahasa pemrograman Python.

1. MainProg.py

```
# Tugas Kecil 3 IF2211 Strategi Algoritma
# NIM / Nama    : 13517048 / Leonardo
#                 13517054 / Vinsen Marselino Andreas
# Nama File     : MainProg.py
# Deskripsi     : Memanggil algoritma A* dan BFS untuk mendapatkan path pada maze

from colorama import init
from AStar import *
from BFS import *
from EksFile import *

if __name__ == '__main__':
    init() #colorama
    try:
        file_name = str(input("Masukkan nama file yang berisi matriks(.txt): "))
        matAStar = AmbilData(file_name)
        matBFS = AmbilData(file_name)
        print("Maze =")
        matAStar.Print()
        x0 = input("Masukkan x1 dan y1 (dipisah spasi) = ")
        x1, y1= int(x0.split()[0]), int(x0.split()[1])
        x0 = input("Masukkan x2 dan y2 (dipisah spasi) = ")
        x2, y2 = int(x0.split()[0]), int(x0.split()[1])
        start_point = Point(x1, y1)
        end_point = Point(x2, y2)
        print("\nHasil Algoritma A* =")
        try:
            path = Astar(matAStar, start_point, end_point)
            for ea in path:
                matAStar.AddData(ea.getX(), ea.getY(), 2) #berikan nilai 2 agar path
diwarnai hijau
            matAStar.Print()
        except (TypeError):
            print("Path tidak ditemukan!")

        print("\nHasil Algoritma BFS =")
        try:
            path = BFS(matBFS, start_point, end_point)
```

```
            for ea in path:
                matBFS.AddData(ea.getX(), ea.getY(), 2) #berikan nilai 2 agar path
diwarnai hijau
            matBFS.Print()
        except (TypeError):
            print("Path tidak ditemukan!")
    except (FileNotFoundError):
        print("File tidak ditemukan")
```

2. EksFile.py

```
# Tugas Kecil 3 IF2211 Strategi Algoritma
# NIM / Nama    : 13517048 / Leonardo
#                 13517054 / Vinsen Marselino Andreas
# Nama File     : EksFile.py
# Deskripsi     : Pembacaan file
from ADT import *

def AmbilData(file_name):
    list_input = []
    n_kolom = 0
    n_baris = 1
    check_baris = True

    mat_file = open(file_name,'r')
    a = mat_file.read(1)
    while (a!=""):
        if(a == '1' or a == '0'):
            list_input.append(a)
            if(check_baris):
                n_kolom += 1
        elif(a == '\n'):
            n_baris += 1
            check_baris = False
        a = mat_file.read(1) #baca 1 karakter

    iter_baris = 0
    iter_kolom = 0
    matriks_maze = Matriks(n_baris,n_kolom)
    for i in list_input:
        matriks_maze.AddData(iter_baris,iter_kolom,i)
        iter_kolom += 1
        if(iter_kolom == n_kolom):
            iter_baris += 1
```

```
            iter_kolom = iter_kolom % n_kolom

    return matriks_maze
```

3. ADT.py

```
# Tugas Kecil 3 IF2211 Strategi Algoritma
# NIM / Nama    : 13517048 / Leonardo
#                 13517054 / Vinsen Marselino Andreas
# Nama File     : ADT.py
# Deskripsi     : Tipe bentukan untuk Point, Matriks, dan Node

from colorama import Back, Style
import numpy as np
from math import sqrt

class Point:
    def __init__(self, _x = 0, _y = 0):
        self.x = _x
        self.y = _y

    def __eq__(self, other):
        return ((self.x == other.x) and (self.y == other.y))

    def getX(self):
        return self.x

    def getY(self):
        return self.y

    @staticmethod
    def EuclideanDistance(P1, P2): #P1 dan P2 = Point
        return sqrt((P1.x - P2.x)**2 + (P1.y - P2.y)**2)

#matriks NxM
class Matriks:
    def __init__(self, _n = 0, _m = 0):
        self.N = _n
        self.M = _m
        self.data = np.zeros((self.N, self.M), dtype = int)

    def AddData(self, i, j, value):
        self.data[i][j] = value
```

```
    def getData(self, i, j):
        return self.data[i][j]

    def Print(self):
        for i in range(self.N):
            for j in range(self.M):
                if (self.getData(i,j) == 1):
                    print(Back.LIGHTBLACK_EX + " ", end = " ")
                    print(Style.RESET_ALL, end = "")
                elif (self.getData(i,j) == 2):
                    print(Back.GREEN + " ", end = " ")
                    print(Style.RESET_ALL, end = "")
                else: #self.getData(i,j) == 0
                    print(Back.WHITE + " ", end = " ")
                    print(Style.RESET_ALL, end = "")
            print(Style.RESET_ALL)

class Node:
    def __init__(self, _pred = None, _pos = Point()):
        self.pred = _pred
        self.pos = _pos

        self.toN = 0
        self.fromN = 0

    def isEqual(self, node2):
        return ((self.pos.x == node2.pos.x) and
                (self.pos.y == node2.pos.y))

    def ExistIn(self, listOfNode):
        for v in listOfNode:
            if (self.isEqual(v)):
                return True
        #sampai bagian ini jika self tidak exist di listOfNode
        return False

    def search(self, listOfNode):
        for v in listOfNode:
            if (self.isEqual(v)):
                return v.pred
        #sampai bagian ini jika self tidak exist di listOfNode
        return False

    def g(self):
```

```
        return self.toN

    def h(self):
        return self.fromN

    def f(self):
        return self.g() + self.h()
```

4. BFS.py

```
# Tugas Kecil 3 IF2211 Strategi Algoritma
# NIM / Nama    : 13517048 / Leonardo
#                 13517054 / Vinsen Marselino Andreas
# Nama File     : BFS.py
# Deskripsi     : Implementasi algoritma BFS
from ADT import *

def BFS(maze, start, end):
    if(maze.data[start.x][start.y] == 0 and maze.data[end.x][end.y] == 0):
        visited = []
        queue = []
        curr_node = Node(None, start)

        queue.append(curr_node)
        while (queue != [] and curr_node.pos != end):
            curr_node = queue.pop(0)
            prev_node = curr_node
            if(not(curr_node.ExistIn(visited))):
                visited.append(curr_node)
                if(curr_node.pos.x+1 < maze.N):
                    if (maze.data[curr_node.pos.x+1][curr_node.pos.y] == 0):
                        next_pos = Point(curr_node.pos.x+1,curr_node.pos.y)
                        next_node = Node(prev_node, next_pos)
                        queue.append(next_node)
                if(curr_node.pos.x-1 >= 0):
                    if (maze.data[curr_node.pos.x-1][curr_node.pos.y] == 0):
                        next_pos = Point(curr_node.pos.x-1,curr_node.pos.y)
                        next_node = Node(prev_node, next_pos)
                        queue.append(next_node)
                if(curr_node.pos.y+1 < maze.M):
                    if (maze.data[curr_node.pos.x][curr_node.pos.y+1] == 0):
                        next_pos = Point(curr_node.pos.x,curr_node.pos.y+1)
                        next_node = Node(prev_node, next_pos)
                        queue.append(next_node)
```

```
                if(curr_node.pos.y-1 >= 0):
                    if (maze.data[curr_node.pos.x][curr_node.pos.y-1] == 0):
                        next_pos = Point(curr_node.pos.x,curr_node.pos.y-1)
                        next_node = Node(prev_node, next_pos)
                        queue.append(next_node)
        if (curr_node.pos == end):
            path = [end]
            start_node = Node(None,end)
            while(start_node.pos != start):
                path_node = start_node.search(visited)
                path.append(path_node.pos)
                start_node = path_node
            path.append(start)
            return path[::-1]
```

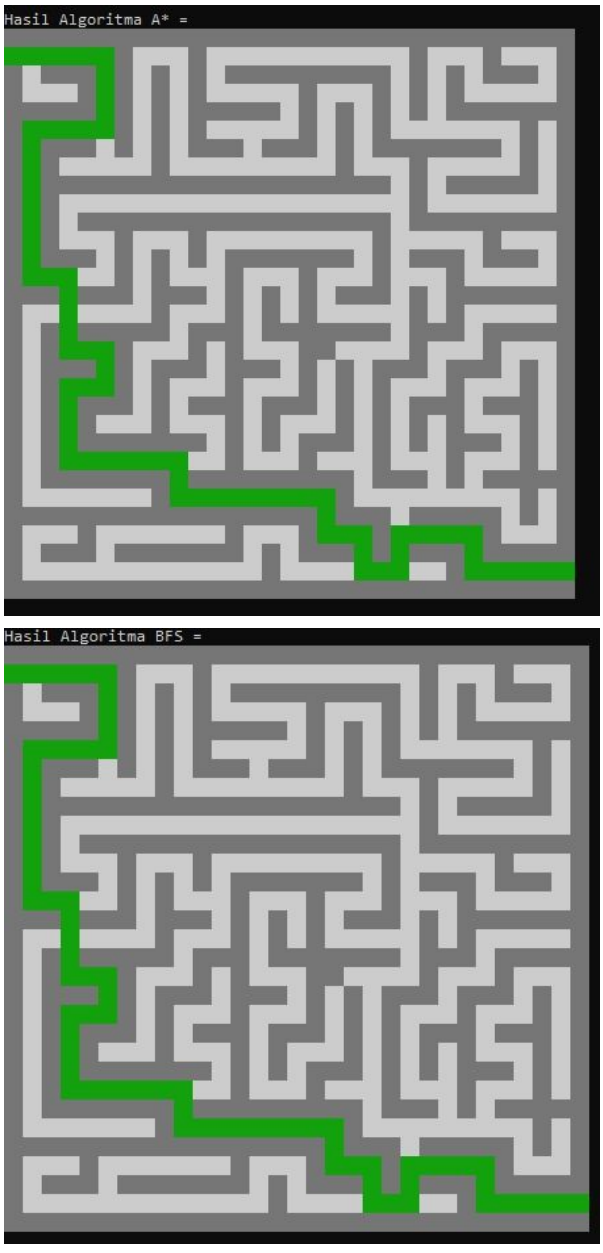
5. AStar.py

```
# Tugas Kecil 3 IF2211 Strategi Algoritma
# NIM / Nama    : 13517048 / Leonardo
#                 13517054 / Vinsen Marselino Andreas
# Nama File     : AStar.py
# Deskripsi     : Implementasi algoritma Astar

from ADT import *

#algoritma A Star
#matriks = Matriks
#Pstart, Pend = Point
def Astar(matriks, Pstart, Pend):
    if (matriks.getData(Pstart.getX(), Pstart.getY()) == 0): #dimulai dari jalan
        node_start = Node(None, Pstart)
        node_end = Node(None, Pend)

        candidate = []; visited = []
        candidate.append(node_start)
        #selagi masih ada kandidat
        while (len(candidate) > 0):
            idx = 0
            node_current = candidate[0]
            for i, n in enumerate(candidate):
                if (n.f() < node_current.f()):
                    idx = i
                    node_current = n #mengambil kandidat yang memiliki nilai f()
terkecil
```

```
            candidate.pop(idx); visited.append(node_current)
            if (node_current.isEqual(node_end)):
                path = []
                current = node_current
                while current is not None:
                    path.append(current.pos)
                    current = current.pred
                return path[::-1] #dibalik

            else: #penelusuran belum selesai
                '''
                melakukan perjalanan sesuai arah jalan
                    0,1  = bergerak 1 ke atas
                    0,-1 = bergerak 1 ke bawah
                    1,0  = bergerak 1 ke kanan
                    -1,0 = bergerak 1 ke kiri
                '''
                arah_jalan = [[0, 1], [0, -1], [1, 0], [-1, 0]]
                successor = []
                for arah in arah_jalan:
                    temp_pos = Point(node_current.pos.getX() + arah[0],
                                     node_current.pos.getY() + arah[1])

                    if ((temp_pos.getX() < matriks.N) and
                        (temp_pos.getX() >= 0) and
                        (temp_pos.getY() < matriks.M) and
                        (temp_pos.getY() >= 0)):
                        #valid (ada di dalam maze)
                        if (matriks.getData(temp_pos.getX(), temp_pos.getY()) == 0):
                            #ada jalan
                            node_new = Node(node_current, temp_pos)
                            successor.append(node_new)

                for each in successor:
                    if (not each.ExistIn(visited)):
                        each.toN = node_current.g() + 1
                        each.fromN = Point.EuclideanDistance(each.pos, Pend)

                        if (not each.ExistIn(candidate)):
                            candidate.append(each)
    else: #Pstart tidak dimulai dari jalan yang ada
        raise TypeError
```

Teruntuk algoritma A*, g(n) kami merupakan berapa banyaknya langkah yang telah dilakukan, dan fungsi heuristik h(n) merupakan jarak *Euclidean* dari point sekarang menuju ke point finish.

BAB II
LABIRIN INPUT DAN SCREENSHOT HASIL

11111111111111111111 00001000100010010000 10101010111010101101 10100010000000101000 1 10111111111111110101 10000000001000001010 1 11111111101011101010 1 10001010001000100010 1 10101010111111111101 10100010001000000010 1 10111111101011110101 10100000101000001000 1 10101110101111101110 1 10001000001000101010 1 11111011101010101010 1 10001010101010101000 1 10101010101011101011 1 10101000101000001000 1 10111111101111111110 1 10000000000000000001 11111111111111111111	

```
1111111111111111111111111111111111111111111111111
1000100000100010000000100000000000000000000000101
1010101110101010111110111011101111111110101010101
1010101000101000100010100010001000001010101010101
1011101010111111101010101110101011101010101010101
1000001010100000101010001000101000101010101010101
1111111010101110101011111111101110101010101010101
1000000010001010001000000010001000100010101010101
1010111111111011111011111011101011111110101010101
1010000010001000000010001000001010000000101010101
1011111010101111111110101111111010101111101010101
0000100010101000100000100000001000100000101010101
1111101010101010101111111111111111111110111010101
1000101010100010001000000000000000000010001010101
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1010001000100000000000100010001000100000101010101
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1010101010111111101111101011101111101011101010101
1010101010001000001000101010000000101000101010101
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1010111110111010101011111010111111111111101010101
1010100000101010101000001010001000001010101010101
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1010001000100010100000101000000010101010101010101
1010111010111111011101110111111111101010101010101
1010100010000010101000001000000010101000001010101
1010101110111010101010111011111010101111101010101
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1011101010101111101011111011111011111010101010101
1000101010101000101000000010001000100000101010101
1010111010101110101111111111011101011111101010101
1010001010100000100000100000100010000010101010101
1111101011111111111111010111110111111101010101101
1000001000000000010001000100010100000101010101101
1011111111101111101011111010111011101010101010101
1000000000100000001000000010000010001000101010101
1111111111111111111111111111111111111111111111111
```
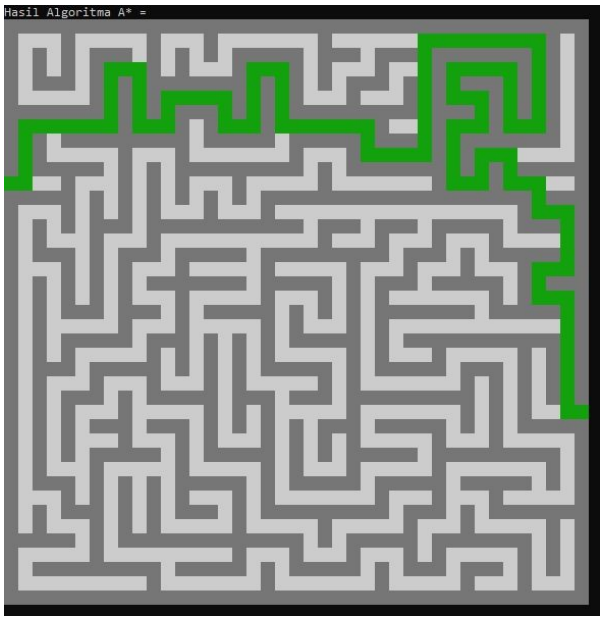
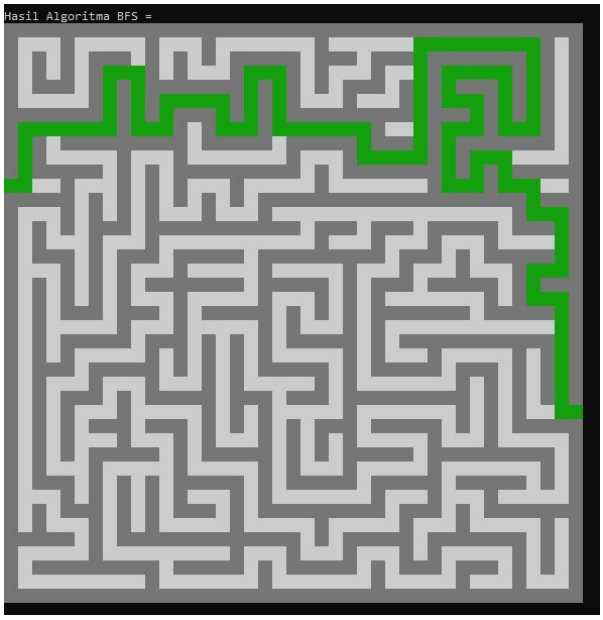
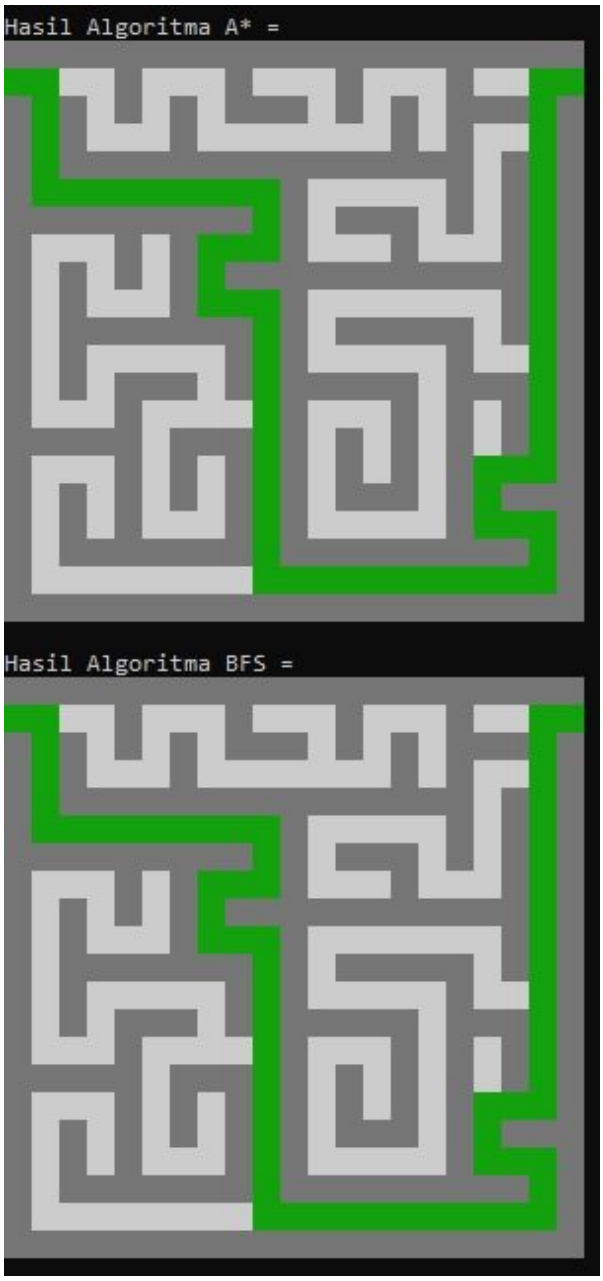





1111111111 1000001000 1001100011 1100111001 1000101111 1010101001 0010000011 1111111111	

```
11111111111111111111
00001000100010010000
10101010111010101101
10100010000000101001
10111111111111110101
10000000001000001010
11111111101011010101
10001010001000100101
10101010111111111101
10100010001000000101
10111111101011110101
10100000101000001001
10101110101111101101
10001000001000101010
11111011101010101010
10001010101010101001
10101010101011101011
10101000101000001001
10111111101111111101
10000000000000000001
11111111111111111111
```



111111111111 100000000001 001111110111 101000000001 101011111101 101010000001 100011011101 101000010111 101111000001 101011111111 100011000001 111111011111	Masukkan x1 dan y1 (dipisah spasi) = 2 0 Masukkan x2 dan y2 (dipisah spasi) = 10 10 Hasil Algoritma A* = Path tidak ditemukan! Hasil Algoritma BFS = Path tidak ditemukan!

BAB III
TABEL PENILAIAN

1.	Program dapat menerima input labirin	✔
2.	Program dapat mencari lintasan dengan Algoritma BFS	✔
3.	Program dapat mencari lintasan dengan Algoritma A*	✔
4.	Program dapat menampilkan lintasan di dalam labirin dengan algoritma BFS	✔
5.	Program dapat menampilkan lintasan di dalam labirin dengan algoritma a*	✔

BAB IV
DAFTAR PUSTAKA

1. http://informatika.stei.itb.ac.id/~rinaldi.munir/Stmik/2018-2019/Tucil3-Stima-2019.pdf
2. http://informatika.stei.itb.ac.id/~rinaldi.munir/Stmik/2018-2019/BFS-dan-DFS-(2019).pdf
3. http://informatika.stei.itb.ac.id/~rinaldi.munir/Stmik/2017-2018/A-Star-Best-FS-dan-UCS-(2018).pdf