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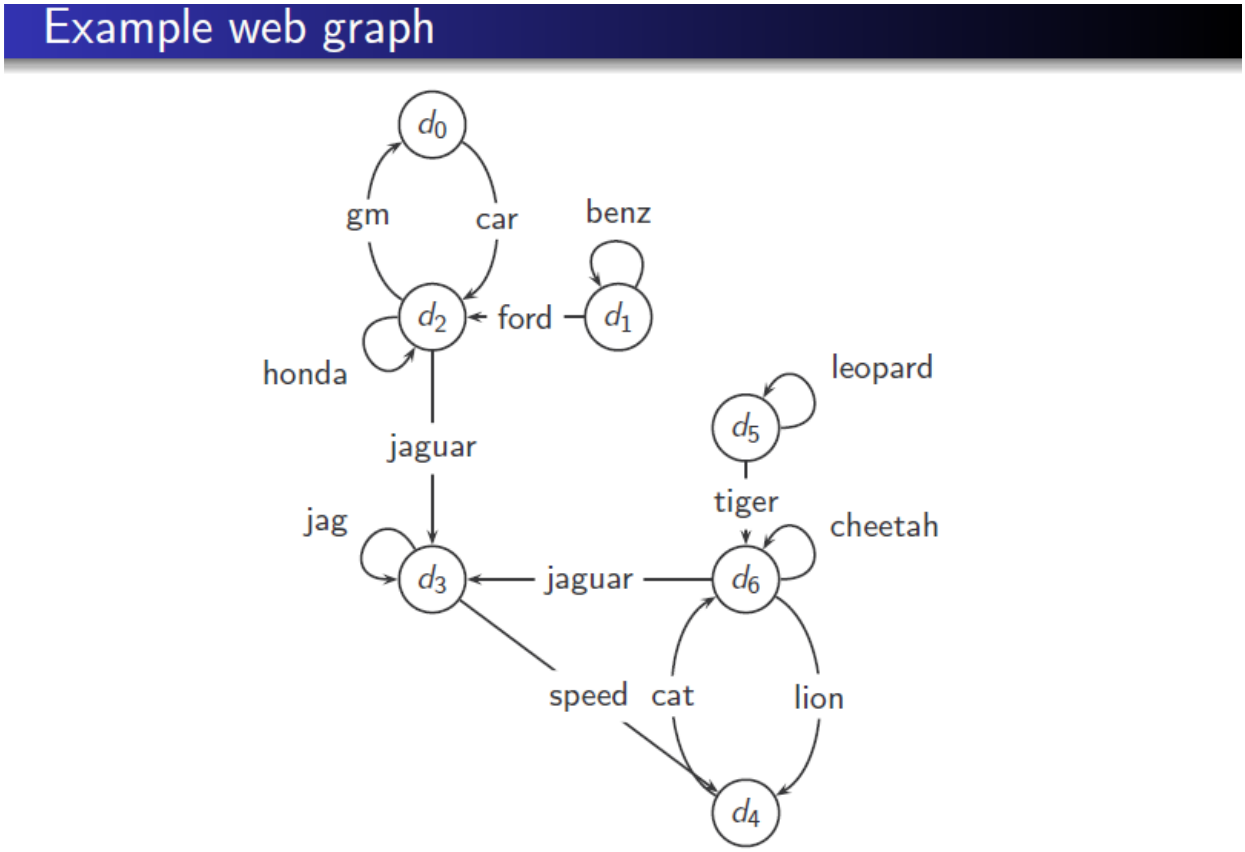
19BCE1403

9/29/2021

Page rank algorithm – lab assignment



Note: The value of d used is 0.85 (damping factor)

PROGRAM CODE:

```
import numpy as np

trial = np.matrix((
                    [0,1,1,0,0],
                    [1,0,1,1,0],
                    [1,0,0,1,1],
                    [1,0,0,0,1],
                    [0,0,0,0,0]
                ))

# adjancency matrix for Q1
ag1 = np.matrix((
             [0,0,1,0,0,0,0],
             [0,0,1,0,0,0,0],
             [1,0,0,1,0,0,0],
             [0,0,0,0,1,0,0],
             [0,0,0,0,0,0,1],
             [0,0,0,0,0,0,1],
             [0,0,0,1,1,0,0]
            ))

# adjancency matrix for Q2
ag2 = np.matrix((
             [0,0,1,0,0,0,0],
             [0,1,1,0,0,0,0],
             [1,0,1,1,0,0,0],
             [0,0,0,1,1,0,0],
             [0,0,0,0,0,0,1],
             [0,0,0,0,0,1,1],
             [0,0,0,1,1,0,1]
            ))

# adjancency matrix for Q3
ag3= np.matrix((
             [0,0,1,0,0,0,0],
             [0,1,1,0,0,0,0],
             [1,0,1,2,0,0,0],
             [0,0,0,1,1,0,0],
             [0,0,0,0,0,0,1],
             [0,0,0,0,0,1,1],
             [0,0,0,2,1,0,1]
            ))

# logic

adjac_grp = ag3 # select the adjacency matrix
```

```python
M = adjac_grp.T

s = np.sum(M,axis=0) # sum along the column
s = np.where(s==0,1,s) # changing any value of sum if it is zero to 1 so that we can divide

M = M / s

print("Inlink matrix: ")
print(np.round(M,2))

rank = [(1/len(M))] * len(M)

rank = np.transpose([rank])

k=25
d = 0.85

for _ in range(k):
    rank = np.round((1-d) + d * np.dot(M,rank),3)

print("\nRank after 25 iterations")
print(f"Rank of the pages are: {[r for r in rank.T[0]]}")
```

1. Form the adjacency graph of this **IGNORING SELF LOOPS with the following principles**
   a. **dx-dy entry is 1 if there is alink**
   b. **dx-dy entry is 0 if there is no link**
   c. Calculate the Page rank using Page rank algorithm for this graph **IGNORING SELF LOOPS** by writing a program in python**.**Perform 25 iterations and print out the final values of Page rank for all nodes.

OUTPUT:

```
(venv) PS C:\Users\Gerosh\Desktop\VIT\Third Year\Web Minning\Programs> python page_rank.py
Inlink matrix:
[[0.  0.  0.5 0.  0.  0.  0. ]
 [0.  0.  0.  0.  0.  0.  0. ]
 [1.  1.  0.  0.  0.  0.  0. ]
 [0.  0.  0.5 0.  0.  0.  0.5]
 [0.  0.  0.  1.  0.  0.  0.5]
 [0.  0.  0.  0.  0.  0.  0. ]
 [0.  0.  0.  0.  1.  1.  0. ]]

Rank after 25 iterations
Rank of the pages are:
D0 : 0.419
D1 : 0.15
D2 : 0.634
D3 : 1.306
D4 : 2.144
D5 : 0.15
D6 : 2.093
```

2. Form the adjacency graph of this INCLUDING SELF LOOPS with the following principles.
   a.dx-dy entry is 1 if there is alink
   b.dx-dy entry is 0 if there is no link
   c.Calculate the Page rank using page rank algorithm for this graph **INCLUDING SELF LOOPS** by writing a program in python**.**Perform 25 iterations and print out the final values of Page rank for all nodes.

   The program as well as the output should be uploaded.

OUTPUT:

```
(venv) PS C:\Users\Gerosh\Desktop\VIT\Third Year\Web Minning\Programs> python page_rank.py
Inlink matrix:
[[0.   0.   0.33 0.   0.   0.   0.  ]
 [0.   0.5  0.   0.   0.   0.   0.  ]
 [1.   0.5  0.33 0.   0.   0.   0.  ]
 [0.   0.   0.33 0.5  0.   0.   0.33]
 [0.   0.   0.   0.5  0.   0.   0.33]
 [0.   0.   0.   0.   0.   0.5  0.  ]
 [0.   0.   0.   0.   1.   0.5  0.33]]

Rank after 25 iterations
Rank of the pages are:
D0 : 0.381
D1 : 0.261
D2 : 0.816
D3 : 1.672
D4 : 1.441
D5 : 0.261
D6 : 2.064
```

Raw matrix A for HITS

	d_0	d_1	d_2	d_3	d_4	d_5	d_6
d_0	0	0	1	0	0	0	0
d_1	0	1	1	0	0	0	0
d_2	1	0	1	2	0	0	0
d_3	0	0	0	1	1	0	0
d_4	0	0	0	0	0	0	1
d_5	0	0	0	0	0	1	1
d_6	0	0	0	2	1	0	1

NOTE: You have entries having value more than 1 –This indicates there are multiple links from dx to dy and all links from dx to dy must be considered for computing Hub score and Authority score.

Calculate the Page rank score for this graph **INCLUDING SELF LOOPS** by writing a program in python**.**Perform 25 iterations and print out the final values of Hub score and authority score for all nodes.

The program as well as the output should be uploaded.

OUTPUT:

```
(venv) PS C:\Users\Gerosh\Desktop\VIT\Third Year\Web Minning\Programs> python page_rank.py
Inlink matrix:
[[0.   0.   0.25 0.   0.   0.   0.  ]
 [0.   0.5  0.   0.   0.   0.   0.  ]
 [1.   0.5  0.25 0.   0.   0.   0.  ]
 [0.   0.   0.5  0.5  0.   0.   0.5 ]
 [0.   0.   0.   0.5  0.   0.   0.25]
 [0.   0.   0.   0.   0.   0.5  0.  ]
 [0.   0.   0.   0.   1.   0.5  0.25]]

Rank after 25 iterations
Rank of the pages are:
D0 : 0.286
D1 : 0.261
D2 : 0.64
D3 : 2.118
D4 : 1.446
D5 : 0.261
D6 : 1.885
```