Notebook-GraphSearchPath.ipynb

File Edit View Insert Runtime Tools Help All changes saved

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Praktikum Teknologi Kecerdasan Artifisial

Section

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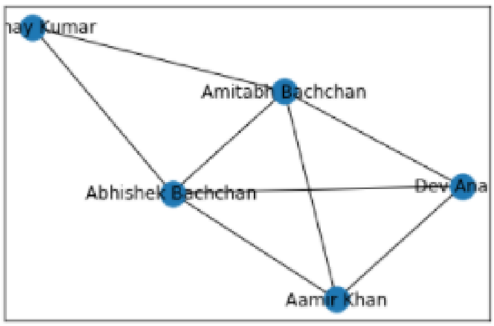
Praktikum Teknologi Kecerdasan Artifisial

```
[ ] import networkx as nx
    G_symmetric = nx.Graph()
    G_symmetric.add_edge('Amitabh Bachchan','Abhishek Bachchan')
    G_symmetric.add_edge('Amitabh Bachchan','Aamir Khan')
    G_symmetric.add_edge('Amitabh Bachchan','Akshay Kumar')
    G_symmetric.add_edge('Amitabh Bachchan','Dev Anand')
    G_symmetric.add_edge('Abhishek Bachchan','Aamir Khan')
    G_symmetric.add_edge('Abhishek Bachchan','Akshay Kumar')
    G_symmetric.add_edge('Abhishek Bachchan','Dev Anand')
    G_symmetric.add_edge('Dev Anand','Aamir Khan')
    nx.draw_networkx(G_symmetric)
    G_asymmetric = nx.DiGraph()
    G_asymmetric.add_edge('A','B')
    G_asymmetric.add_edge('A','D')
    G_asymmetric.add_edge('C','A')
    G_asymmetric.add_edge('D','E')
    G_asymmetric.add_edge('A','E')
```



Logika Pemrograman :

Untuk membuat program diatas kita dapat menggunakan import network as nx. import network as nx berguna untuk membentuk dan memanipulasi segala bentuk graf dan jaringan. G_symmetric berguna untuk menambahkan busur yang menghumbungkan satu simpul ke simpul lainnya. Pertama tama masukkan nama-nama yang ingin di buat graph, lalu kita misalkan nama-nama tersebut dengan huruf abjad seperti A,B,C,D,E. Setelah itu kelompokkan nama yang ingin saling terhubung misal (‘A’,’B’) .

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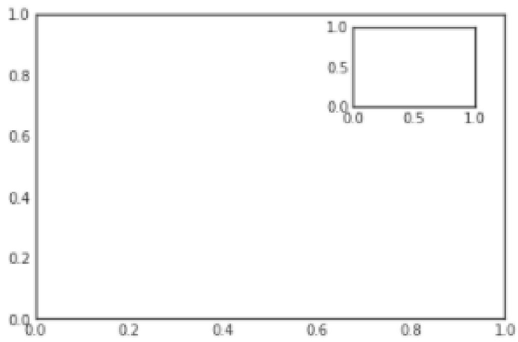
```python
import matplotlib.pyplot as plt
plt.style.use('seaborn-white')
import numpy as np
ax1 = plt.axes()  # standard axes
ax2 = plt.axes([0.65, 0.65, 0.2, 0.2])
```




```python
[ ]  import networkx as nx
     import numpy as np
     import sys
     import time

     class Graph:
         def __init__(self):
             # dictionary containing keys that map to the corresponding vertex object
             self.vertices = {}

         def add_vertex(self, key):
             """Add a vertex with the given key to the graph."""
             vertex = Vertex(key)
```

Logika Pemrograman :

Untuk membuat program tersebut kita dapat menggunakan import matplotlib.pyplot as plt dan juga import numpy as np. Pertama tama buat graph dengan kelipatan 0,2 di setiap bilangannya di mulai dari angka 0 sampai angka 10. Kemudian buat graph yang lebih kecil ukurannya dan di letakkan di dalam graph yang pertama namun graph yang kedua memiliki kelipatan 0.5 dimulai dari angka 0 sampai 10.

Untuk membuat program tersebut kita dapat menggunakan import matplotlib.pyplot as plt, import numpy as np, import sys, import time.

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```
    def add_vertex(self, key):
        """Add a vertex with the given key to the graph."""
        vertex = Vertex(key)
        self.vertices[key] = vertex

    def get_vertex(self, key):
        """Return vertex object with the corresponding key."""
        return self.vertices[key]

    def __contains__(self, key):
        return key in self.vertices

    def add_edge(self, src_key, dest_key, weight=1):
        """Add edge from src_key to dest_key with given weight."""
        self.vertices[src_key].add_neighbour(self.vertices[dest_key], weight)

    def does_vertex_exist(self, key):
        return key in self.vertices

    def does_edge_exist(self, src_key, dest_key):
        """Return True if there is an edge from src_key to dest_key."""
        return self.vertices[src_key].does_it_point_to(self.vertices[dest_key])

    def display(self):
        #print('Vertices: ', end='')
        #for v in self:
        #    print(v.get_key(), end=' ')
        #print()
        list_edge = []

        #print('Edges: ')
        G_symmetric = nx.Graph()
        tot_w = 0
        tot_edge = 0
        for v in self:
            for dest in v.get_neighbours():
```

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```
        #print('Edges: ')
        G_symmetric = nx.Graph()
        tot_w = 0
        tot_edge = 0
        for v in self:
            for dest in v.get_neighbours():
                w = v.get_weight(dest)
                if (int(v.get_key()) < int(dest.get_key())):
                    edge = []
                    tot_w += w
                    tot_edge += 1
                    edge.append(v.get_key())
                    edge.append(dest.get_key())
                    edge.append(w)
                    #print('(src={}, dest={}, weight={}) '.format(v.get_key(),
                    #                                          dest.get_key(), w))
                    list_edge.append(edge)
        print("Total nilai sapnning= %d dan jumlah edge= %d"%(tot_w,tot_edge))
        return list_edge

    def __len__(self):
        return len(self.vertices)

    def __iter__(self):
        return iter(self.vertices.values())


class Vertex:
    def __init__(self, key):
        self.key = key
        self.points_to = {}

    def get_key(self):
        """Return key corresponding to this vertex object."""
        return self.key
```

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```python
class Vertex:
    def __init__(self, key):
        self.key = key
        self.points_to = {}

    def get_key(self):
        """Return key corresponding to this vertex object."""
        return self.key

    def add_neighbour(self, dest, weight):
        """Make this vertex point to dest with given edge weight."""
        self.points_to[dest] = weight

    def get_neighbours(self):
        """Return all vertices pointed to by this vertex."""
        return self.points_to.keys()

    def get_weight(self, dest):
        """Get weight of edge from this vertex to dest."""
        return self.points_to[dest]

    def does_it_point_to(self, dest):
        """Return True if this vertex points to dest."""
        return dest in self.points_to


def mst_krusal(g):
    """Return a minimum cost spanning tree of the connected graph g."""
    mst = Graph() # create new Graph object to hold the MST

    if len(g) == 1:
        u = next(iter(g)) # get the single vertex
        mst.add_vertex(u.get_key()) # add a copy of it to mst
        return mst
```

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```
def mst_krusal(g):
    """Return a minimum cost spanning tree of the connected graph g."""
    mst = Graph() # create new Graph object to hold the MST

    if len(g) == 1:
        u = next(iter(g)) # get the single vertex
        mst.add_vertex(u.get_key()) # add a copy of it to mst
        return mst

    # get all the edges in a list
    edges = []
    for v in g:
        for n in v.get_neighbours():
            # avoid adding two edges for each edge of the undirected graph
            if v.get_key() < n.get_key():
                edges.append((v, n))

    # sort edges
    edges.sort(key=lambda edge: edge[0].get_weight(edge[1]))

    # initially, each vertex is in its own component
    component = {}
    for i, v in enumerate(g):
        component[v] = i

    # next edge to try
    edge_index = 0

    # loop until mst has the same number of vertices as g
    while len(mst) < len(g):
        u, v = edges[edge_index]
        edge_index += 1

        # if adding edge (u, v) will not form a cycle
        if component[u] != component[v]:
```

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```
        # next edge to try
        edge_index = 0

        # loop until mst has the same number of vertices as g
        while len(mst) < len(g):
            u, v = edges[edge_index]
            edge_index += 1

            # if adding edge (u, v) will not form a cycle
            if component[u] != component[v]:

                # add to mst
                if not mst.does_vertex_exist(u.get_key()):
                    mst.add_vertex(u.get_key())
                if not mst.does_vertex_exist(v.get_key()):
                    mst.add_vertex(v.get_key())
                mst.add_edge(u.get_key(), v.get_key(), u.get_weight(v))
                mst.add_edge(v.get_key(), u.get_key(), u.get_weight(v))

                # merge components of u and v
                for w in g:
                    if component[w] == component[v]:
                        component[w] = component[u]

        return mst


    g = Graph()
    print('Undirected Graph')
    print('Menu')
    print('add vertex <key>')
    print('add edge <src> <dest> <weight>')
    print('mst')
    print('display')
    print('quit')
```

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```
N = 10

for i in range (0,N):
     g.add_vertex(str(i))

a = np.random.randint(2,200,(N,N), dtype=int)
print(a)

for i in range (0,N):
     for j in range (0,N):
         #if (i < j) :
            g.add_edge(str(i),str(j),a[i,j])

start = time.time()
mst = mst_krusal(g)
print('Waktu Minimum Spanning Tree:%2f'%(time.time()-start))
l_edge = mst.display()
G_sym = nx.Graph()
for e in l_edge:
    G_sym.add_edge(e[0],e[1],weight=int(e[2]))
nx.draw_networkx(G_sym)

sh_path = nx.shortest_path(G_sym,'0', str(N-1))
G_sp = nx.Graph()
print("Jalur terpendek dari node : 0 ke 9: ", sh_path)

for i in range (len(sh_path)-1):
    v1 = g.get_vertex((sh_path[i]))
    v2 = g.get_vertex((sh_path[i+1]))
    print("weight dari ",v1.get_key()," ke ",v2.get_key()," = ",v1.get_weight(v2))
    G_sp.add_edge(v1,v2,weight=v1.get_weight(v2))

#nx.draw_networkx(G_sp)
```

Undirected Graph

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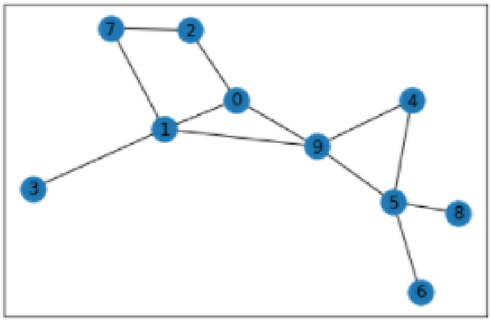
```
#nx.draw_networkx(G_sp)
```

```
Undirected Graph
Menu
add vertex <key>
add edge <src> <dest> <weight>
mst
display
quit
[[148  29  37  70 104  87 191 120  89  39]
 [194 154 162   9 112  55  62  13  89  10]
 [ 32  43 169  22 163  67 196  19 178 141]
 [124  10 112  82  25  30  93 169 129 116]
 [  8   7 158  40 160   9  52  87 113  13]
 [ 24 159 159 124 112 165  29  61  59  48]
 [ 31   4 128  70  39  48 125 164 148 197]
 [ 85  77 106  44  80   4  93 148 114 163]
 [102  16  97  51  76 176  36  23 152  75]
 [109 159 151 176  25  42 195  52  13 138]]
Waktu Minimum Spanning Tree:0.000186
Total nilai sapnning= 314 dan jumlah edge= 12
Jalur terpendek dari node : 0 ke 9:  ['0', '9']
weight dari  0  ke  9  =  39
```



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Logika Pemograman:

Untuk membuat program tersebut kita dapat menggunakan import matplotlib.pyplot as plt, import numpy as np, import sys, import time. Kemudian run seluruh program.

Keterangan:

• import matplotlib.pyplot as plt = berfungsi untuk mengimport library plotting 2D python untuk menghasilkan gambar.

• import numpy as np = berfungsi untuk menyimpan data array. • import sys = berfungsi sebagai interpreter pada python.

• import time = berfungsi untuk mengimport sebuah modul waktu.

Pertama tama masukkan angka dari 0 sampai 9 dan kemudian di buat graph lalu pada outputnya nanti akan terhubung dengan garis-garis dan di setiap garisnya tersebut memiliki bobot dan nanti akan di cari jalur tercepat dari 0 ke 9 lalu nanti akan ada bobot dari setiap garis yang di lalui.