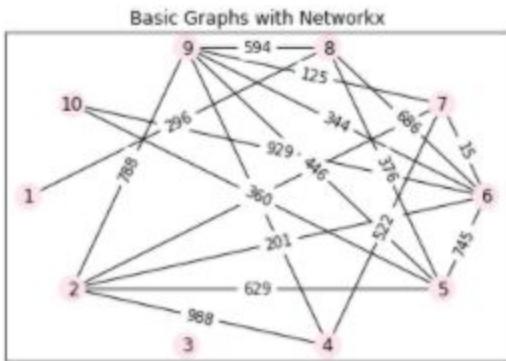


Assignment#2 Topology Mapping

Toqa alaa ahmed (14)
Nada salama mohamed (58)

For topology sizes 10

For t_10_0

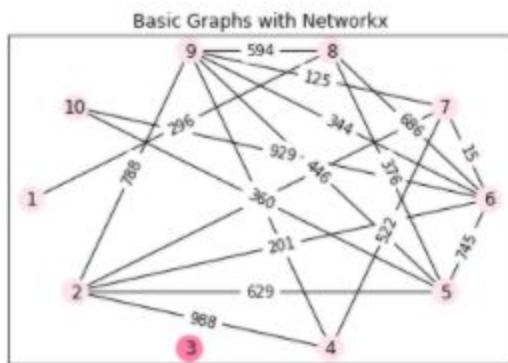


5 A

```
array([[ 0.,  0.,  0.,  0.,  0.,  0., 296.,  0.,  0.],
       [ 0.,  0.,  0., 988., 629., 201., 650.,  0., 788.,  0.],
       [ 0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.],
       [ 0., 988.,  0.,  0.,  0.,  0., 522.,  0., 269.,  0.],
       [ 0., 629.,  0.,  0.,  0., 745.,  0., 376., 446., 360.],
       [ 0., 201.,  0.,  0., 745.,  0., 15., 686., 344., 929.],
       [ 0., 650.,  0., 522.,  0., 15.,  0.,  0., 125.,  0.],
       [296.,  0.,  0., 376., 686.,  0.,  0., 594.,  0.],
       [ 0., 788.,  0., 269., 446., 344., 125., 594.,  0.,  0.],
       [ 0.,  0.,  0., 360., 929.,  0.,  0.,  0.,  0.,  0.]])
```

K = 2

Label : [0 0 1 0 0 0 0 0 0 0]



Conditional Entropy : 1.9774437510817338

FMeasure = 0.6666666666666666

```

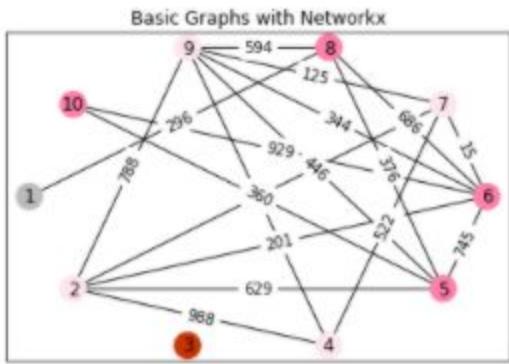
label [0 0 1 0 0 0 0 0 0 0]
True_clustering [2, 1, 20, 2, 4, 0, 3, 3, 0, 2]
[[ 0  0]
 [ 0  1]
 [ 0  2]
 [ 0  3]
 [ 0  4]
 [ 1 20]] [2 1 3 2 1 1]
[0 1] [9 1]
max [3, 1]
numclass [0, 1]
sumClass [9, 1]
prec [0.3333333333333333, 1.0]
rec [0.3333333333333333, 1.0]
F1 [0.3333333333333333, 1.0]
FMeasure = 0.6666666666666666

W = [[19.50868549  9.
      [ 9.          0.        ]]
WCC = [9. 9.]
NC = 1.3156932648458828

```

K = 4

Label : [2 0 3 0 1 1 0 1 0 1]



Conditional Entropy : 1.5999999999999999

FMeasure = 0.625

```

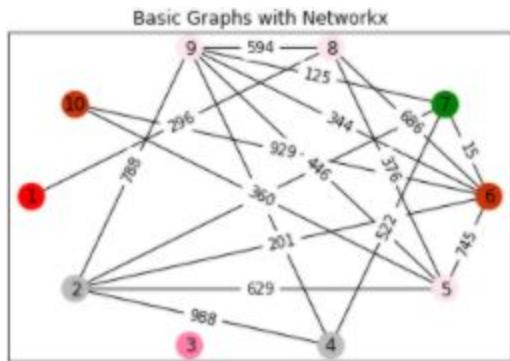
label [2 0 3 0 1 1 0 1 0 1]
True_clustering [2, 1, 20, 2, 4, 0, 3, 3, 0, 2]
[[ 0  0]
 [ 0  1]
 [ 0  2]
 [ 0  3]
 [ 1  0]
 [ 1  2]
 [ 1  3]
 [ 1  4]
 [ 2  2]
 [ 3 20]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3] [4 4 1 1]
max [1, 1, 1, 1]
numclass [0, 1, 2, 3]
sumClass [4, 4, 1, 1]
prec [0.25, 0.25, 1.0, 1.0]
rec [0.25, 0.25, 1.0, 1.0]
F1 [0.25, 0.25, 1.0, 1.0]
FMeasure = 0.625

```
W = [[0.36172593 11.04281049 4. 4.]
 [11.04281049 1.05233016 3.05181892 4.]
 [4. 3.05181892 0. 1.]
 [4. 4. 1. 0.]]
WCC = [19.04281049 18.09462941 8.05181892 9.]
NC = 3.9263979999979903

```

K = 6

Label : [4 2 1 2 0 3 5 0 0 3]



Conditional Entropy : 0.8754887502163471

FMeasure = 0.7222222222222222

```

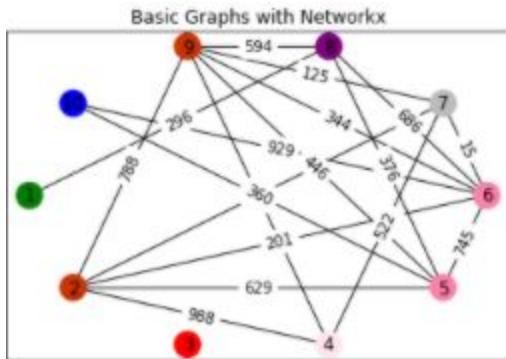
label [4 2 1 2 0 3 5 0 0 3]
True_clustering [2, 1, 20, 2, 4, 0, 3, 3, 0, 2]
[[0 0]
 [0 3]
 [0 4]
 [1 20]
 [2 1]
 [2 2]
 [3 0]
 [3 2]
 [4 2]
 [5 3]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5] [3 1 2 2 1 1]
max [1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [3, 1, 2, 2, 1, 1]
prec [0.3333333333333333, 1.0, 0.5, 0.5, 1.0, 1.0]
rec [0.3333333333333333, 1.0, 0.5, 0.5, 1.0, 1.0]
F1 [0.3333333333333333, 1.0, 0.5, 0.5, 1.0, 1.0]
FMeasure = 0.7222222222222222

W = [[3.74781333e-02 3.00000000e+00 3.07011393e+00 2.06101876e+00
2.05181892e+00 2.28650480e+00]
[3.00000000e+00 0.00000000e+00 2.00000000e+00 2.00000000e+00
1.00000000e+00 1.00000000e+00]
[3.07011393e+00 2.00000000e+00 5.11882779e-05 3.13398867e+00
2.00000000e+00 6.91076832e-03]
[2.06101876e+00 2.00000000e+00 3.13398867e+00 9.23430603e-05
2.00000000e+00 1.86070798e+00]
[2.05181892e+00 1.00000000e+00 2.00000000e+00 2.00000000e+00
0.00000000e+00 1.00000000e+00]
[2.28650480e+00 1.00000000e+00 6.91076832e-03 1.86070798e+00
1.00000000e+00 0.00000000e+00]]
WCC = [12.46945641 9. 10.21101338 11.05571541 8.05181892 6.15412354]
NC = 5.99699004626379

```

K = 8

Label : [5 3 4 0 1 1 2 7 3 6]



Conditional Entropy : 0.3999999999999999

FMeasure = 0.875

```

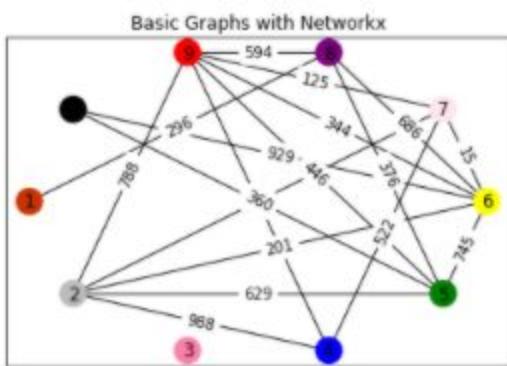
label [5 3 4 0 1 1 2 7 3 6]
True_clustering [2, 1, 20, 2, 4, 0, 3, 3, 0, 2]
[[0 2]
 [1 0]
 [1 4]
 [2 3]
 [3 0]
 [3 1]
 [4 20]
 [5 2]
 [6 2]
 [7 3]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 1 2 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 1, 2, 1, 1, 1, 1]
prec [1.0, 0.5, 1.0, 0.5, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 0.5, 1.0, 0.5, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 0.5, 1.0, 0.5, 1.0, 1.0, 1.0, 1.0]
FMeasure = 0.875

W = [[0.0000000e+00 2.0000000e+00 5.40732913e-03 6.79321276e-02
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
[2.0000000e+00 5.81441612e-04 1.86070798e+00 1.79470483e-01
2.0000000e+00 2.0000000e+00 2.74160655e-02 2.43326543e-02]
[5.40732913e-03 1.86070798e+00 0.0000000e+00 2.88008236e-01
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
[6.79321276e-02 1.79470483e-01 2.88008236e-01 3.78233057e-04
2.0000000e+00 2.0000000e+00 2.0000000e+00 1.00263203e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 2.0000000e+00
0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 2.0000000e+00
1.0000000e+00 0.0000000e+00 1.0000000e+00 5.18189172e-02]
[1.0000000e+00 2.74160655e-02 1.0000000e+00 2.0000000e+00
1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.43326543e-02 1.0000000e+00 1.00263203e+00
1.0000000e+00 5.18189172e-02 1.0000000e+00 0.0000000e+00]]
WCC = [6.07333946 8.09192718 6.15412354 7.53804288 9. 8.05181892
7.02741607 5.0787836]
NC = 7.999877976592273

```

K = 10

Label : [3 2 1 6 5 9 0 7 4 8]



Conditional Entropy : 0.0

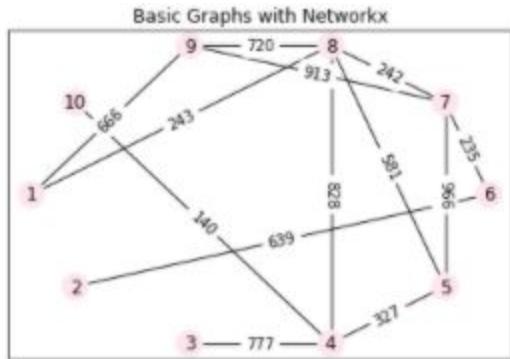


```
FMeasure = 1.0
```

```
label [3 2 1 6 5 9 0 7 4 8]
True_clustering [2, 1, 20, 2, 4, 0, 3, 3, 0, 2]
[[0 3]
 [1 20]
 [2 1]
 [3 2]
 [4 0]
 [5 4]
 [6 2]
 [7 3]
 [8 2]
 [9 0]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0.0000000e+00 1.0000000e+00 1.50343919e-03 1.0000000e+00
2.86504797e-01 1.0000000e+00 5.40732913e-03 1.0000000e+00
1.0000000e+00 8.60707976e-01]
[1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.50343919e-03 1.0000000e+00 0.0000000e+00 1.0000000e+00
3.78233057e-04 1.85475995e-03 5.11882779e-05 1.0000000e+00
1.0000000e+00 1.33988675e-01]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 5.18189172e-02
1.0000000e+00 1.0000000e+00]
[2.86504797e-01 1.0000000e+00 3.78233057e-04 1.0000000e+00
0.0000000e+00 1.15623633e-02 6.78809394e-02 2.63202965e-03
1.0000000e+00 3.20646853e-02]
[1.0000000e+00 1.0000000e+00 1.85475995e-03 1.0000000e+00
1.15623633e-02 0.0000000e+00 1.0000000e+00 2.32837404e-02
2.73237224e-02 5.81441612e-04]
[5.40732913e-03 1.0000000e+00 5.11882779e-05 1.0000000e+00
6.78809394e-02 1.0000000e+00 0.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 5.18189172e-02
2.63202965e-03 2.32837404e-02 1.0000000e+00 0.0000000e+00
1.0000000e+00 1.04891393e-03]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 2.73237224e-02 1.0000000e+00 1.0000000e+00
0.0000000e+00 9.23430603e-05]
[8.60707976e-01 1.0000000e+00 1.33988675e-01 1.0000000e+00
3.20646853e-02 5.81441612e-04 1.0000000e+00 1.04891393e-03
9.23430603e-05 0.0000000e+00]]
WCC = [6.15412354 9. 4.1377763 8.05181892 3.40102305 4.06460603
6.07333946 5.0787836 7.02741607 4.02848404]
NC = 10.0
```

For t\_10\_1



5 A

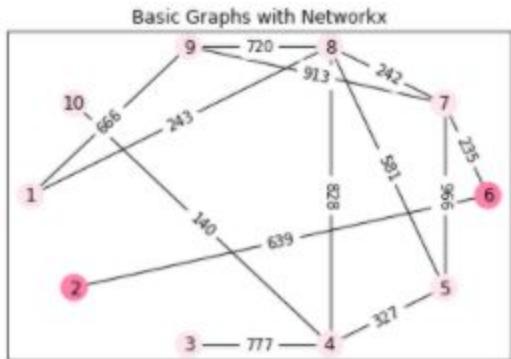
```

array([[0., 0., 0., 0., 0., 0., 0., 243., 666., 0.],
 [0., 0., 0., 0., 0., 0., 0., 639., 0., 0.],
 [0., 0., 0., 777., 0., 0., 0., 0., 0., 0.],
 [0., 0., 777., 0., 327., 0., 0., 828., 0., 140.],
 [0., 0., 0., 327., 0., 0., 966., 581., 0., 0.],
 [0., 639., 0., 0., 0., 235., 0., 0., 0., 0.],
 [0., 0., 0., 966., 235., 0., 242., 913., 0.],
 [243., 0., 0., 828., 581., 0., 242., 0., 720., 0.],
 [666., 0., 0., 0., 0., 913., 720., 0., 0.],
 [0., 0., 0., 140., 0., 0., 0., 0., 0., 0.]])

```

 $K = 2$ 

Label : [0 1 0 0 0 1 0 0 0 0]



Conditional Entropy : 0.963547202339972

FMeasure = 0.5625

```

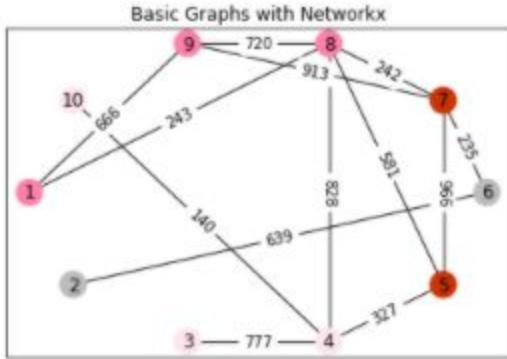
label [0 1 0 0 0 1 0 0 0 0]
True_clustering [0, 0, 0, 1, 1, 1, 1, 0, 0, 0]
[[0 0]
 [0 1]
 [1 0]
 [1 1]] [5 3 1 1]
[0 1] [8 2]
max [5, 1]
numclass [0, 1]
sumClass [8, 2]
prec [0.625, 0.5]
rec [0.625, 0.5]
F1 [0.625, 0.5]
FMeasure= 0.5625

```

```
W = [[1.74674349e+01 1.50953692e+01
 [1.50953692e+01 1.67825620e-03]]
WCC = [15.09536916 15.09536916]
NC = 1.4634659012389317
```

K = 4

Label : [1 2 0 0 3 2 3 1 1 0]



Conditional Entropy : 0.47548875021634696

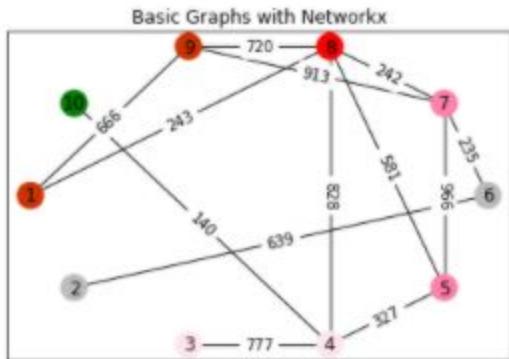
FMeasure = 0.7916666666666666

```
label [1 2 0 0 3 2 3 1 1 0]
True_clustering [0, 0, 0, 1, 1, 1, 1, 0, 0, 0]
[[0 0]
 [0 1]
 [1 0]
 [2 0]
 [2 1]
 [3 1]] [2 1 3 1 1 2]
[0 1 2 3] [3 3 2 2]
max [2, 3, 1, 2]
numclass [0, 1, 2, 3]
sumClass [3, 3, 2, 2]
prec [0.6666666666666666, 1.0, 0.5, 1.0]
rec [0.6666666666666666, 1.0, 0.5, 1.0]
F1 [0.6666666666666666, 1.0, 0.5, 1.0]
FMeasure= 0.7916666666666666

W = [[1.24701918e+00 8.00025354e+00 6.00000000e+00 5.03800643e+00
 [8.00025354e+00 9.00645648e-02 6.00000000e+00 3.09202741e+00]
 [6.00000000e+00 6.00000000e+00 1.67825620e-03 3.09536916e+00]
 [5.03800643e+00 3.09202741e+00 3.09536916e+00 6.37845219e-05]]
WCC = [19.03825996 17.09228095 15.09536916 11.225403]
NC = 3.933167366233219
```

K = 6

Label : [3 2 0 0 1 2 1 4 3 5]



Conditional Entropy : 0.4000000000000036

FMeasure = 0.8333333333333334

---

```

label [3 2 0 0 1 2 1 4 3 5]
True_clustering [0, 0, 0, 1, 1, 1, 1, 0, 0, 0]
[[0 0]
[0 1]
[1 1]
[2 0]
[2 1]
[3 0]
[4 0]
[5 0]] [1 1 2 1 1 2 1 1]
[0 1 2 3 4 5] [2 2 2 2 1 1]
max [1, 2, 1, 2, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [2, 2, 2, 2, 1, 1]
prec [0.5, 1.0, 0.5, 1.0, 1.0, 1.0]
rec [0.5, 1.0, 0.5, 1.0, 1.0, 1.0]
F1 [0.5, 1.0, 0.5, 1.0, 1.0, 1.0]
FMeasure= 0.8333333333333334

```

---

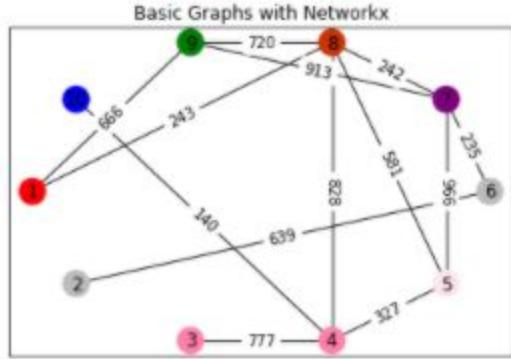
```

W = [[4.2213267e-04 3.03800643e+00 4.00000000e+00 4.00000000e+00
1.00025354e+00 1.24659696e+00]
[3.03800643e+00 6.37845219e-05 3.09536916e+00 3.00010837e+00
9.19190475e-02 2.00000000e+00]
[4.00000000e+00 3.09536916e+00 1.67825620e-03 4.00000000e+00
2.00000000e+00 2.00000000e+00]
[4.00000000e+00 3.00010837e+00 4.00000000e+00 1.28114637e-03
8.87834184e-02 2.00000000e+00]
[1.00025354e+00 9.19190475e-02 2.00000000e+00 8.87834184e-02
0.00000000e+00 1.00000000e+00]
[1.24659696e+00 2.00000000e+00 2.00000000e+00 2.00000000e+00
1.00000000e+00 0.00000000e+00]]
WCC = [13.28485693 11.225403 15.09536916 13.08889178 4.180956 8.24659696]
NC = 5.9997535019566035

```

K = 8

Label : [4 2 1 1 0 2 7 3 5 6]



Conditional Entropy : 0.3999999999999999

FMeasure = 0.875

```

label [4 2 1 1 0 2 7 3 5 6]
true_clustering [0, 0, 0, 1, 1, 1, 1, 0, 0, 0]
[[0 1]
 [1 0]
 [1 1]
 [2 0]
 [2 1]
 [3 0]
 [4 0]
 [5 0]
 [6 0]
 [7 1]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 2 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 2, 1, 1, 1, 1, 1]
prec [1.0, 0.5, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 0.5, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 0.5, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 0.875

```

```

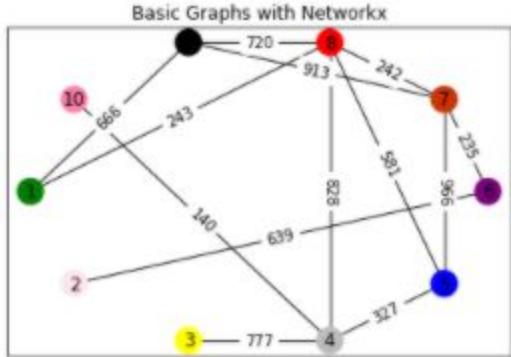
W = [[0.0000000e+00 1.03800643e+00 2.0000000e+00 2.99743007e-03
 1.0000000e+00 1.0000000e+00 1.0000000e+00 6.37845219e-05]
[1.03800643e+00 4.22213267e-04 4.0000000e+00 1.00025354e+00
 2.0000000e+00 2.0000000e+00 1.24659696e+00 2.0000000e+00]
[2.0000000e+00 4.0000000e+00 1.67825620e-03 2.0000000e+00
 2.0000000e+00 2.0000000e+00 2.0000000e+00 1.09536916e+00]
[2.99743007e-03 1.00025354e+00 2.0000000e+00 0.0000000e+00
 8.80368326e-02 7.46585808e-04 1.0000000e+00 8.89216175e-02]
[1.0000000e+00 2.0000000e+00 2.0000000e+00 8.80368326e-02
 0.0000000e+00 1.28114637e-03 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 2.0000000e+00 7.46585808e-04
 1.28114637e-03 0.0000000e+00 1.0000000e+00 1.08365585e-04]
[1.0000000e+00 1.24659696e+00 2.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00]
[6.37845219e-05 2.0000000e+00 1.09536916e+00 8.89216175e-02
 1.0000000e+00 1.08365585e-04 1.0000000e+00 0.0000000e+00]
WCC = [6.04106764 13.28485693 15.09536916 4.180956 7.08931798 6.0021361
 8.24659696 5.18446293]
NC = 7.999857054934525

```



K = 10

Label : [5 0 9 2 6 7 3 4 8 1]



Conditional Entropy : 0.0

FMeasure = 1.0

```

label [5 0 9 2 6 7 3 4 8 1]
True_clustering [0, 0, 0, 1, 1, 1, 1, 0, 0, 0]
[[0 0]
 [1 0]
 [2 1]
 [3 1]
 [4 0]
 [5 0]
 [6 1]
 [7 1]
 [8 0]
 [9 0]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

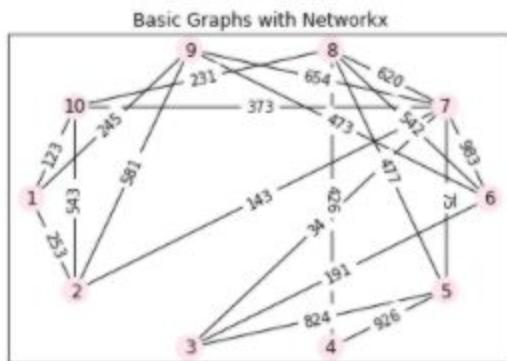
```

```

W = [[0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.67825620e-03
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 0.0000000e+00 2.46596964e-01 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 2.46596964e-01 0.0000000e+00 1.0000000e+00
 2.53537200e-04 1.0000000e+00 3.80064271e-02 1.0000000e+00
 1.0000000e+00 4.22213267e-04]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 8.89216175e-02 1.0000000e+00 6.37845219e-05 9.53691622e-02
 1.08365585e-04 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 2.53537200e-04 8.89216175e-02
 0.0000000e+00 8.80368326e-02 2.99743007e-03 1.0000000e+00
 7.46585808e-04 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 8.80368326e-02 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.28114637e-03 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 3.80064271e-02 6.37845219e-05
 2.99743007e-03 1.0000000e+00 0.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.67825620e-03 1.0000000e+00 1.0000000e+00 9.53691622e-02
 1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.08365585e-04
 7.46585808e-04 1.28114637e-03 1.0000000e+00 1.0000000e+00
 0.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 4.22213267e-04 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 0.0000000e+00]]
WCC = [8.00167826 8.24659696 5.28527914 5.18446293 4.180956 7.08931798
 6.04106764 7.09704742 6.0021361 8.00042221]
NC = 10.0

```

## For t\_10\_2



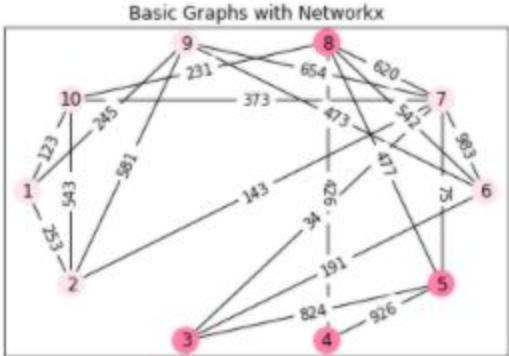
```

array([[0., 253., 0., 0., 0., 0., 0., 245., 123.],
 [253., 0., 0., 0., 0., 143., 0., 581., 543.],
 [0., 0., 0., 824., 191., 34., 0., 0., 0.],
 [0., 0., 0., 926., 0., 0., 426., 0., 0.],
 [0., 0., 824., 926., 0., 0., 75., 477., 0., 0.],
 [0., 0., 191., 0., 0., 983., 542., 473., 0.],
 [0., 143., 34., 0., 75., 983., 0., 620., 654., 373.],
 [0., 0., 0., 426., 477., 542., 620., 0., 0., 231.],
 [245., 581., 0., 0., 473., 654., 0., 0., 0.],
 [123., 543., 0., 0., 0., 373., 231., 0., 0.]])

```

K = 2

Label : [0 0 1 1 1 0 0 1 0 0]



Conditional Entropy : 0.5509775004326936

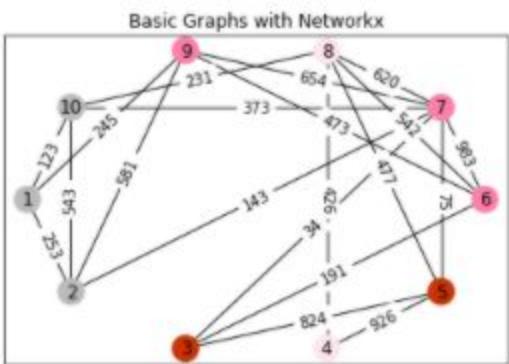
FMeasure = 0.8333333333333333

```
label [0 0 1 1 1 0 0 1 0 0]
True_clustering [1, 1, 1, 1, 1, 0, 0, 1, 1, 1]
[[0 0]
 [0 1]
 [1 1]] [2 4 4]
[0 1] [6 4]
max [4, 4]
numclass [0, 1]
sumClass [6, 4]
prec [0.6666666666666666, 1.0]
rec [0.6666666666666666, 1.0]
F1 [0.6666666666666666, 1.0]
FMeasure= 0.8333333333333333
```

```
W = [[5.73925224 19.43793509]
 [19.43793509 2.02296172]]
WCC = [19.43793509 19.43793509]
NC = 1.67778285268189
```

K = 4

Label : [2 2 3 0 3 1 1 0 1 2]



Conditional Entropy : 0.2754887502163468

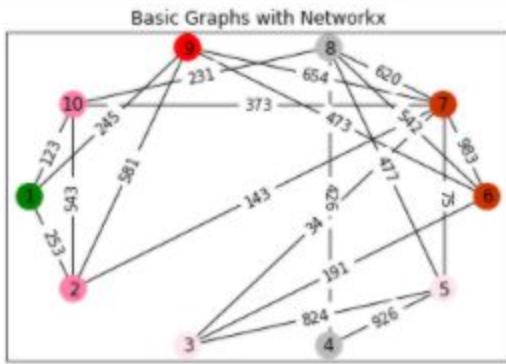
FMeasure = 0.9166666666666666

```
label [2 2 3 0 3 1 1 0 1 2]
True_clustering [1, 1, 1, 1, 1, 0, 0, 1, 1, 1]
[[0 1]
 [1 0]
 [1 1]
 [2 1]
 [3 1]] [2 2 1 3 2]
[0 1 2 3] [2 3 3 2]
max [2, 2, 3, 2]
numClass [0, 1, 2, 3]
sumClass [2, 3, 3, 2]
prec [1.0, 0.6666666666666666, 1.0, 1.0]
rec [1.0, 0.6666666666666666, 1.0, 1.0]
F1 [1.0, 0.6666666666666666, 1.0, 1.0]
FMeasure= 0.9166666666666666

W = [[1.41223024e-02 4.00645658e+00 5.09926125e+00 2.00857554e+00]
 [4.00645658e+00 1.03247723e-02 5.35259277e+00 4.33221726e+00]
 [5.09926125e+00 5.35259277e+00 3.76334694e-01 6.00000000e+00]
 [2.00857554e+00 4.33221726e+00 6.00000000e+00 2.63884249e-04]]
WCC = [11.11429336 13.69126661 16.45185403 12.3407928]
NC = 3.9755926899093272
```

K = 6

Label : [5 1 0 2 0 3 3 2 4 1]



Conditional Entropy : 0.0

FMeasure = 1.0

```

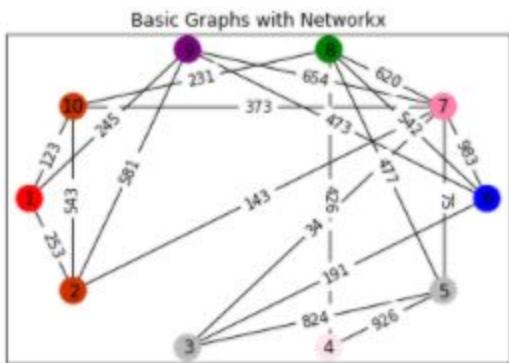
label [5 1 0 2 0 3 3 2 4 1]
True_clustering [1, 1, 1, 1, 1, 0, 0, 1, 1, 1]
[[0 1]
 [1 1]
 [2 1]
 [3 0]
 [4 1]
 [5 1]] [2 2 2 2 1 1]
[0 1 2 3 4 5] [2 2 2 2 1 1]
max [2, 2, 2, 2, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [2, 2, 2, 2, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

W = [[2.63884249e-04 4.0000000e+00 2.00857554e+00 2.33221726e+00
 2.0000000e+00 2.0000000e+00]
 [4.0000000e+00 4.38309580e-03 3.09926125e+00 2.26330176e+00
 1.00299743e+00 3.71951598e-01]
 [2.00857554e+00 3.09926125e+00 1.41223024e-02 2.00645658e+00
 2.0000000e+00 2.0000000e+00]
 [2.33221726e+00 2.26330176e+00 2.00645658e+00 5.38127570e-05
 1.02709595e-02 2.0000000e+00]
 [2.0000000e+00 1.00299743e+00 2.0000000e+00 1.02709595e-02
 0.0000000e+00 8.62935865e-02]
 [2.0000000e+00 3.71951598e-01 2.0000000e+00 2.0000000e+00
 8.62935865e-02 0.0000000e+00]]
WCC = [12.3407928 10.73751204 11.11429336 8.61224656 5.09956198 6.45824518]
NC = 5.998295300715555

```

K = 8

Label : [4 3 2 0 2 6 1 5 7 3]



Conditional Entropy : 0.0

FMeasure = 1.0

```

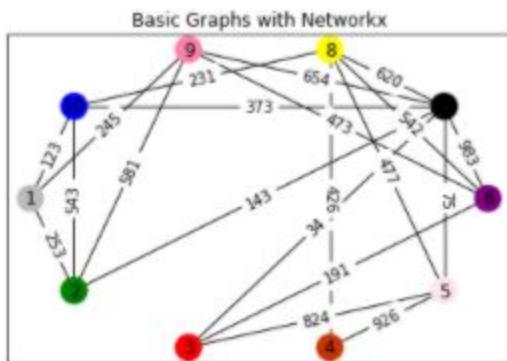
label [4 3 2 0 2 6 1 5 7 3]
True_clustering [1, 1, 1, 1, 1, 0, 0, 1, 1, 1]
[[0 1]
[1 0]
[2 1]
[3 1]
[4 1]
[5 1]
[6 0]
[7 1]] [1 1 2 2 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 1 2 2 1 1 1 1]
max [1, 1, 2, 2, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 1, 2, 2, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

W = [[0.0000000e+00 1.0000000e+00 1.00009516e+00 2.0000000e+00
 1.0000000e+00 1.41223024e-02 1.0000000e+00 1.0000000e+00
 1.0000000e+00 0.0000000e+00 1.18413688e+00 2.63301758e-01
 1.0000000e+00 2.02943064e-03 5.38127570e-05 1.44448850e-03]
 [1.00009516e+00 1.18413688e+00 2.63884249e-04 4.0000000e+00
 2.0000000e+00 1.00848038e+00 1.14808039e+00 2.0000000e+00
 [2.0000000e+00 2.63301758e-01 4.0000000e+00 4.38389580e-03
 3.71951598e-01 1.09926125e+00 2.0000000e+00 1.00299743e+00]
 [1.0000000e+00 1.0000000e+00 2.0000000e+00 3.71951598e-01
 0.0000000e+00 1.0000000e+00 1.0000000e+00 8.62935865e-02]
 [1.41223024e-02 2.02943064e-03 1.00848038e+00 1.09926125e+00
 1.0000000e+00 0.0000000e+00 4.42714665e-03 1.0000000e+00]
 [1.0000000e+00 5.38127570e-05 1.14808039e+00 2.0000000e+00
 1.0000000e+00 4.42714665e-03 0.0000000e+00 8.82647104e-03]
 [1.0000000e+00 1.44448850e-03 2.0000000e+00 1.00299743e+00
 8.62935865e-02 1.0000000e+00 8.82647104e-03 0.0000000e+00]]
WCC = [7.01421746 3.45096637 12.3407928 10.73751204 6.45824518 4.12832051
5.16138782 5.09956198]
NC = 7.9995705798916275

```

K = 10

Label : [2 5 4 3 0 7 8 9 1 6]



Conditional Entropy : 0.0

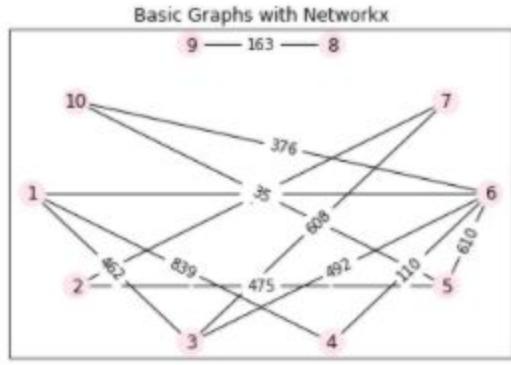


```
FMeasure = 1.0
```

```
label [2 5 4 3 0 7 8 9 1 6]
True_clustering [1, 1, 1, 1, 1, 0, 0, 1, 1, 1]
[[0 1]
 [1 1]
 [2 1]
 [3 1]
 [4 1]
 [5 1]
 [6 1]
 [7 0]
 [8 0]
 [9 1]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

W = [[0.0000000e+00 1.0000000e+00 1.0000000e+00 9.51553251e-05
2.63884249e-04 1.0000000e+00 1.0000000e+00 1.0000000e+00
4.72366553e-01 8.48038016e-03]
[1.0000000e+00 0.0000000e+00 8.62935865e-02 1.0000000e+00
1.0000000e+00 2.99743007e-03 1.0000000e+00 8.82647104e-03
1.44448850e-03 1.0000000e+00]
[1.0000000e+00 8.62935865e-02 0.0000000e+00 1.0000000e+00
1.0000000e+00 7.96590203e-02 2.92292578e-01 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[9.51553251e-05 1.0000000e+00 1.0000000e+00 0.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.41223024e-02]
[2.63884249e-04 1.0000000e+00 1.0000000e+00 1.0000000e+00
0.0000000e+00 1.0000000e+00 1.0000000e+00 1.48080387e-01
7.11770323e-01 1.0000000e+00]
[1.0000000e+00 2.99743007e-03 7.96590203e-02 1.0000000e+00
1.0000000e+00 0.0000000e+00 4.38309580e-03 1.0000000e+00
2.39308922e-01 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 2.92292578e-01 1.0000000e+00
1.0000000e+00 4.38309580e-03 0.0000000e+00 1.0000000e+00
2.39928358e-02 9.92612516e-02]
[1.0000000e+00 8.82647104e-03 1.0000000e+00 1.0000000e+00
1.48080387e-01 1.0000000e+00 1.0000000e+00 0.0000000e+00
5.38127570e-05 4.42714665e-03]
[4.72366553e-01 1.44448850e-03 1.0000000e+00 1.0000000e+00
7.11770323e-01 2.39308922e-01 2.39928358e-02 5.38127570e-05
0.0000000e+00 2.02943064e-03]
[8.48038016e-03 1.0000000e+00 1.0000000e+00 1.41223024e-02
1.0000000e+00 1.0000000e+00 9.92612516e-02 4.42714665e-03
2.02943064e-03 0.0000000e+00]
WCC = [5.48120597 5.09956198 6.45824518 7.01421746 6.86011459 5.32634847
5.41992976 5.16138782 3.45096637 4.12832051]
NC = 10.0
```

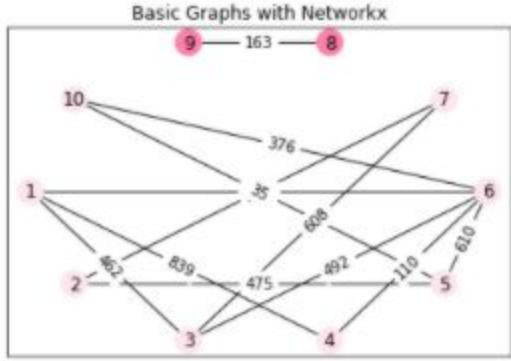
For t\_10\_3



```
array([[0., 0., 462., 839., 0., 640., 0., 0., 0., 0.],
 [0., 0., 0., 475., 0., 831., 0., 0., 0., 0.],
 [462., 0., 0., 0., 492., 608., 0., 0., 0., 0.],
 [839., 0., 0., 0., 110., 0., 0., 0., 0., 0.],
 [0., 475., 0., 0., 610., 0., 0., 0., 35.],
 [640., 0., 492., 110., 610., 0., 0., 0., 0., 376.],
 [0., 831., 608., 0., 0., 0., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 163., 0.],
 [0., 0., 0., 0., 0., 0., 0., 163., 0., 0.],
 [0., 0., 0., 0., 35., 376., 0., 0., 0., 0.]])
```

$K = 2$

Label : [0 0 0 0 0 0 0 1 1 0]



Conditional Entropy : 0.963547202339972

FMeasure = 0.5625

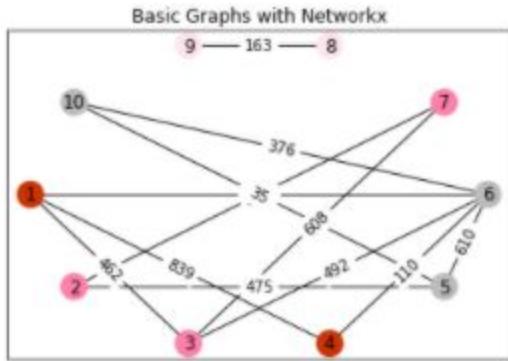
```
label [0 0 0 0 0 0 0 1 1 0]
True_clustering [0, 0, 1, 0, 0, 1, 0, 0, 1, 1]
[[0 0]
 [0 1]
 [1 0]
 [1 1]] [5 3 1 1]
[0 1] [8 2]
max [5, 1]
numclass [0, 1]
sumClass [8, 2]
prec [0.625, 0.5]
rec [0.625, 0.5]
F1 [0.625, 0.5]
FMeasure= 0.5625

W = [[18.09331231 16.
 [16. 0.19592957]]
WCC = [16. 16.]
NC = 1.4572027925232263
```



$K = 4$

Label : [3 1 1 3 2 2 1 0 0 2]



Conditional Entropy : 0.750977500432694

FMeasure = 0.708333333333333

```

label [3 1 1 3 2 2 1 0 0 2]
True_clustering [0, 0, 1, 0, 0, 1, 0, 0, 1, 1]
[[0 0]
 [0 1]
 [1 0]
 [1 1]
 [2 0]
 [2 1]
 [3 0]] [1 1 2 1 1 2 2]
[0 1 2 3] [2 3 3 2]
max [1, 2, 2, 2]
numclass [0, 1, 2, 3]
sumClass [2, 3, 3, 2]
prec [0.5, 0.6666666666666666, 0.6666666666666666, 1.0]
rec [0.5, 0.6666666666666666, 0.6666666666666666, 1.0]
F1 [0.5, 0.6666666666666666, 0.6666666666666666, 1.0]
FMeasure= 0.708333333333333

```

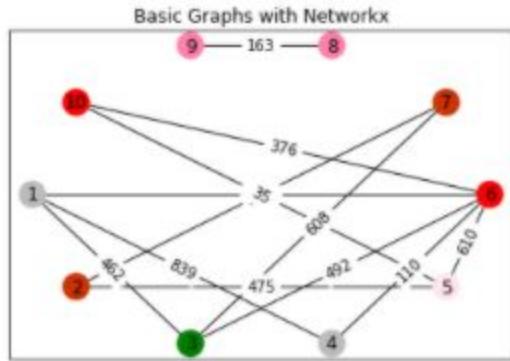
```

W = [[1.95929574e-01 6.0000000e+00 6.0000000e+00 4.0000000e+00]
 [6.0000000e+00 1.00253422e+00 7.01595083e+00 5.00985280e+00]
 [6.0000000e+00 7.01595083e+00 7.30214698e-01 4.33453264e+00]
 [4.0000000e+00 5.00985280e+00 4.33453264e+00 2.27127278e-04]]
WCC = [16. 18.02580362 17.35048347 13.34438544]
NC = 3.8948127214671215

```

$K = 6$

Label : [2 3 5 2 0 4 3 1 1 4]



Conditional Entropy : 0.20000000000000018

FMeasure = 0.9166666666666666

```

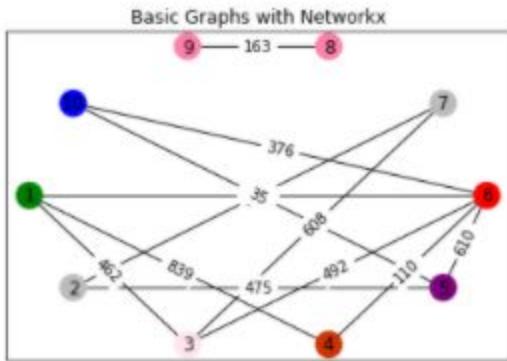
label [2 3 5 2 0 4 3 1 1 4]
True_clustering [0, 0, 1, 0, 0, 1, 0, 0, 1, 1]
[[0 0]
[1 0]
[1 1]
[2 0]
[3 0]
[4 1]
[5 1]] [1 1 1 2 2 2 1]
[0 1 2 3 4 5] [1 2 2 2 2 1]
max [1, 1, 2, 2, 2, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [1, 2, 2, 2, 2, 1]
prec [1.0, 0.5, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 0.5, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 0.5, 1.0, 1.0, 1.0, 1.0]
FMeasure= 0.9166666666666666

W = [[0.0000000e+00 2.0000000e+00 2.0000000e+00 1.00865170e+00
7.06930957e-01 1.0000000e+00]
[2.0000000e+00 1.95929574e-01 4.0000000e+00 4.0000000e+00
4.0000000e+00 2.0000000e+00]
[2.0000000e+00 4.0000000e+00 2.27127278e-04 4.0000000e+00
2.33453264e+00 1.00985280e+00]
[1.00865170e+00 4.0000000e+00 4.0000000e+00 2.46044043e-04
4.0000000e+00 1.00228818e+00]
[7.06930957e-01 4.0000000e+00 2.33453264e+00 4.0000000e+00
2.32837404e-02 1.00729913e+00]
[1.0000000e+00 2.0000000e+00 1.00985280e+00 1.00228818e+00
1.00729913e+00 0.0000000e+00]]
WCC = [6.71558265 16. 13.34438544 14.01093987 12.04876273 6.0194401]
NC = 5.985939229696921

```

K = 8

Label : [5 2 0 3 7 4 2 1 1 6]



Conditional Entropy : 0.1999999999999973

FMeasure = 0.9375

```

label [5 2 0 3 7 4 2 1 1 6]
True_clustering [0, 0, 1, 0, 0, 1, 0, 0, 1, 1]
[[0 1]
[1 0]
[1 1]
[2 0]
[3 0]
[4 1]
[5 0]
[6 1]
[7 0]] [1 1 1 2 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 2 1 1 1 1 1]
max [1, 1, 2, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 2, 1, 1, 1, 1, 1]
prec [1.0, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 0.9375

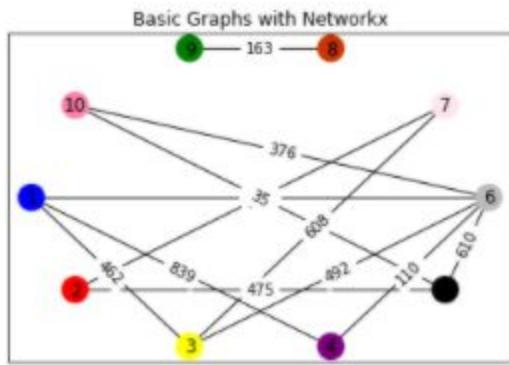
W = [[0.0000000e+00 2.0000000e+00 1.00228818e+00 1.0000000e+00
7.29913085e-03 9.85279606e-03 1.0000000e+00 1.0000000e+00
[2.0000000e+00 1.95929574e-01 4.0000000e+00 2.0000000e+00
2.0000000e+00 2.0000000e+00 2.0000000e+00 2.0000000e+00]
[1.00228818e+00 4.0000000e+00 2.46044843e-04 2.0000000e+00
2.0000000e+00 2.0000000e+00 2.0000000e+00 1.00865170e+00]
[1.0000000e+00 2.0000000e+00 2.0000000e+00 0.0000000e+00
3.32871084e-01 2.27127278e-04 1.0000000e+00 1.0000000e+00]
[7.29913085e-03 2.0000000e+00 2.0000000e+00 3.32871084e-01
0.0000000e+00 1.66155727e-03 2.32837404e-02 2.24286772e-03]
[9.85279606e-03 2.0000000e+00 2.0000000e+00 2.27127278e-04
1.66155727e-03 0.0000000e+00 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 2.0000000e+00 1.0000000e+00
2.32837404e-02 1.0000000e+00 0.0000000e+00 7.04688090e-01]
[1.0000000e+00 2.0000000e+00 1.00865170e+00 1.0000000e+00
2.24286772e-03 1.0000000e+00 7.04688090e-01 0.0000000e+00]]
WCC = [6.0194401 16. 14.01093987 7.33309821 4.36735838 6.01174148
7.72797183 6.71558265]
NC = 7.987884981682661

```

K = 10



Label : [6 4 9 7 8 2 0 3 5 1]



Conditional Entropy : 0.0

FMeasure = 1.0

```

label [6 4 9 7 8 2 0 3 5 1]
True_clustering [0, 0, 1, 0, 0, 1, 0, 0, 1, 1]
[[0 0]
 [1 1]
 [2 1]
 [3 0]
 [4 0]
 [5 1]
 [6 0]
 [7 0]
 [8 0]
 [9 1]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

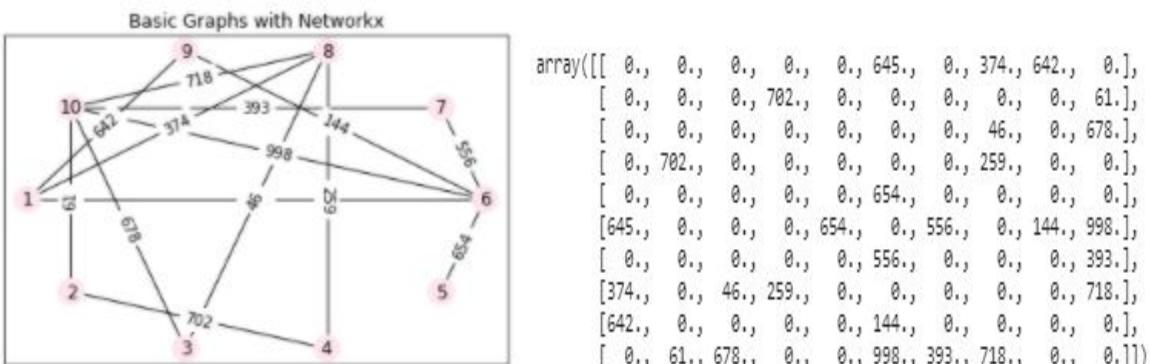
```

```

W = [[0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 2.46044043e-04 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 2.28817665e-03]
[1.0000000e+00 0.0000000e+00 2.32837404e-02 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 7.04688090e-01 1.0000000e+00]
[1.0000000e+00 2.32837404e-02 0.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.66155727e-03 3.32871084e-01
 2.24286772e-03 7.29913085e-03]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 1.0000000e+00 1.95929574e-01 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
[2.46044043e-04 1.0000000e+00 1.0000000e+00 1.0000000e+00
 0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 8.65169520e-03 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 1.95929574e-01
 1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.66155727e-03 1.0000000e+00
 1.0000000e+00 1.0000000e+00 0.0000000e+00 2.27127278e-04
 1.0000000e+00 9.85279606e-03]
[1.0000000e+00 1.0000000e+00 3.32871084e-01 1.0000000e+00
 1.0000000e+00 2.27127278e-04 0.0000000e+00
 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 7.04688090e-01 2.24286772e-03 1.0000000e+00
 8.65169520e-03 1.0000000e+00 1.0000000e+00 1.0000000e+00
 0.0000000e+00 1.0000000e+00]
[2.28817665e-03 1.0000000e+00 7.29913085e-03 1.0000000e+00
 1.0000000e+00 1.0000000e+00 9.85279606e-03 1.0000000e+00
 1.0000000e+00 0.0000000e+00]]
WCC = [7.00253422 7.72797183 4.36735838 8.19592957 7.00889774 8.19592957
 6.01174148 7.33309821 6.71558265 6.0194401]
NC = 10.0

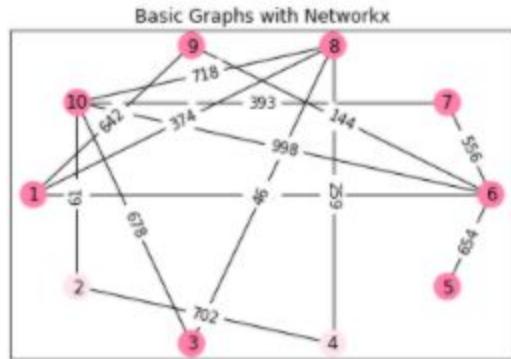
```

## For t\_10\_4



K = 2

Label :[1 0 1 0 1 1 1 1 1]



Conditional Entropy : 1.8

FMeasure = 0.375

```

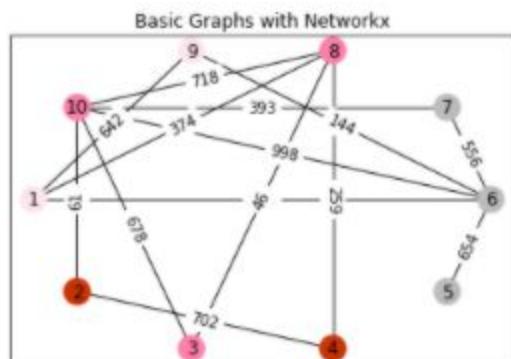
label [1 0 1 0 1 1 1 1 1 1]
True_clustering [1, 0, 0, 2, 2, 2, 3, 1, 0, 3]
[[0 0]
 [0 2]
 [1 0]
 [1 1]
 [1 2]
 [1 3]] [1 1 2 2 2 2]
[0 1] [2 8]
max [1, 2]
numclass [0, 1]
sumClass [2, 8]
prec [0.5, 0.25]
rec [0.5, 0.25]
F1 [0.5, 0.25]
FMeasure= 0.375

W = [[8.93825493e-04 1.46183709e+01]
 [1.46183709e+01 1.79220559e+01]]
WCC = [14.61837091 14.61837091]
NC = 1.4491760809626892

```

K = 4

Label : [0 3 1 3 2 2 2 1 0 1]



Conditional Entropy : 1.1509775004326934

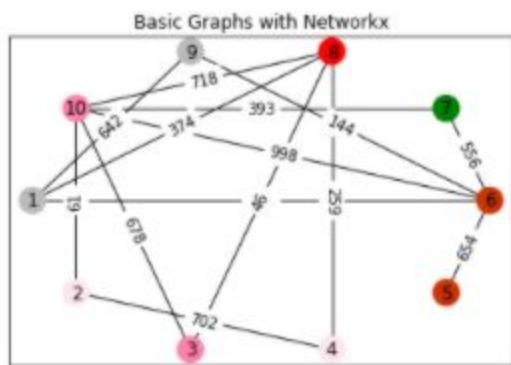
FMeasure = 0.5

```
label [0 3 1 3 2 2 2 1 0 1]
True_clustering [1, 0, 0, 2, 2, 2, 3, 1, 0, 3]
[[0 0]
 [0 1]
 [1 0]
 [1 1]
 [1 3]
 [2 2]
 [2 3]
 [3 0]
[3 2]] [1 1 1 1 2 1 1 1]
[0 1 2 3] [2 3 3 2]
max [1, 1, 2, 1]
numclass [0, 1, 2, 3]
sumClass [2, 3, 3, 2]
prec [0.5, 0.333333333333333, 0.666666666666666, 0.5]
rec [0.5, 0.333333333333333, 0.666666666666666, 0.5]
F1 [0.5, 0.333333333333333, 0.666666666666666, 0.5]
FMeasure= 0.5
```

```
W = [[1.62865623e-03 5.02375410e+00 4.23850828e+00 4.00000000e+00]
[5.02375410e+00 6.33181588e-01 7.01968999e+00 4.61837091e+00]
[4.23850828e+00 7.01968999e+00 1.00529326e+00 6.00000000e+00]
[4.00000000e+00 4.61837091e+00 6.00000000e+00 8.93825493e-04]]
WCC = [13.26226238 16.661815 17.25819827 14.61837091]
NC = 3.908161520277977
```

K = 6

Label :[2 0 1 0 3 3 5 4 2 1]



Conditional Entropy : 0.6000000000000001

FMeasure = 0.75

```

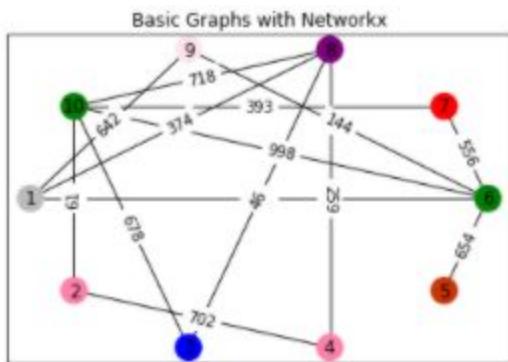
label [2 0 1 0 3 3 5 4 2 1]
True_clustering [1, 0, 0, 2, 2, 2, 3, 1, 0, 3]
[[0 0]
[0 2]
[1 0]
[1 3]
[2 0]
[2 1]
[3 2]
[4 1]
[5 3]] [1 1 1 1 1 2 1 1]
[0 1 2 3 4 5] [2 2 2 2 1 1]
max [1, 1, 1, 2, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [2, 2, 2, 2, 1, 1]
prec [0.5, 0.5, 0.5, 1.0, 1.0, 1.0]
rec [0.5, 0.5, 0.5, 1.0, 1.0, 1.0]
F1 [0.5, 0.5, 0.5, 1.0, 1.0, 1.0]
FMeasure= 0.75

W = [[8.93825493e-04 3.54335087e+00 4.00000000e+00 4.00000000e+00
1.07502004e+00 2.00000000e+00]
[3.54335087e+00 1.13627490e-03 4.00000000e+00 3.00004632e+00
6.32045313e-01 1.01964367e+00]
[4.00000000e+00 4.00000000e+00 1.62865623e-03 2.23850828e+00
1.02375410e+00 2.00000000e+00]
[4.00000000e+00 3.00004632e+00 2.23850828e+00 1.44448850e-03
2.00000000e+00 1.00384878e+00]
[1.07502004e+00 6.32045313e-01 1.02375410e+00 2.00000000e+00
0.00000000e+00 1.00000000e+00]
[2.00000000e+00 1.01964367e+00 2.00000000e+00 1.00384878e+00
1.00000000e+00 0.00000000e+00]]
WCC = [14.61837091 12.19508617 13.26226238 12.24240337 5.73081946 7.02349245]
NC = 5.999604928215672

```

K = 8

Label : [2 1 6 1 3 5 4 7 0 5]



Conditional Entropy : 0.3999999999999999

FMeasure = 0.875

```

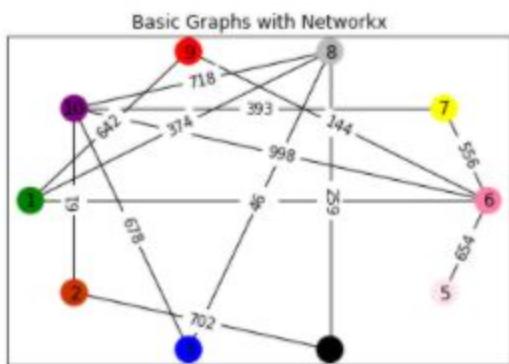
label [2 1 6 1 3 5 4 7 0 5]
True_clustering [1, 0, 0, 2, 2, 2, 3, 1, 0, 3]
[[0 0]
[1 0]
[1 2]
[2 1]
[3 2]
[4 3]
[5 2]
[5 3]
[6 0]
[7 1]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 1 1 1 2 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 1, 1, 1, 2, 1, 1]
prec [1.0, 0.5, 1.0, 1.0, 1.0, 0.5, 1.0, 1.0]
rec [1.0, 0.5, 1.0, 1.0, 1.0, 0.5, 1.0, 1.0]
F1 [1.0, 0.5, 1.0, 1.0, 1.0, 0.5, 1.0, 1.0]
FMeasure= 0.875

W = [[0.0000000e+00 2.0000000e+00 1.62865623e-03 1.0000000e+00
1.0000000e+00 1.23692776e+00 1.0000000e+00 1.0000000e+00
2.0000000e+00 8.93825493e-04 2.0000000e+00 2.0000000e+00
2.0000000e+00 3.54335087e+00 2.0000000e+00 1.07502004e+00
[1.62865623e-03 2.0000000e+00 0.0000000e+00 1.0000000e+00
1.0000000e+00 1.00158052e+00 1.0000000e+00 2.37541031e-02]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 0.0000000e+00
1.0000000e+00 1.00144449e+00 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 1.0000000e+00
0.0000000e+00 2.34924490e-02 1.0000000e+00 1.0000000e+00]
[1.23692776e+00 3.54335087e+00 1.00158052e+00 1.00144449e+00
2.34924490e-02 4.63170692e-05 1.00113627e+00 1.00076167e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.00113627e+00 0.0000000e+00 6.31283646e-01]
[1.0000000e+00 1.07502004e+00 2.37541031e-02 1.0000000e+00
1.0000000e+00 1.00076167e+00 6.31283646e-01 0.0000000e+00]]
WCC = [7.23855641 14.61837091 6.02696328 8.00144449 7.02349245 8.80869403
7.63241992 5.73081946]
NC = 7.9999336016696585

```

K = 10

Label : [5 3 6 8 0 1 9 2 4 7]



Conditional Entropy : 0.0

FMeasure = 1.0

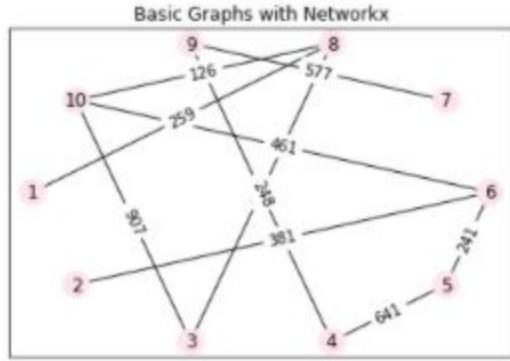
```

label [5 3 6 8 0 1 9 2 4 7]
True_clustering [1, 0, 0, 2, 2, 2, 3, 1, 0, 3]
[[0 2]
 [1 2]
 [2 1]
 [3 0]
 [4 0]
 [5 1]
 [6 0]
 [7 3]
 [8 2]
 [9 3]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

W = [[[0.0000000e+00 1.44448850e-03 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.44448850e-03 0.0000000e+00 1.0000000e+00 1.0000000e+00
 2.36927759e-01 1.58052217e-03 1.0000000e+00 4.63170692e-05
 1.0000000e+00 3.84877640e-03]
 [1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00
 1.0000000e+00 2.37541031e-02 6.31283646e-01 7.61667842e-04
 7.50200401e-02 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 5.43350869e-01
 8.93825493e-04 1.0000000e+00]
 [1.0000000e+00 2.36927759e-01 1.0000000e+00 1.0000000e+00
 0.0000000e+00 1.62865623e-03 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.58052217e-03 2.37541031e-02 1.0000000e+00
 1.62865623e-03 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 6.31283646e-01 1.0000000e+00
 1.0000000e+00 1.0000000e+00 0.0000000e+00 1.13627490e-03
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 4.63170692e-05 7.61667842e-04 5.43350869e-01
 1.0000000e+00 1.0000000e+00 1.13627490e-03 0.0000000e+00
 1.0000000e+00 1.96436726e-02]
 [1.0000000e+00 1.0000000e+00 7.50200401e-02 8.93825493e-04
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 0.0000000e+00 1.0000000e+00]
 [1.0000000e+00 3.84877640e-03 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.96436726e-02
 1.0000000e+00 0.0000000e+00]]
WCC = [8.00144449 4.24384786 5.73081946 7.54424469 7.23855641 6.02696328
 7.63241992 4.5649388 7.07591387 7.02349245]
NC = 10.0

```

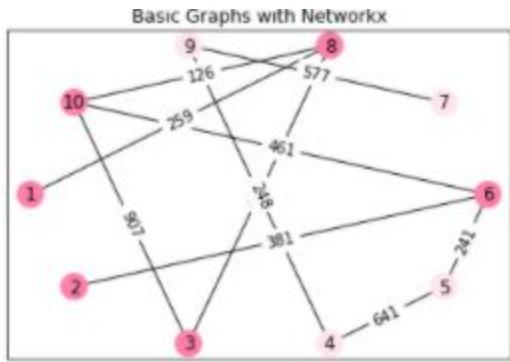
For t\_10\_5



```
array([[0., 0., 0., 0., 0., 0., 0., 259., 0., 0.],
 [0., 0., 0., 0., 0., 381., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 0., 411., 0., 907.],
 [0., 0., 0., 0., 641., 0., 0., 0., 248., 0.],
 [0., 0., 0., 641., 0., 241., 0., 0., 0., 0.],
 [0., 381., 0., 0., 241., 0., 0., 0., 461.],
 [0., 0., 0., 0., 0., 0., 577., 0.],
 [259., 0., 411., 0., 0., 0., 0., 0., 126.],
 [0., 0., 248., 0., 0., 577., 0., 0., 0.],
 [0., 0., 907., 0., 0., 461., 0., 126., 0., 0.]])
```

$K = 2$

Label : [1 1 1 0 0 1 0 1 0 1]



Conditional Entropy : 1.0000000000000002

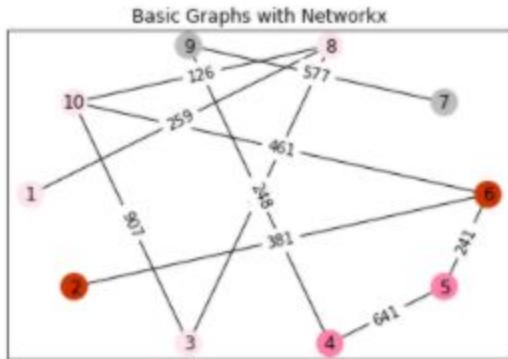
FMeasure = 0.5

```
label [1 1 1 0 0 1 0 1 0 1]
True_clustering [1, 0, 1, 1, 1, 0, 0, 0, 0, 1]
[[0 0]
 [0 1]
 [1 0]
 [1 1]] [2 2 3 3]
[0 1] [4 6]
max [2, 3]
numclass [0, 1]
sumClass [4, 6]
prec [0.5, 0.5]
rec [0.5, 0.5]
F1 [0.5, 0.5]
FMeasure= 0.5
```

```
W = [[3.08850801 23.08981529]
 [23.08981529 9.4072969]]
WCC = [23.08981529 23.08981529]
NC = 1.5925393926492708
```

K = 4

Label : [0 3 0 1 1 3 2 0 2 0]



Conditional Entropy : 0.3245112497836531

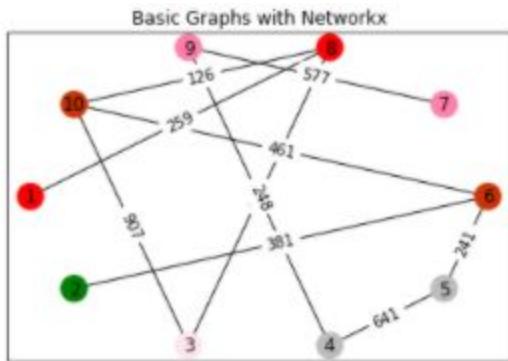
FMeasure = 0.9375

```
label [0 3 0 1 1 3 2 0 2 0]
True_clustering [1, 0, 1, 1, 1, 0, 0, 0, 0, 1]
[[0 0]
 [0 1]
 [1 1]
 [2 0]
 [3 0]] [1 3 2 2 2]
[0 1 2 3] [4 2 2 2]
max [3, 2, 2, 2]
numclass [0, 1, 2, 3]
sumClass [4, 2, 2, 2]
prec [0.75, 1.0, 1.0, 1.0]
rec [0.75, 1.0, 1.0, 1.0]
F1 [0.75, 1.0, 1.0, 1.0]
FMeasure= 0.9375

W = [[2.37519691e+00 8.0000000e+00 8.0000000e+00 7.00995182e+00]
 [8.0000000e+00 1.64502450e-03 3.08374323e+00 3.08981529e+00]
 [8.0000000e+00 3.08374323e+00 3.11975751e-03 4.0000000e+00]
 [7.00995182e+00 3.08981529e+00 4.0000000e+00 2.21481790e-02]]
WCC = [23.00995182 14.17355852 15.08374323 14.09976711]
NC = 3.90454241185623
```

K = 6

Label :[4 5 0 2 2 3 1 4 1 3]



Conditional Entropy : 0.3999999999999999

FMeasure = 0.833333333333334

```

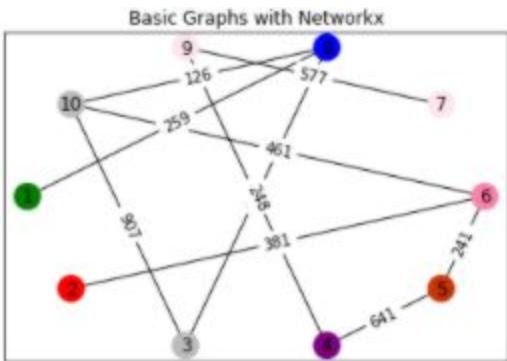
label [4 5 0 2 2 3 1 4 1 3]
True_clustering [1, 0, 1, 1, 1, 0, 0, 0, 0, 1]
[[0 1]
[1 0]
[2 1]
[3 0]
[3 1]
[4 0]
[4 1]
[5 0]] [1 2 2 1 1 1 1 1]
[0 1 2 3 4 5] [1 2 2 2 2 1]
max [1, 2, 2, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [1, 2, 2, 2, 2, 1]
prec [1.0, 1.0, 1.0, 0.5, 0.5, 1.0]
rec [1.0, 1.0, 1.0, 0.5, 0.5, 1.0]
F1 [1.0, 1.0, 1.0, 0.5, 0.5, 1.0]
FMeasure= 0.833333333333334

W = [[0.0000000e+00 2.0000000e+00 2.0000000e+00 1.00011507e+00
1.01640777e+00 1.0000000e+00]
[2.0000000e+00 3.11975751e-03 3.08374323e+00 4.0000000e+00
4.0000000e+00 2.0000000e+00]
[2.0000000e+00 3.08374323e+00 1.64502450e-03 3.08981529e+00
4.0000000e+00 2.0000000e+00]
[1.00011507e+00 4.0000000e+00 3.08981529e+00 9.95181831e-03
3.28365403e+00 1.02214818e+00]
[1.01640777e+00 4.0000000e+00 4.0000000e+00 3.28365403e+00
7.50200401e-02 2.0000000e+00]
[1.0000000e+00 2.0000000e+00 2.0000000e+00 1.02214818e+00
2.0000000e+00 0.0000000e+00]]
WCC = [7.01652284 15.08374323 14.17355852 12.39573257 14.3000618 8.02214818]
NC = 5.9936562102572175

```

K = 8

Label : [5 4 2 7 3 1 0 6 0 2]



Conditional Entropy : 0.0

FMeasure = 1.0

```

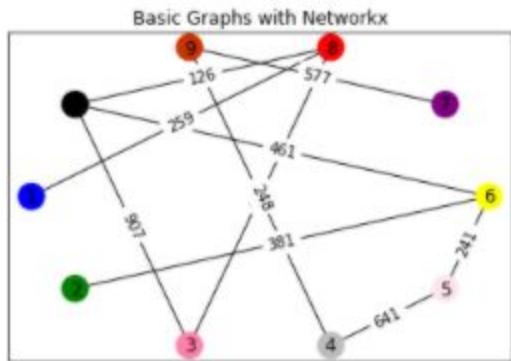
label [5 4 2 7 3 1 0 6 0 2]
True_clustering [1, 0, 1, 1, 1, 0, 0, 0, 0, 1]
[[0 0]
[1 0]
[2 1]
[3 1]
[4 0]
[5 1]
[6 0]
[7 1]] [2 1 2 1 1 1 1]
[0 1 2 3 4 5 6 7] [2 1 2 1 1 1 1]
max [2, 1, 2, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [2, 1, 2, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

W = [[3.11975751e-03 2.00000000e+00 4.00000000e+00 2.00000000e+00
2.00000000e+00 2.00000000e+00 2.00000000e+00 1.08374323e+00
2.00000000e+00 0.00000000e+00 1.00995182e+00 8.98152946e-02
2.21481790e-02 1.00000000e+00 1.00000000e+00 1.00000000e+00]
[4.00000000e+00 1.00995182e+00 1.15066539e-04 2.00000000e+00
2.00000000e+00 2.00000000e+00 3.00061801e-01 2.00000000e+00]
[2.00000000e+00 8.98152946e-02 2.00000000e+00 0.00000000e+00
1.00000000e+00 1.00000000e+00 1.00000000e+00 1.64502450e-03]
[2.00000000e+00 2.21481790e-02 2.00000000e+00 1.00000000e+00
0.00000000e+00 1.00000000e+00 1.00000000e+00 1.00000000e+00]
[2.00000000e+00 1.00000000e+00 2.00000000e+00 1.00000000e+00
1.00000000e+00 0.00000000e+00 7.50200401e-02 1.00000000e+00]
[2.00000000e+00 1.00000000e+00 3.00061801e-01 1.00000000e+00
1.00000000e+00 7.50200401e-02 0.00000000e+00 1.00000000e+00]
[1.08374323e+00 1.00000000e+00 2.00000000e+00 1.64502450e-03
1.00000000e+00 1.00000000e+00 1.00000000e+00 0.00000000e+00]]
WCC = [15.08374323 6.12191529 13.31001362 7.09146032 8.02214818 8.07502004
6.37508184 7.08538825]
NC = 7.999784568601967

```

K = 10

Label : [6 5 1 2 0 9 7 4 3 8]



Conditional Entropy : 0.0

FMeasure = 1.0

```

label [6 5 1 2 0 9 7 4 3 8]
true_clustering [1, 0, 1, 1, 1, 0, 0, 0, 0, 1]
[[0 1]
 [1 1]
 [2 1]
 [3 0]
 [4 0]
 [5 0]
 [6 1]
 [7 0]
 [8 1]
[9 0]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

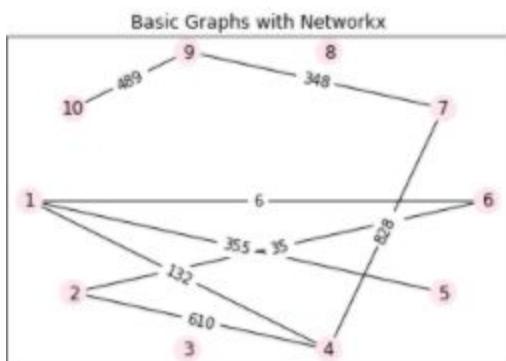
```

```

W = [[0.0000000e+00 1.0000000e+00 1.64502450e-03 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 8.98152946e-02]
 [1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.64077745e-02 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.15066539e-04 1.0000000e+00]
 [1.64502450e-03 1.0000000e+00 0.0000000e+00 8.37432256e-02
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 8.37432256e-02 0.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 3.11975751e-03
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.64077745e-02 1.0000000e+00 1.0000000e+00
 0.0000000e+00 1.0000000e+00 7.50200401e-02 1.0000000e+00
 2.83654026e-01 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 2.21481790e-02]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 7.50200401e-02 1.0000000e+00 0.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 3.11975751e-03
 1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.15066539e-04 1.0000000e+00 1.0000000e+00
 2.83654026e-01 1.0000000e+00 1.0000000e+00 1.0000000e+00
 0.0000000e+00 9.95181831e-03]
 [8.98152946e-02 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 2.21481790e-02 1.0000000e+00 1.0000000e+00
 9.95181831e-03 0.0000000e+00]]
WCC = [7.09146032 7.01652284 7.08538825 7.08686298 6.37508184 8.02214818
 8.07502004 8.00311976 6.29372091 6.12191529]
NC = 10.0

```

## For t\_10\_6



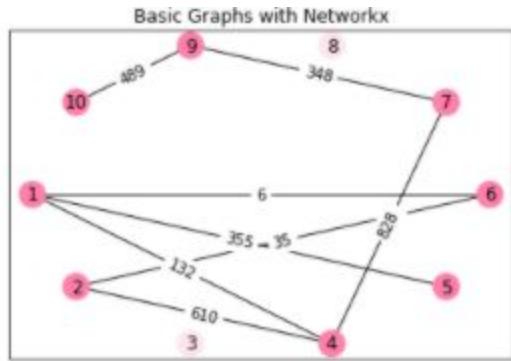
```

array([[0., 0., 0., 132., 355., 6., 0., 0., 0., 0.],
 [0., 0., 0., 610., 0., 35., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
 [132., 610., 0., 0., 0., 0., 828., 0., 0., 0.],
 [355., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
 [6., 35., 0., 0., 0., 0., 0., 0., 0., 0.],
 [0., 0., 0., 828., 0., 0., 0., 0., 348., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 0., 348., 0., 0., 489.],
 [0., 0., 0., 0., 0., 0., 0., 0., 489., 0.]])

```

K = 2

Label : [1 1 0 1 1 1 1 0 1 1]



Conditional Entropy: 0.0

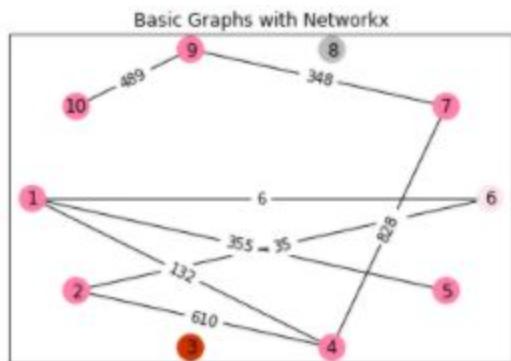
FMeasure = 1.0

```
label [1 1 0 1 1 1 1 0 1 1]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0] [2 8]
[0 1] [2 8]
max [2, 8]
numclass [0, 1]
sumClass [2, 8]
prec [1.0, 1.0]
rec [1.0, 1.0]
F1 [1.0, 1.0]
FMeasure = 1.0
```

```
W = [[1. 16.]
 [16. 21.9831378]]
WCC = [16. 16.]
NC = 1.3624160238562308
```

K = 4

Label : [1 1 3 1 1 0 1 2 1 1]



Conditional Entropy: 0.0

FMeasure = 1.0

```

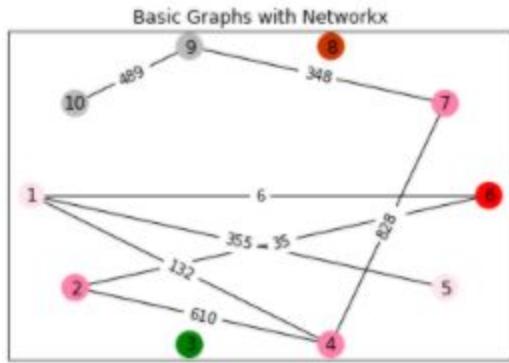
label [1 1 3 1 1 0 1 2 1 1]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]] [1 7 1 1]
[0 1 2 3] [1 7 1 1]
max [1, 7, 1, 1]
numclass [0, 1, 2, 3]
sumClass [1, 7, 1, 1]
prec [1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0. 6.64645262 1. 1.]
 [6.64645262 15.33668518 7. 7.]
 [1. 7. 0. 1.]
 [1. 7. 1. 0.]]
WCC = [8.64645262 20.64645262 9. 9.]
NC = 3.5737813288028653

```

K = 6

Label : [0 1 5 1 0 4 1 3 2 2]



Conditional Entropy: 0.0

FMeasure = 1.0

```

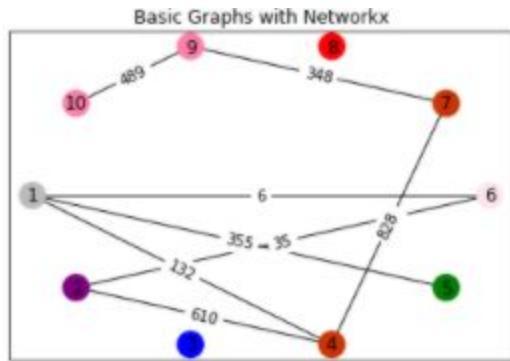
label [0 1 5 1 0 4 1 3 2 2]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]
 [4 0]
 [5 0]] [2 3 2 1 1 1]
[0 1 2 3 4 5] [2 3 2 1 1 1]
max [2, 3, 2, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [2, 3, 2, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0.02872464 5.2671353 4. 2. 1.94176453 2.]
 [5.2671353 1.0024964 5.03080741 3. 2.70468809 3.]
 [4. 5.03080741 0.00752142 2. 2. 2.]
 [2. 3. 2. 0. 1. 1.]
 [1.94176453 2.70468809 2. 1. 0. 1.]
 [2. 3. 2. 1. 1. 0.]]
WCC = [15.20889984 19.0026308 15.03080741 9. 8.64645262 9.]
NC = 5.947502763609523

```

$K = 8$

Label : [2 7 6 3 5 0 3 4 1 1]



Conditional Entropy: 0.0

FMeasure = 1.0

```

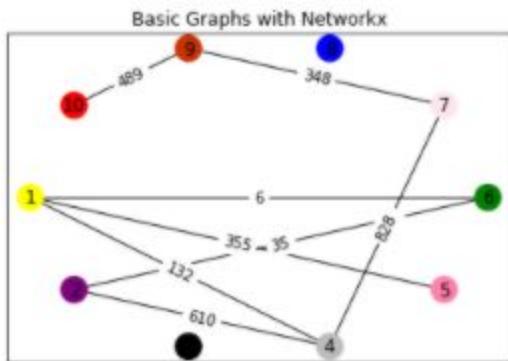
label [2 7 6 3 5 0 3 4 1 1]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]
 [4 0]
 [5 0]
 [6 0]
 [7 0]] [1 2 1 2 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 1 2 1 1 1 1]
max [1, 2, 1, 2, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 1, 2, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0.0000000e+00 2.0000000e+00 9.41764534e-01 2.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 7.04688090e-01
2.0000000e+00 7.52142247e-03 2.0000000e+00 3.03080741e+00
2.0000000e+00 2.0000000e+00 2.0000000e+00 2.0000000e+00
[9.41764534e-01 2.0000000e+00 0.0000000e+00 1.26713530e+00
1.0000000e+00 2.87246397e-02 1.0000000e+00 1.0000000e+00]
[2.0000000e+00 3.03080741e+00 1.26713530e+00 2.53537200e-04
2.0000000e+00 2.0000000e+00 2.0000000e+00 1.00224287e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 2.0000000e+00
0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 2.87246397e-02 2.0000000e+00
1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 2.0000000e+00
1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.0000000e+00 1.0000000e+00 1.0000000e+00
[7.04688090e-01 2.0000000e+00 1.0000000e+00 1.00224287e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00]]
NCC = [8.64645262 15.03080741 7.23762448 13.30018558 9. 8.02872464
9. 7.70693096]
NC = 7.999480787528462

```

K = 10

Label : [9 7 8 2 1 5 0 6 3 4]



Conditional Entropy: 0.0

FMeasure = 1.0

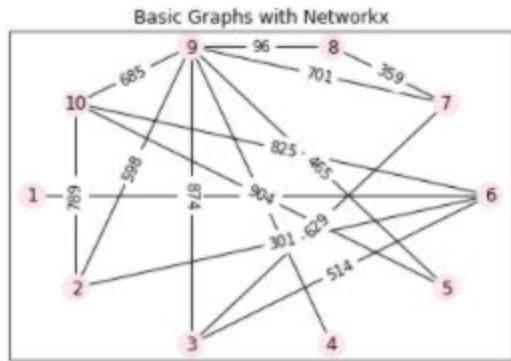
```

label [9 7 8 2 1 5 0 6 3 4]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
[1 0]
[2 0]
[3 0]
[4 0]
[5 0]
[6 0]
[7 0]
[8 0]
[9 0]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0.0000000e+00 1.0000000e+00 2.53537200e-04 3.08074110e-02
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 2.87246397e-02]
[2.53537200e-04 1.0000000e+00 0.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 2.24286772e-03
1.0000000e+00 2.67135302e-01]
[3.08074110e-02 1.0000000e+00 1.0000000e+00 0.0000000e+00
7.52142247e-03 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 7.52142247e-03
0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 0.0000000e+00 1.0000000e+00 7.04688090e-01
1.0000000e+00 9.41764534e-01]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 2.24286772e-03 1.0000000e+00
1.0000000e+00 7.04688090e-01 1.0000000e+00 0.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
0.0000000e+00 1.0000000e+00]
[1.0000000e+00 2.87246397e-02 2.67135302e-01 1.0000000e+00
1.0000000e+00 9.41764534e-01 1.0000000e+00 1.0000000e+00
1.0000000e+00 0.0000000e+00]]
WCC = [7.03106095 8.02872464 6.26963171 7.03832883 8.00752142 8.64645262
9. 7.70693096 9. 7.23762448]
NC = 10.0

```

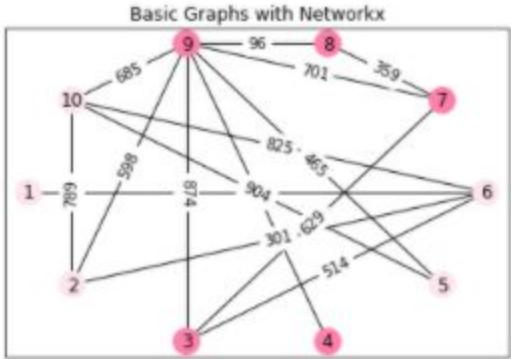
For t\_10\_7



```
array([[0., 0., 0., 0., 0., 325., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 301., 0., 0., 598., 789.],
 [0., 0., 0., 0., 0., 514., 629., 0., 874., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 76., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 465., 904.],
 [325., 301., 514., 0., 0., 0., 0., 0., 825.],
 [0., 0., 629., 0., 0., 0., 0., 359., 701., 0.],
 [0., 0., 0., 0., 0., 0., 359., 0., 96., 0.],
 [0., 598., 874., 76., 465., 0., 701., 96., 0., 685.],
 [0., 789., 0., 0., 904., 825., 0., 0., 685., 0.]])
```

$K = 2$

Label : [0 0 1 1 0 0 1 1 1 0]



Conditional Entropy: 0.9709505944546686

FMeasure = 0.6

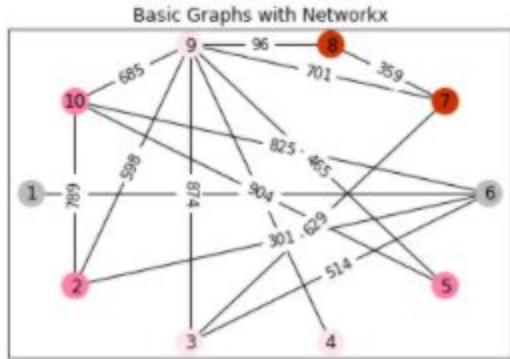
```
label [0 0 1 1 0 0 1 1 1 0]
True_clustering [0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1]
[[0 0]
 [0 1]
 [1 0]
 [1 1]] [2 3 3 2]
[0 1] [5 5]
max [3, 3]
numclass [0, 1]
sumClass [5, 5]
prec [0.6, 0.6]
rec [0.6, 0.6]
F1 [0.6, 0.6]
FMeasure= 0.6
```

```
W = [[5.08882019 21.01900757]
 [21.01900757 4.88107527]]
WCC = [21.01900757 21.01900757]
NC = 1.6166266027425191
```



$K = 4$

Label : [2 1 0 0 1 2 3 3 0 1]



Conditional Entropy: 0.47548875021634696

FMeasure = 0.7916666666666666

```

label [2 1 0 0 1 2 3 3 0 1]
True_clustering [0, 1, 0, 0, 0, 1, 1, 1, 0, 1]
[[0 0]
 [1 0]
 [1 1]
 [2 0]
 [2 1]
 [3 1]] [3 1 2 1 1 2]
[0 1 2 3] [3 3 2 2]
max [3, 2, 1, 2]
numclass [0, 1, 2, 3]
sumClass [3, 3, 2, 2]
prec [1.0, 0.6666666666666666, 0.5, 1.0]
rec [1.0, 0.6666666666666666, 0.5, 1.0]
F1 [1.0, 0.6666666666666666, 0.5, 1.0]
FMeasure= 0.7916666666666666

```

---

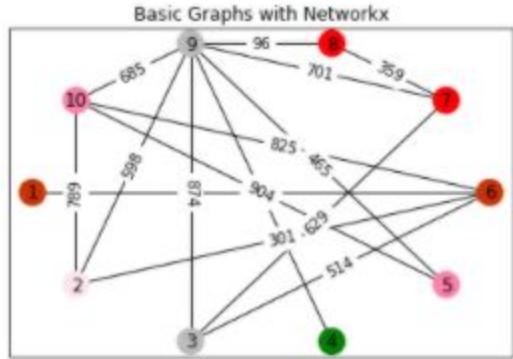
```

W = [[1.46782648 6.01314988 5.00585769 3.38565045]
 [6.01314988 1.00049304 4.04955294 6.]
 [5.00585769 4.04955294 0.03877421 4.]
 [3.38565045 6. 4. 0.02759833]]
WCC = [14.40465803 16.06270282 13.05541063 13.38565045]
NC = 3.843870552277199

```

$K = 6$

Label : [3 0 2 5 1 3 4 4 2 1]



Conditional Entropy: 0.3999999999999999

FMeasure = 0.8333333333333334

```

label [3 0 2 5 1 3 4 4 2 1]
True_clustering [0, 1, 0, 0, 0, 1, 1, 1, 0, 1]
[[0 1]
 [1 0]
 [1 1]
 [2 0]
 [3 0]
 [3 1]
 [4 1]
[5 0]] [1 1 1 2 1 1 2 1]
[0 1 2 3 4 5] [1 2 2 2 2 1]
max [1, 1, 2, 1, 2, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [1, 2, 2, 2, 2, 1]
prec [1.0, 0.5, 1.0, 0.5, 1.0, 1.0]
rec [1.0, 0.5, 1.0, 0.5, 1.0, 1.0]
F1 [1.0, 0.5, 1.0, 0.5, 1.0, 1.0]
FMeasure= 0.833333333333334

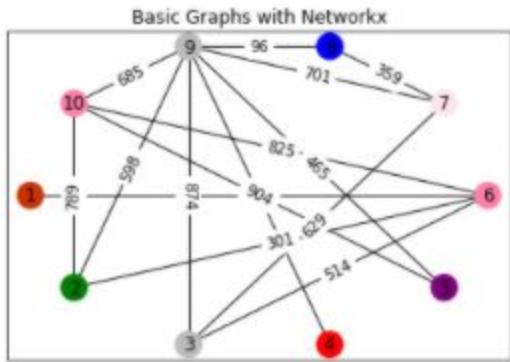
W = [[0.0000000e+00 1.00037447e+00 1.00252883e+00 1.04929168e+00
 2.0000000e+00 1.0000000e+00]
[1.00037447e+00 1.18570836e-04 2.01062106e+00 3.00026126e+00
 4.0000000e+00 2.0000000e+00]
[1.00252883e+00 2.01062106e+00 1.60053888e-04 3.00585769e+00
 1.38565045e+00 1.46766643e+00]
[1.04929168e+00 3.00026126e+00 3.00585769e+00 3.87742078e-02
 4.0000000e+00 2.0000000e+00]
[2.0000000e+00 4.0000000e+00 1.38565045e+00 4.0000000e+00
 2.75983304e-02 2.0000000e+00]
[1.0000000e+00 2.0000000e+00 1.46766643e+00 2.0000000e+00
 2.0000000e+00 0.0000000e+00]]
WCC = [6.05219497 12.01125679 8.87232446 13.05541063 13.38565045 8.46766643]
NC = 5.994953368850307

```



$K = 8$

Label : [3 5 2 4 7 1 0 6 2 1]



Conditional Entropy : 0.0

FMeasure = 1.0

```

label [3 5 2 4 7 1 0 6 2 1]
True_clustering [0, 1, 0, 0, 0, 1, 1, 1, 0, 1]
[[0 1]
 [1 1]
 [2 0]
 [3 0]
 [4 0]
 [5 1]
 [6 1]
[7 0]] [1 2 2 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 2 1 1 1 1 1]
max [1, 2, 2, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 2, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

```

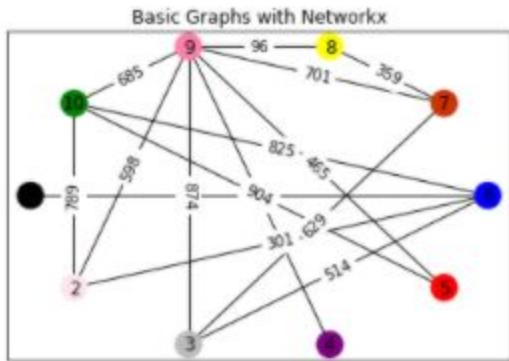
```

W = [[0.0000000e+00 2.0000000e+00 2.75756854e-03 1.0000000e+00
 1.0000000e+00 1.0000000e+00 2.75983304e-02 1.0000000e+00]
 [2.0000000e+00 2.61258557e-04 2.00691715e+00 1.03877421e+00
 2.0000000e+00 4.96661483e-02 2.0000000e+00 1.00011857e+00]
 [2.75756854e-03 2.00691715e+00 1.60053888e-04 2.0000000e+00
 1.46766643e+00 1.00252883e+00 1.38289289e+00 1.00956160e+00]
 [1.0000000e+00 1.03877421e+00 2.0000000e+00 0.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 2.0000000e+00 1.46766643e+00 1.0000000e+00
 0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 4.96661483e-02 1.00252883e+00 1.0000000e+00
 1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00]
 [2.75983304e-02 2.0000000e+00 1.38289289e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.00011857e+00 1.00956160e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00]]
WCC = [6.0303559 10.09547607 8.87232446 8.03877421 8.46766643 6.05219497
 7.41049122 7.00968017]
NC = 7.99995608254046

```

$K = 10$

Label : [8 0 2 7 4 6 3 9 1 5]



Conditional Entropy : 0.0

FMeasure = 1.0

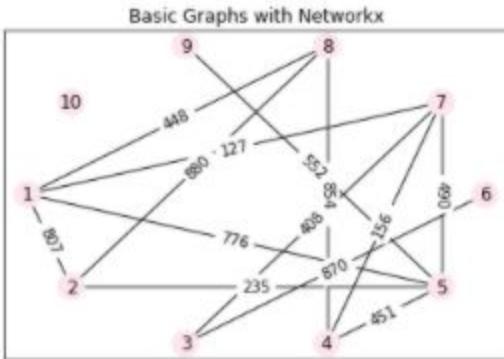
```

label [8 0 2 7 4 6 3 9 1 5]
True_clustering [0, 1, 0, 0, 0, 1, 1, 1, 0, 1]
[[0 1]
 [1 0]
 [2 0]
 [3 1]
 [4 0]
 [5 1]
 [6 1]
 [7 0]
 [8 0]
[9 1]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure= 1.0

W = [[0.0000000e+00 2.52882629e-03 1.0000000e+00 1.0000000e+00
1.0000000e+00 3.74469575e-04 4.92916788e-02 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[2.52882629e-03 0.0000000e+00 1.60053888e-04 9.02808588e-04
9.56160193e-03 1.05945569e-03 1.0000000e+00 4.67666427e-01
1.0000000e+00 3.82892886e-01]
[1.0000000e+00 1.60053888e-04 0.0000000e+00 1.85475995e-03
1.0000000e+00 1.0000000e+00 5.85768971e-03 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 9.02808588e-04 1.85475995e-03 0.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 2.75983304e-02]
[1.0000000e+00 9.56160193e-03 1.0000000e+00 1.0000000e+00
0.0000000e+00 1.18570836e-04 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[3.74469575e-04 1.05945569e-03 1.0000000e+00 1.0000000e+00
1.18570836e-04 0.0000000e+00 2.61258557e-04 1.0000000e+00
1.0000000e+00 1.0000000e+00]
[4.92916788e-02 1.0000000e+00 5.85768971e-03 1.0000000e+00
1.0000000e+00 2.61258557e-04 0.0000000e+00 1.0000000e+00
3.87742078e-02 1.0000000e+00]
[1.0000000e+00 4.67666427e-01 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
1.0000000e+00 1.0000000e+00]
[1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 1.0000000e+00 3.87742078e-02 1.0000000e+00
0.0000000e+00 1.0000000e+00]
[1.0000000e+00 3.82892886e-01 1.0000000e+00 2.75983304e-02
1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
1.0000000e+00 0.0000000e+00]]
WCC = [6.05219497 2.86477206 6.0078725 6.0303559 7.00968017 5.00181375
5.09418483 8.46766643 8.03877421 7.41049122]
NC = 10.0

```

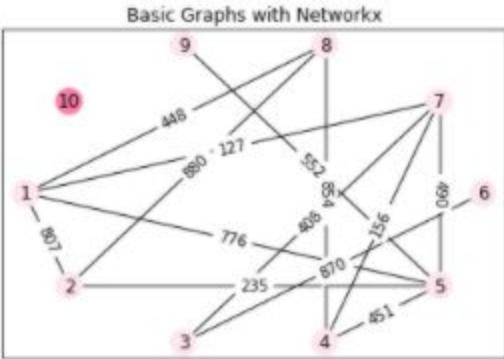
For t\_10\_8



```
array([[0., 807., 0., 0., 776., 0., 127., 448., 0., 0.],
[807., 0., 0., 0., 235., 0., 0., 880., 0., 0.],
[0., 0., 0., 0., 0., 870., 408., 0., 0., 0.],
[0., 0., 0., 0., 451., 0., 156., 854., 0., 0.],
[776., 235., 0., 451., 0., 0., 490., 0., 552., 0.],
[0., 0., 870., 0., 0., 0., 0., 0., 0., 0.],
[127., 0., 408., 156., 490., 0., 0., 0., 0., 0.],
[448., 880., 0., 854., 0., 0., 0., 0., 0., 0.],
[0., 0., 0., 0., 552., 0., 0., 0., 0., 0.],
[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

$K = 2$

Label : [0 0 0 0 0 0 0 0 1]



Conditional Entropy: 1.7019550008653872

FMeasure = 0.6666666666666666

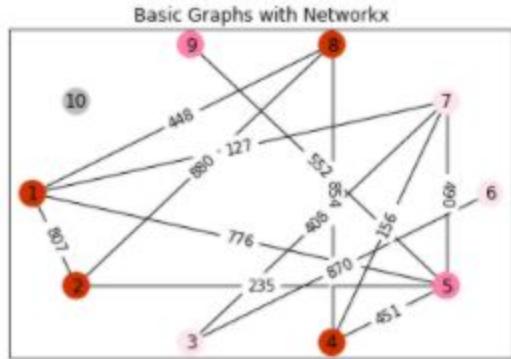
```
label [0 0 0 0 0 0 0 0 1]
True_clustering [0, 3, 2, 0, 2, 1, 0, 3, 2, 0]
[[0 0]
 [0 1]
 [0 2]
 [0 3]
 [1 0]] [3 1 3 2 1]
[0 1] [9 1]
max [3, 1]
numclass [0, 1]
sumClass [9, 1]
prec [0.3333333333333333, 1.0]
rec [0.3333333333333333, 1.0]
F1 [0.3333333333333333, 1.0]
FMeasure = 0.6666666666666666

W = [[23.63828067 9.]
 [9. 0.]]
WCC = [9. 9.]
NC = 1.2757498193559766
```



K = 4

Label : [3 3 0 3 1 0 0 3 1 2]



Conditional Entropy: 0.8754887502163471

FMeasure = 0.7083333333333333

```

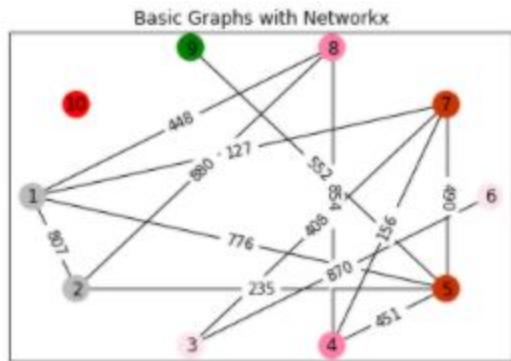
label [3 3 0 3 1 0 0 3 1 2]
True_clustering [0, 3, 2, 0, 2, 1, 0, 3, 2, 0]
[[0 0]
[0 1]
[0 2]
[1 2]
[2 0]
[3 0]
[3 3]] [1 1 1 2 1 2 2]
[0 1 2 3] [3 2 1 4]
max [1, 2, 1, 2]
numclass [0, 1, 2, 3]
sumClass [3, 2, 1, 4]
prec [0.3333333333333333, 1.0, 1.0, 0.5]
rec [0.3333333333333333, 1.0, 1.0, 0.5]
F1 [0.3333333333333333, 1.0, 1.0, 0.5]
FMeasure = 0.7083333333333333

W = [[1.01707405e+00 5.00744658e+00 3.00000000e+00 1.04909677e+01]
[5.00744658e+00 4.00584794e-03 2.00000000e+00 5.10679408e+00]
[3.00000000e+00 2.00000000e+00 0.00000000e+00 4.00000000e+00]
[1.04909677e+01 5.10679408e+00 4.00000000e+00 2.01199242e+00]]
WCC = [18.49841428 12.11424066 9. 19.59776177]
NC = 3.8544474353022977

```

K = 6

Label : [2 2 0 1 3 0 3 1 5 4]



Conditional Entropy: 0.8000000000000003

FMeasure = 0.6666666666666666

```

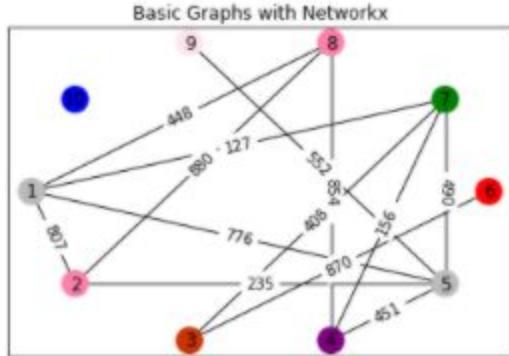
label [2 2 0 1 3 0 3 1 5 4]
True_clustering [0, 3, 2, 0, 2, 1, 0, 3, 2, 0]
[[0 1]
[0 2]
[0 0]
[1 3]
[2 0]
[2 3]
[3 0]
[3 2]
[4 0]
[5 2]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5] [2 2 2 2 1 1]
max [1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumclass [2, 2, 2, 2, 1, 1]
prec [0.5, 0.5, 0.5, 0.5, 1.0, 1.0]
rec [0.5, 0.5, 0.5, 0.5, 1.0, 1.0]
F1 [0.5, 0.5, 0.5, 0.5, 1.0, 1.0]
FMeasure = 0.6666666666666666

W = [[1.66585811e-04 4.0000000e+00 4.0000000e+00 3.01690747e+00
2.0000000e+00 2.0000000e+00]
[4.0000000e+00 1.95490260e-04 2.01148415e+00 2.22113453e+00
2.0000000e+00 2.0000000e+00]
[4.0000000e+00 2.01148415e+00 3.12783281e-04 1.37662724e+00
2.0000000e+00 2.0000000e+00]
[3.01690747e+00 2.22113453e+00 1.37662724e+00 7.44658307e-03
2.0000000e+00 1.00400585e+00]
[2.0000000e+00 2.0000000e+00 2.0000000e+00 2.0000000e+00
0.0000000e+00 1.0000000e+00]
[2.0000000e+00 2.0000000e+00 2.0000000e+00 1.00400585e+00
1.0000000e+00 0.0000000e+00]]
WCC = [15.01690747 12.23261868 11.38811139 9.61867509 9. 8.00400585]
NC = 5.999171880261575

```

K = 8

Label : [2 1 3 7 2 4 5 1 0 6]



Conditional Entropy: 0.20000000000000018

FMeasure = 0.9375

```

label [2 1 3 7 2 4 5 1 0 6]
True_clustering [0, 3, 2, 0, 2, 1, 0, 3, 2, 0]
[[0 2]
[1 3]
[2 0]
[2 2]
[3 2]
[4 1]
[5 0]
[6 0]
[7 0]] [1 2 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 2 2 1 1 1 1 1]
max [1, 2, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 2, 2, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 0.5, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 0.9375

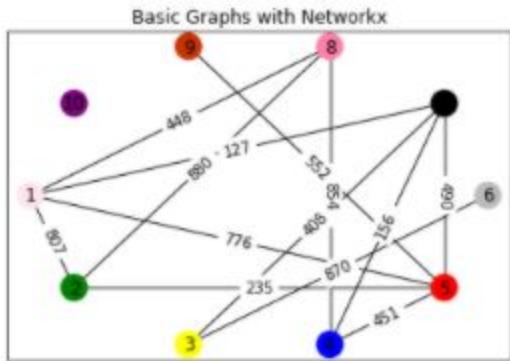
W = [[0.0000000e+00 2.0000000e+00 1.00400585e+00 1.00000000e+00
1.00000000e+00 1.00000000e+00 1.00000000e+00 1.00000000e+00
1.00000000e+00 1.50733075e-04 1.10701536e+00 2.00000000e+00
2.00000000e+00 2.00000000e+00 2.00000000e+00 1.00019549e+00
[1.00400585e+00 1.10701536e+00 4.26456581e-04 2.00000000e+00
2.00000000e+00 2.88278205e-01 2.00000000e+00 1.01099846e+00]
[1.00000000e+00 2.00000000e+00 2.00000000e+00 0.00000000e+00
1.66585811e-04 1.69074657e-02 1.00000000e+00 1.00000000e+00]
[1.00000000e+00 2.00000000e+00 2.00000000e+00 1.66585811e-04
0.00000000e+00 1.00000000e+00 1.00000000e+00 1.00000000e+00]
[1.00000000e+00 2.00000000e+00 2.88278205e-01 1.69074657e-02
1.00000000e+00 0.00000000e+00 1.00000000e+00 2.10136071e-01]
[1.00000000e+00 2.00000000e+00 2.00000000e+00 1.00000000e+00
1.00000000e+00 1.00000000e+00 0.00000000e+00 1.00000000e+00]
[1.00000000e+00 1.00019549e+00 1.01099846e+00 1.00000000e+00
1.00000000e+00 2.10136071e-01 1.00000000e+00 0.00000000e+00]]
WCC = [8.00400585 12.10721085 9.41029787 7.01707405 8.00016659 5.51532174
9. 6.22133002]
NC = 7.999942234274471

```

K = 10



Label : [0 5 9 6 4 2 8 1 3 7]



Conditional Entropy: 0.0

FMeasure = 1.0

```

label [0 5 9 6 4 2 8 1 3 7]
True_clustering [0, 3, 2, 0, 2, 1, 0, 3, 2, 0]
[[0 0]
 [1 3]
 [2 1]
 [3 2]
 [4 2]
 [5 3]
 [6 0]
 [7 0]
 [8 0]
 [9 2]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

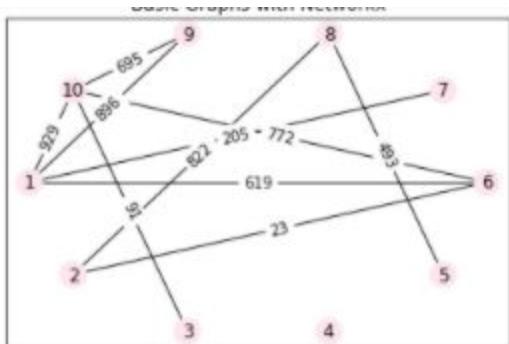
```

```

W = [[0.0000000e+00 1.13334132e-02 1.0000000e+00 1.0000000e+00
 4.26456581e-04 3.12783281e-04 1.0000000e+00 1.0000000e+00
 2.80831622e-01 1.0000000e+00]
 [1.13334132e-02 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.50733075e-04 1.95490260e-04 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.66585811e-04]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 4.00584794e-03 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [4.26456581e-04 1.0000000e+00 1.0000000e+00 4.00584794e-03
 0.0000000e+00 9.53691622e-02 1.09984602e-02 1.0000000e+00
 7.44658307e-03 1.0000000e+00]
 [3.12783281e-04 1.50733075e-04 1.0000000e+00 1.0000000e+00
 9.53691622e-02 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.95490260e-04 1.0000000e+00 1.0000000e+00
 1.09984602e-02 1.0000000e+00 0.0000000e+00 1.0000000e+00
 2.10136071e-01 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [2.80831622e-01 1.0000000e+00 1.0000000e+00 1.0000000e+00
 7.44658307e-03 1.0000000e+00 2.10136071e-01 1.0000000e+00
 0.0000000e+00 1.69074657e-02]
 [1.0000000e+00 1.0000000e+00 1.66585811e-04 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.69074657e-02 0.0000000e+00]]
WCC = [5.29290427 6.01167964 8.00016659 8.00400585 4.11824651 6.09583268
 6.22133002 9. 5.51532174 7.01707405]
NC = 10.0

```

## For t\_10\_9



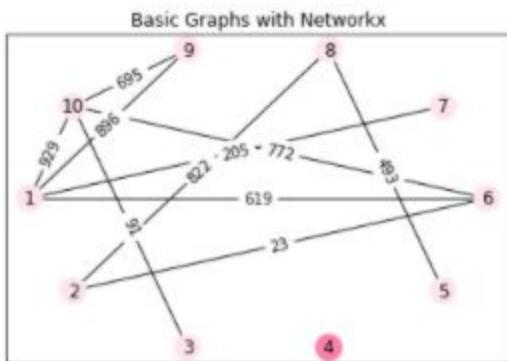
```

array([[0., 0., 0., 0., 0., 619., 205., 0., 896., 929.],
 [0., 0., 0., 0., 0., 23., 0., 822., 0., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 0., 91.],
 [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
 [0., 0., 0., 0., 0., 0., 0., 493., 0., 0.],
 [619., 23., 0., 0., 0., 0., 0., 0., 0., 772.],
 [205., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
 [0., 822., 0., 0., 493., 0., 0., 0., 0., 0.],
 [896., 0., 0., 0., 0., 0., 0., 0., 0., 695.],
 [929., 0., 91., 0., 0., 772., 0., 0., 695., 0.]])

```

K = 2

Label : [0 0 0 1 0 0 0 0 0 0]



Conditional Entropy: 0.0

FMeasure = 1.0

```

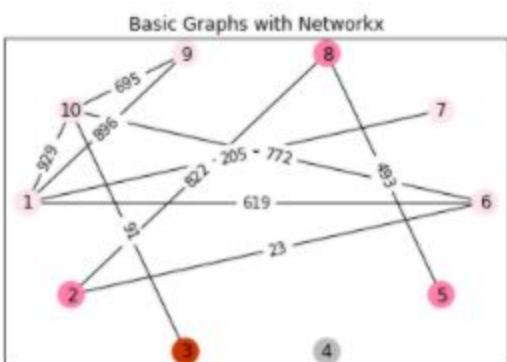
label [0 0 0 1 0 0 0 0 0 0]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]] [9 1]
[0 1] [9 1]
max [9, 1]
numclass [0, 1]
sumClass [9, 1]
prec [1.0, 1.0]
rec [1.0, 1.0]
F1 [1.0, 1.0]
FMeasure = 1.0

```
W = [[27.33696156 9.          ]
 [ 9.          0.          ]]
WCC = [9. 9.]
NC = 1.2476816886592403

```

K = 4

Label : [0 1 3 2 1 0 0 1 0 0]



Conditional Entropy: 0.0

FMeasure = 1.0

```

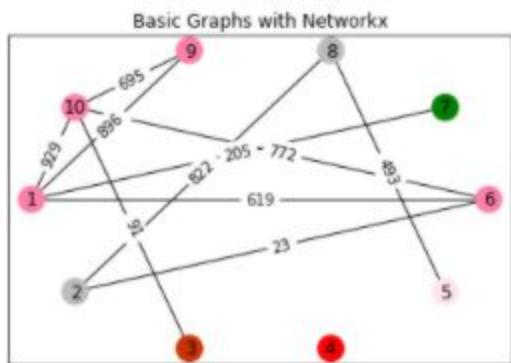
label [0 1 3 2 1 0 0 1 0 0]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]] [5 3 1 1]
[0 1 2 3] [5 3 1 1]
max [5, 3, 1, 1]
numclass [0, 1, 2, 3]
sumClass [5, 3, 1, 1]
prec [1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[ 4.13240802 14.7945336  5.      4.40252422]
 [14.7945336  1.00749572  3.      3.      ]
 [ 5.      3.      0.      1.      ]
 [ 4.40252422  3.      1.      0.      ]]
WCC = [24.19705783 20.7945336  9.      8.40252422]
NC = 3.8079192959613035

```

K = 6

Label :[1 2 3 4 0 1 5 2 1 1]



Conditional Entropy: 0.0

FMeasure = 1.0

```

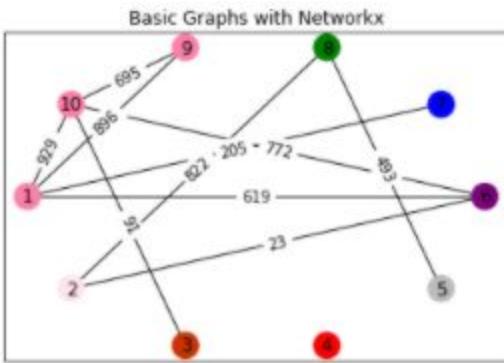
label [1 2 3 4 0 1 5 2 1 1]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]
 [4 0]
 [5 0]] [1 4 2 1 1 1]
[0 1 2 3 4 5] [1 4 2 1 1 1]
max [1, 4, 2, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5]
sumClass [1, 4, 2, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0.00000000e+00 4.00000000e+00 1.00722650e+00 1.00000000e+00
      1.00000000e+00 1.00000000e+00]
     [4.00000000e+00 1.00367311e+00 7.79453360e+00 3.40252422e+00
      4.00000000e+00 3.12873490e+00]
     [1.00722650e+00 7.79453360e+00 2.69215065e-04 2.00000000e+00
      2.00000000e+00 2.00000000e+00]
     [1.00000000e+00 3.40252422e+00 2.00000000e+00 0.00000000e+00
      1.00000000e+00 1.00000000e+00]
     [1.00000000e+00 4.00000000e+00 2.00000000e+00 1.00000000e+00
      0.00000000e+00 1.00000000e+00]
     [1.00000000e+00 3.12873490e+00 2.00000000e+00 1.00000000e+00
      1.00000000e+00 0.00000000e+00]]
WCC = [ 8.0072265  22.32579273 14.80176011  8.40252422  9.           8.1287349 ]
NC = 5.9569601195217015

```

K = 8

Label : [1 0 3 4 2 7 6 5 1 1]



Conditional Entropy: 0.0

FMeasure = 1.0

```

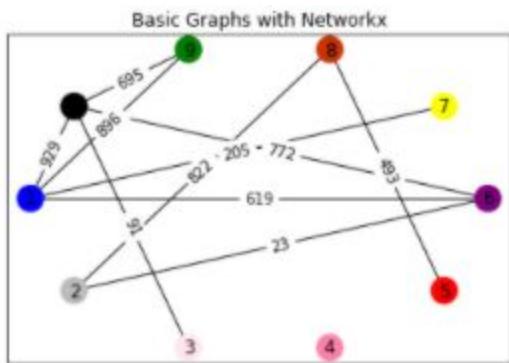
label [1 0 3 4 2 7 6 5 1 1]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]
 [4 0]
 [5 0]
 [6 0]
 [7 0]] [1 3 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7] [1 3 1 1 1 1 1 1]
max [1, 3, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7]
sumClass [1, 3, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

W = [[0.0000000e+00 3.0000000e+00 1.0000000e+00 1.0000000e+00
      1.0000000e+00 2.69215065e-04 1.0000000e+00 7.94533603e-01]
     [3.0000000e+00 1.17942447e-03 3.0000000e+00 2.40252422e+00
      3.0000000e+00 3.0000000e+00 2.12873490e+00 1.00249369e+00]
     [1.0000000e+00 3.0000000e+00 0.0000000e+00 1.0000000e+00
      1.0000000e+00 7.22650328e-03 1.0000000e+00 1.0000000e+00]
     [1.0000000e+00 2.40252422e+00 1.0000000e+00 0.0000000e+00
      1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
     [1.0000000e+00 3.0000000e+00 1.0000000e+00 1.0000000e+00
      0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00]
     [2.69215065e-04 3.0000000e+00 7.22650328e-03 1.0000000e+00
      1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00]
     [1.0000000e+00 2.12873490e+00 1.0000000e+00 1.0000000e+00
      1.0000000e+00 1.0000000e+00 0.0000000e+00 1.0000000e+00]
     [7.94533603e-01 1.00249369e+00 1.0000000e+00 1.0000000e+00
      1.0000000e+00 1.0000000e+00 1.0000000e+00 0.0000000e+00]]
WCC = [ 7.79480282 17.53375281 8.0072265 8.40252422 9. 7.00749572
        8.1287349 6.79702729]
NC = 7.9999327385785355

```

K = 10

Label :[6 2 0 1 4 7 9 3 5 8]



Conditional Entropy: 0.0

FMeasure = 1.0

```

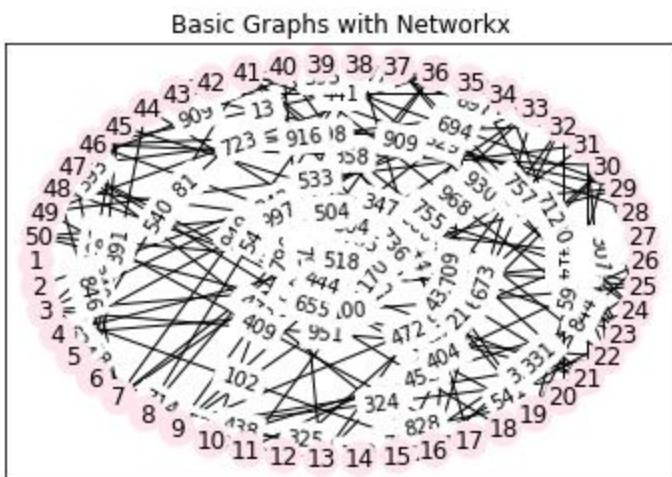
label [6 2 0 1 4 7 9 3 5 8]
True_clustering [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[[0 0]
 [1 0]
 [2 0]
 [3 0]
 [4 0]
 [5 0]
 [6 0]
 [7 0]
 [8 0]
 [9 0]] [1 1 1 1 1 1 1 1 1 1]
[0 1 2 3 4 5 6 7 8 9] [1 1 1 1 1 1 1 1 1 1]
max [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
prec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
rec [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
F1 [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
FMeasure = 1.0

```
W = [[0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 4.02524224e-01 1.0000000e+00]
 [1.0000000e+00 0.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 0.0000000e+00 2.69215065e-04
 1.0000000e+00 1.0000000e+00 1.0000000e+00 7.94533603e-01
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 2.69215065e-04 0.0000000e+00
 7.22650328e-03 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 7.22650328e-03
 0.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 0.0000000e+00 1.28446254e-04 1.0000000e+00
 9.58635154e-04 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.28446254e-04 0.0000000e+00 2.04982675e-03
 9.23430603e-05 1.28734904e-01]
 [1.0000000e+00 1.0000000e+00 7.94533603e-01 1.0000000e+00
 1.0000000e+00 1.0000000e+00 2.04982675e-03 0.0000000e+00
 4.43860604e-04 1.0000000e+00]
 [4.02524224e-01 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 9.58635154e-04 9.23430603e-05 4.43860604e-04
 0.0000000e+00 1.0000000e+00]
 [1.0000000e+00 1.0000000e+00 1.0000000e+00 1.0000000e+00
 1.0000000e+00 1.0000000e+00 1.28734904e-01 1.0000000e+00
 1.0000000e+00 0.0000000e+00]]
WCC = [8.40252422 9. 7.79480282 7.00749572 8.0072265 7.00108708
 5.13100552 6.79702729 5.40401906 8.1287349]
NC = 10.0

```

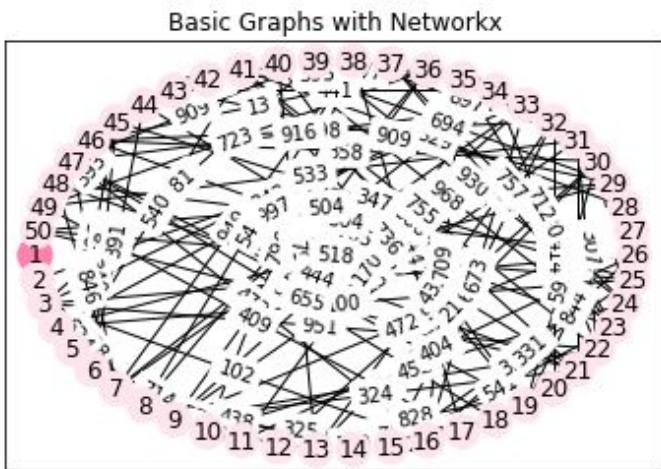
# For topology sizes 50

For t > 0



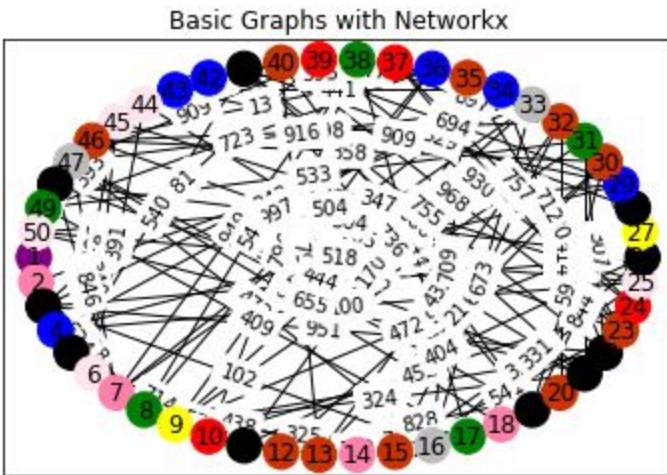
$$K=2$$

```
1 visualize(N,label)
```



Entropy = 3.052025529332475

$$K = 10$$



Entropy = 2.023352357018958

```

Y [4, 1, 1, 4, 1, 2, 6, 3, 1, 2, 5, 5, 3, 5, 0, 24, 1, 1, 4, 0, 0, 3, 2, 3, 1, 5, 6, 0, 1, 3, 3, 2, 20, 5, 21, 7, 4, 2, 4,
X [7 1 8 6 8 0 1 5 9 4 8 3 3 1 3 2 5 1 8 3 8 8 3 4 0 8 9 8 6 3 5 3 2 6 3 6 4
5 4 3 8 3 6 0 0 3 2 8 5 0]

```

```

numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [5, 4, 3, 10, 4, 5, 6, 1, 10, 2]
prec [0.2, 0.5, 0.3333333333333333, 0.3, 0.5, 0.4, 0.3333333333333333, 1.0, 0.2, 0.5]
rec [0.2, 0.5, 0.3333333333333333, 0.3, 0.5, 0.4, 0.3333333333333333, 1.0, 0.2, 0.5]
F1 [0.2000000000000004, 0.5, 0.3333333333333333, 0.3, 0.5, 0.4000000000000001, 0.3333333333333333, 1.0, 0.2000000000000006
FMeasure= 0.4266666666666675

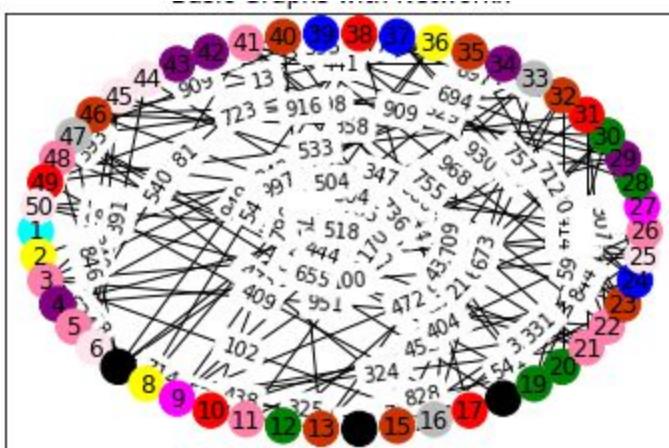
```

```

W = [[5.08020178e+00 2.0000000e+01 1.5000000e+01 4.87269184e+01
 2.0000000e+01 2.5000000e+01 2.73824200e+01 5.0000000e+00
 4.69530394e+01 1.0000000e+01]
[2.0000000e+01 4.01447521e+00 8.64619184e+00 3.73422508e+01
 1.6000000e+01 1.80002456e+01 2.30602050e+01 4.0000000e+00
 3.90002118e+01 8.0000000e+00]
[1.5000000e+01 8.64619184e+00 1.01261669e-02 2.76721052e+01
 1.10001128e+01 1.5000000e+01 1.8000000e+01 3.0000000e+00
 2.64103571e+01 4.06252831e+00]
[4.87269184e+01 3.73422508e+01 2.76721052e+01 3.16428779e+01
 3.81217185e+01 4.90179530e+01 5.88790637e+01 1.0000000e+01
 9.80418761e+01 2.0000000e+01]
[2.0000000e+01 1.6000000e+01 1.10001128e+01 3.81217185e+01
 3.01149614e+00 1.90003492e+01 2.4000000e+01 4.0000000e+00
 3.91636541e+01 8.0000000e+00]
[2.5000000e+01 1.80002456e+01 1.5000000e+01 4.90179530e+01
 1.90003492e+01 5.60709075e+00 2.80036626e+01 5.0000000e+00
 4.82346682e+01 9.79453360e+00]
[2.73824200e+01 2.30602050e+01 1.8000000e+01 5.88790637e+01
 2.4000000e+01 2.80036626e+01 8.09443109e+00 6.0000000e+00
 5.63255657e+01 1.10026320e+01]
[5.0000000e+00 4.0000000e+00 3.0000000e+00 1.0000000e+01
 4.0000000e+00 5.0000000e+00 6.0000000e+00 0.0000000e+00
 1.0000000e+01 2.0000000e+00]
[4.69530394e+01 3.90002118e+01 2.64103571e+01 9.80418761e+01
 3.91636541e+01 4.82346682e+01 5.63255657e+01 1.0000000e+01
 3.30488147e+01 1.75022358e+01]
[1.0000000e+01 8.0000000e+00 4.06252831e+00 2.0000000e+01
 8.0000000e+00 9.79453360e+00 1.10026320e+01 2.0000000e+00
 1.75022358e+01 8.91517855e-03]]
WCC = [218.0623777 174.04910501 128.79129522 387.80188566 179.2858346
 217.05141209 252.65354899 49. 381.63160822 90.36192979]

```

K = 12



```

Y [4, 1, 1, 4, 1, 2, 6, 3, 1, 2, 5, 5, 3, 5, 0, 24, 1, 1, 4, 0, 0, 3, 2, 3, 1, 5, 6, 0, 1, 3, 3, 2, 20, 5, 21, 7, 4, 2, 4,
X [11 9 1 7 1 0 8 9 10 4 1 5 3 8 3 2 4 8 5 5 1 1 3 6
 0 1 10 5 7 5 4 3 2 7 3 9 6 4 6 3 1 7 7 0 0 3 2 1
 4 0]

```

Entropy = 1.8221919272160876

```

Y [4, 1, 1, 4, 1, 2, 6, 3, 1, 2, 5, 5, 3, 5, 0, 24, 1, 1, 4, 0, 0, 3, 2, 3, 1, 5, 6, 0, 1, 3, 3, 2, 20, 5, 21, 7, 4, 2, 4,
X [11 9 1 7 1 0 8 9 10 4 1 5 3 8 3 2 4 8 5 5 1 1 3 6
 0 1 10 5 7 5 4 3 2 7 3 9 6 4 6 3 1 7 7 0 0 3 2 1
 4 0]

```

```

max [1, 2, 1, 2, 2, 2, 2, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
sumClass [5, 8, 3, 7, 5, 5, 3, 5, 3, 3, 2, 1]
prec [0.2, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.2, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.4, 0.3333333333333333, 0.3333333333333333, 0.15, 0.2, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.4, 0.3333333333333333, 0.3333333333333333, 0.1, 0.15, 0.2, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.4, 0.3333333333333333, 0.3333333333333333, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.4, 0.3333333333333333, 0.3333333333333333, 0.0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3333333333333333, 0.2857142857142857, 0.4, 0.4, 0.6666666666666666, 0.4, 0.4, 0.3333333333333333, 0.3333333333333333]

```

```

W = [[5.08020178e+00 3.69530394e+01 1.50000000e+01 3.37269184e+01
2.50000000e+01 2.50000000e+01 1.50000000e+01 2.23824200e+01
1.50000000e+01 1.50000000e+01 1.00000000e+01 5.00000000e+00]
[3.69530394e+01 1.90429207e+01 2.14029105e+01 5.60000000e+01
3.82346682e+01 3.80056780e+01 2.31636541e+01 3.63255657e+01
2.30002118e+01 2.40000000e+01 1.35022358e+01 8.00000000e+00]
[1.50000000e+01 2.14029105e+01 1.01261669e-02 1.94875857e+01
1.50000000e+01 1.31919661e+01 8.00011279e+00 1.50000000e+01
6.64483147e+00 8.00136037e+00 4.06252831e+00 3.00000000e+00]
[3.37269184e+01 5.60000000e+01 1.94875857e+01 1.24857138e+01
3.40179530e+01 3.11960040e+01 2.00788664e+01 3.40009683e+01
2.01686381e+01 2.08780954e+01 1.40000000e+01 7.00000000e+00]
[2.50000000e+01 3.82346682e+01 1.50000000e+01 3.40179530e+01
5.02469165e+00 2.50000000e+01 1.40108890e+01 2.50000000e+01
1.40000756e+01 1.35834728e+01 9.79453360e+00 5.00000000e+00]
[2.50000000e+01 3.80056780e+01 1.31919661e+01 3.11960040e+01
2.50000000e+01 6.00325227e+00 1.40428521e+01 2.50000000e+01
1.31736127e+01 1.50000000e+01 1.00000000e+01 5.00000000e+00]
[1.50000000e+01 2.31636541e+01 8.00011279e+00 2.00788664e+01
1.40108890e+01 1.40428521e+01 1.00060712e+00 1.50000000e+01
9.00000000e+00 9.00000000e+00 6.00000000e+00 3.00000000e+00]
[2.23824200e+01 3.63255657e+01 1.50000000e+01 3.40009683e+01
2.50000000e+01 2.50000000e+01 1.50000000e+01 5.07008396e+00
1.40602050e+01 1.30243471e+01 1.00000000e+01 5.00000000e+00]
[1.50000000e+01 2.30002118e+01 6.64483147e+00 2.01686381e+01
1.40000756e+01 1.31736127e+01 9.00000000e+00 1.40602050e+01
2.01252536e+00 8.00194986e+00 6.00000000e+00 3.00000000e+00]
[1.50000000e+01 2.40000000e+01 8.00136037e+00 2.08780954e+01
1.35834728e+01 1.50000000e+01 9.00000000e+00 1.30243471e+01
8.00194986e+00 1.00310803e+00 5.00263203e+00 3.00000000e+00]
[1.00000000e+01 1.35022358e+01 4.06252831e+00 1.40000000e+01
9.79453360e+00 1.00000000e+01 6.00000000e+00 1.00000000e+01

```

```

9.79453360e+00 1.0000000e+01 6.0000000e+00 1.0000000e+01
6.0000000e+00 5.00263203e+00 8.91517855e-03 2.0000000e+00]
[5.0000000e+00 8.0000000e+00 3.0000000e+00 7.0000000e+00
5.0000000e+00 5.0000000e+00 3.0000000e+00 5.0000000e+00
3.0000000e+00 3.0000000e+00 2.0000000e+00 0.0000000e+00]]
WCC = [218.0623777 318.58796352 128.79129522 290.5550292 218.64159219
214.61011287 136.29637448 214.79350607 132.04952454 134.49185759
90.36192979 49.]
NC = 11.777013090959684

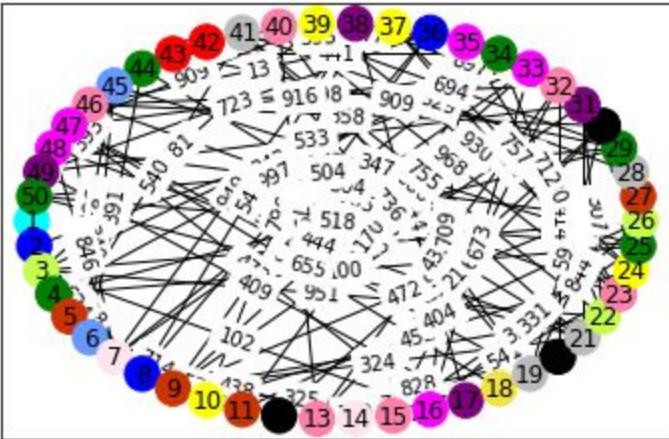
```

K = 15

```
[11 6 13 5 3 14 0 6 3 9 3 8 1 0 1 10 7 12 2 8 2 13 1 9
5 13 3 2 5 8 7 1 10 5 10 6 9 7 9 1 2 4 4 5 14 1 10 10
7 5]
```

```
1 visualize(N,label)
```

Basic Graphs with Networkx



Entropy = 1.657877059791625

```

max [1, 2, 2, 2, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]
sumclass [2, 6, 4, 2, 6, 3, 4, 3, 4, 5, 1, 1, 3, 2]
prec [0.5, 0.3333333333333333, 0.5, 0.5, 0.5, 0.3333333333333333, 0.3333333333333333, 0.25, 0.3333333333333333, 0.5, 0.2, 1
rec [0.5, 0.3333333333333333, 0.5, 0.5, 0.5, 0.3333333333333333, 0.3333333333333333, 0.25, 0.3333333333333333, 0.5, 0.2, 1
F1 [0.5, 0.3333333333333333, 0.5, 0.5, 0.5, 0.3333333333333333, 0.3333333333333333, 0.25, 0.3333333333333333, 0.5, 0.200000
FMeasure= 0.4744444444444445

```

```

W = [[1.25253586e-02 1.2000000e+01 8.0000000e+00 8.0000000e+00
 4.0000000e+00 1.10602050e+01 5.00194986e+00 7.00007560e+00
 5.00327971e+00 8.0000000e+00 7.11245144e+00 2.0000000e+00
 2.0000000e+00 6.0000000e+00 4.0000000e+00]
[1.2000000e+01 8.02189197e+00 2.30391639e+01 2.4000000e+01
 1.2000000e+01 3.37278866e+01 1.78780954e+01 2.4000000e+01
 1.51568401e+01 2.30788664e+01 2.79505741e+01 6.0000000e+00
 5.16863815e+00 1.8000000e+01 1.2000000e+01]
[8.0000000e+00 2.30391639e+01 2.00594623e+00 1.40436805e+01
 7.01707739e+00 2.28120144e+01 1.2000000e+01 1.51882471e+01
 1.10027122e+01 1.6000000e+01 1.80192425e+01 4.0000000e+00
 4.0000000e+00 1.10005261e+01 8.0000000e+00]
4.0000000e+00 8.0000000e+00 7.11245144e+00 2.0000000e+00
5.00327971e+00 8.0000000e+00 7.11245144e+00 2.0000000e+00
2.0000000e+00 6.0000000e+00 4.0000000e+00]
[1.2000000e+01 8.02189197e+00 2.30391639e+01 2.4000000e+01
 1.2000000e+01 3.37278866e+01 1.78780954e+01 2.4000000e+01
 1.51568401e+01 2.30788664e+01 2.79505741e+01 6.0000000e+00
 5.16863815e+00 1.8000000e+01 1.2000000e+01]
[8.0000000e+00 2.30391639e+01 2.00594623e+00 1.40436805e+01
 7.01707739e+00 2.28120144e+01 1.2000000e+01 1.51882471e+01
 1.10027122e+01 1.6000000e+01 1.80192425e+01 4.0000000e+00
 4.0000000e+00 1.10005261e+01 8.0000000e+00]
[8.0000000e+00 2.4000000e+01 1.40436805e+01 3.00976681e+00
 8.0000000e+00 2.31826835e+01 1.10026320e+01 1.57945336e+01
 1.2000000e+01 1.6000000e+01 1.80625283e+01 4.0000000e+00
 4.0000000e+00 1.04806105e+01 7.14085842e+00]
[4.0000000e+00 1.2000000e+01 7.01707739e+00 8.0000000e+00
 5.00451433e-04 1.00122680e+01 5.01925470e+00 8.0000000e+00
 6.0000000e+00 8.0000000e+00 1.0000000e+01 2.0000000e+00
 2.0000000e+00 6.0000000e+00 4.0000000e+00]
[1.10602050e+01 3.37278866e+01 2.28120144e+01 2.31826835e+01
 1.00122680e+01 8.46500720e+00 1.70050924e+01 2.4000000e+01
 1.8000000e+01 2.4000000e+01 2.90001666e+01 6.0000000e+00
 6.0000000e+00 1.61258048e+01 1.00511575e+01]
[5.00194986e+00 1.78780954e+01 1.2000000e+01 1.10026320e+01
 5.01925470e+00 1.70050924e+01 1.00310803e+00 1.05834728e+01
 9.0000000e+00 1.2000000e+01 1.40013604e+01 3.0000000e+00
 3.0000000e+00 9.0000000e+00 6.0000000e+00]
[7.00007560e+00 2.4000000e+01 1.51882471e+01 1.57945336e+01
 8.0000000e+00 2.4000000e+01 1.05834728e+01 2.02434250e+00
 1.2000000e+01 1.50003492e+01 1.90179530e+01 4.0000000e+00
 4.0000000e+00 1.10464212e+01 8.0000000e+00]

```

```

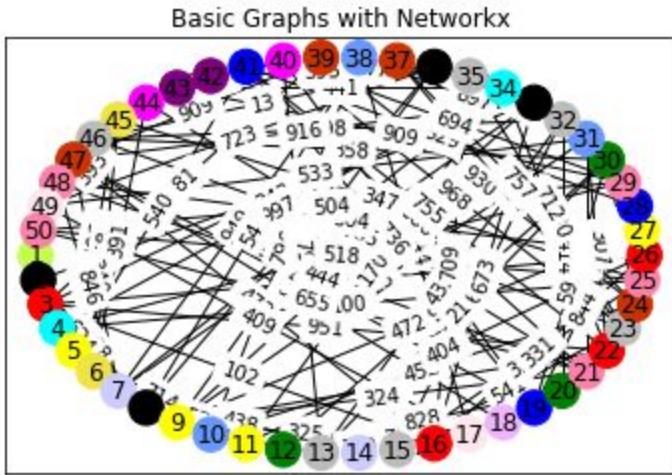
[5.00327971e+00 1.51568401e+01 1.10027122e+01 1.20000000e+01
 6.00000000e+00 1.80000000e+01 9.00000000e+00 1.20000000e+01
 1.00032403e+00 1.10428521e+01 1.41845195e+01 3.00000000e+00
 2.17033299e+00 9.00000000e+00 6.00000000e+00]
[8.00000000e+00 2.30788664e+01 1.60000000e+01 1.60000000e+01
 8.00000000e+00 2.40000000e+01 1.20000000e+01 1.50003492e+01
 1.10428521e+01 3.01149614e+00 1.90001128e+01 4.00000000e+00
 4.00000000e+00 1.11636541e+01 8.00000000e+00]
[7.11245144e+00 2.79505741e+01 1.80192425e+01 1.80625283e+01
 1.00000000e+01 2.90001666e+01 1.40013604e+01 1.90179530e+01
 1.41845195e+01 1.90001128e+01 5.01675897e+00 5.00000000e+00
 4.53259180e+00 1.24035849e+01 1.00000000e+01]
[2.00000000e+00 6.00000000e+00 4.00000000e+00 4.00000000e+00
 2.00000000e+00 6.00000000e+00 3.00000000e+00 4.00000000e+00
 3.00000000e+00 4.00000000e+00 5.00000000e+00 0.00000000e+00
 1.00000000e+00 3.00000000e+00 2.00000000e+00]
[2.00000000e+00 5.16863815e+00 4.00000000e+00 4.00000000e+00
 2.00000000e+00 6.00000000e+00 3.00000000e+00 4.00000000e+00
 2.17033299e+00 4.00000000e+00 4.53259180e+00 1.00000000e+00
 0.00000000e+00 3.00000000e+00 2.00000000e+00]
[6.00000000e+00 1.80000000e+01 1.10005261e+01 1.04806105e+01
 6.00000000e+00 1.61258048e+01 9.00000000e+00 1.10464212e+01
 9.00000000e+00 1.11636541e+01 1.24035849e+01 3.00000000e+00
 3.00000000e+00 1.00116583e+00 6.00000000e+00]
[4.00000000e+00 1.20000000e+01 8.00000000e+00 7.14085842e+00
 4.00000000e+00 1.00511575e+01 6.00000000e+00 8.00000000e+00
 6.00000000e+00 8.00000000e+00 1.00000000e+01 2.00000000e+00
 2.00000000e+00 6.00000000e+00 3.77256552e-03]]
WCC = [89.1779616 254.00006467 174.12266401 175.7075269 92.04860006
 250.97727881 134.49185759 177.63105232 133.56053662 179.2858346
 208.28508526 49. 46.87156294 132.22060159 93.19201595]
NC = 14.834681111139746

```

K = 17

```
[13 8 4 11 9 12 15 8 9 14 9 5 2 15 2 4 0 16 6 5 1 4 2 3 3
1 4 9 6 1 5 14 2 8 11 2 8 3 14 3 10 6 7 7 10 12 2 3 1
0 1]
```

```
1 visualize(N,label)
```



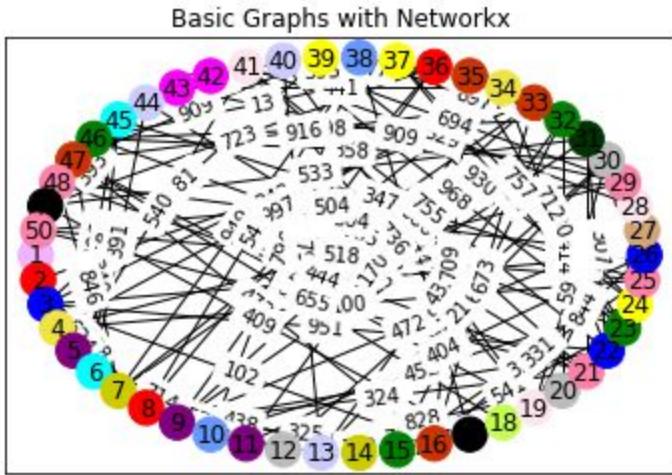
Entropy = 1.3876815597050833

FMeasure= 0.5333333333333333

K = 20

```
[16 4 6 12 7 11 19 4 7 14 7 2 15 19 5 3 8 13 0 2 1 6 5 5 9
1 6 17 0 1 2 18 5 3 12 3 4 9 14 9 15 0 10 10 15 11 5 3 1
8 1]
```

```
1 visualize(N,label)
```



Entropy = 1.1378770597916237

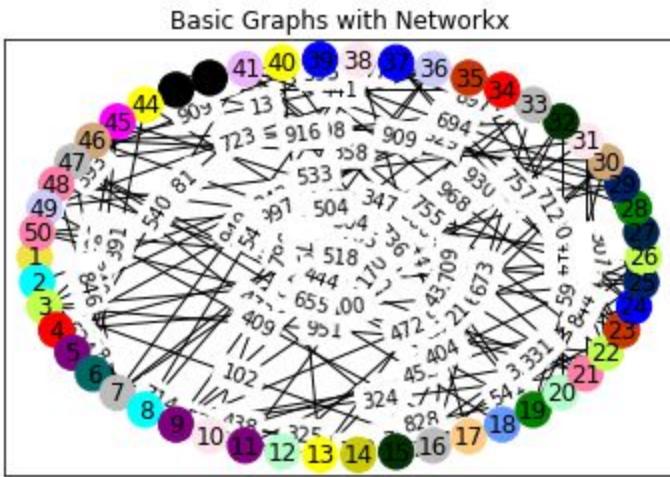
FMeasure= 0.5333333333333333

K = 25



```
[12 11 13 4 7 24 2 11 7 0 7 20 9 19 18 2 23 14 5 20 1 13 3 6
22 13 21 5 22 17 0 18 2 4 3 15 6 0 6 9 16 8 8 9 10 17 2 1
15 1]
```

```
1 visualize(N,label)
```



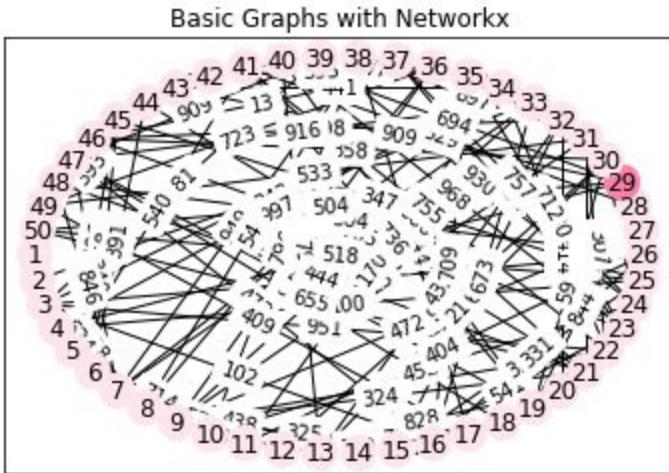
Entropy = 0.8905865002596176

FMeasure= 0.6966666666666665

For t\_50\_1

K = 2

```
1 visualize(N,label)
```



Entropy = 3.949440837398013

```
max [5, 1]
numclass [0, 1]
sumClass [49, 1]
prec [0.10204081632653061, 1.0]
rec [0.10204081632653061, 1.0]
F1 [0.10204081632653061, 1.0]
FMeasure= 0.5510204081632653
```

```

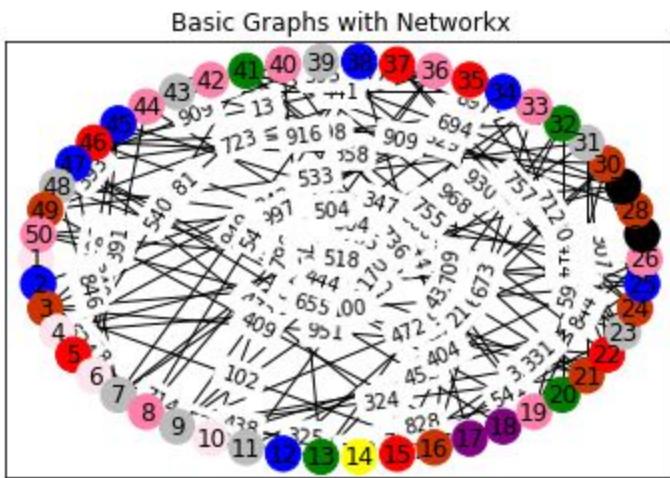
W = [[1100.73710639 49.
 [49. 0.]]
WCC = [49. 49.]
NC = 1.042618438361124

```

K = 10

```
[0 6 3 0 4 0 2 1 2 0 2 6 5 9 4 3 7 7 1 5 3 4 2 3 6 1 8 3 8 3 2 5 1 6 4 1 4
6 2 1 5 1 2 1 6 4 6 2 3 1]
```

```
1 visualize(N,label)
```



Entropy = 2.3868413785222864

FMeasure= 0.3734126984126984

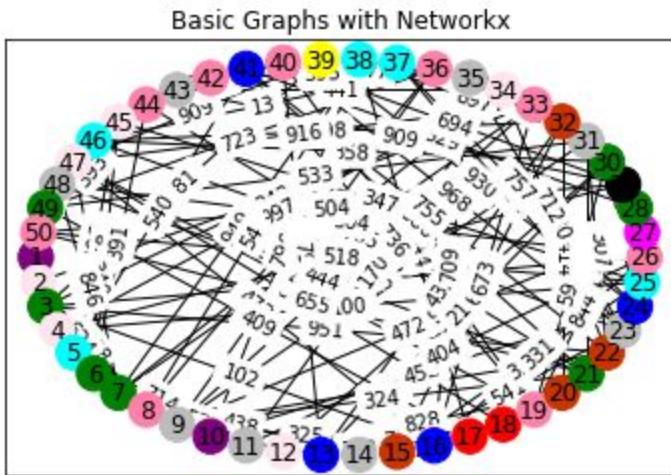
```

2.4000000e+01 1.6000000e+01 2.44599258e+01 8.0000000e+00
8.0000000e+00 4.0000000e+00]
[3.6000000e+01 2.31916745e+01 7.11164842e+01 5.92096445e+01
5.30001310e+01 3.50365162e+01 6.20075970e+01 1.8000000e+01
1.74493290e+01 9.0000000e+00]
[3.2000000e+01 7.11164842e+01 2.01281287e+01 5.41944065e+01
4.43304781e+01 3.2000000e+01 5.6000000e+01 1.54065697e+01
1.6000000e+01 7.14956862e+00]
[2.43868518e+01 5.92096445e+01 5.41944065e+01 1.50055026e+01
4.19231163e+01 2.70317456e+01 4.80057417e+01 1.4000000e+01
1.4000000e+01 7.0000000e+00]
[2.4000000e+01 5.30001310e+01 4.43304781e+01 4.19231163e+01
1.00425397e+01 2.20210248e+01 3.81692245e+01 1.2000000e+01
1.2000000e+01 6.0000000e+00]
[1.6000000e+01 3.50365162e+01 3.2000000e+01 2.70317456e+01
2.20210248e+01 3.15773503e+00 2.8000000e+01 8.0000000e+00
8.0000000e+00 4.0000000e+00]
[2.44599258e+01 6.20075970e+01 5.6000000e+01 4.80057417e+01
3.81692245e+01 2.8000000e+01 1.40178150e+01 1.4000000e+01
1.4000000e+01 7.0000000e+00]
[8.0000000e+00 1.8000000e+01 1.54065697e+01 1.4000000e+01
1.2000000e+01 8.0000000e+00 1.4000000e+01 3.02755475e-03
4.0000000e+00 2.0000000e+00]
[8.0000000e+00 1.74493290e+01 1.6000000e+01 1.4000000e+01
1.2000000e+01 8.0000000e+00 1.4000000e+01 4.0000000e+00
1.0000000e+00 2.0000000e+00]
[4.0000000e+00 9.0000000e+00 7.14956862e+00 7.0000000e+00
6.0000000e+00 4.0000000e+00 7.0000000e+00 2.0000000e+00
2.0000000e+00 0.0000000e+00]]
WCC = [176.84677761 360.8197019 328.19750703 289.75150651 253.44397476
180.08928662 291.64248902 95.40656966 95.44932896 48.14956862]
```

K = 12

[ 7 0 5 0 11 5 5 1 2 7 2 0 6 2 3 6 4 4 1 3 5 3 2 6  
 11 1 10 5 8 5 2 3 1 0 2 1 11 11 9 1 6 1 2 1 1 0 11 0 2  
 5 1 ]

```
1 visualize(N,label)
```



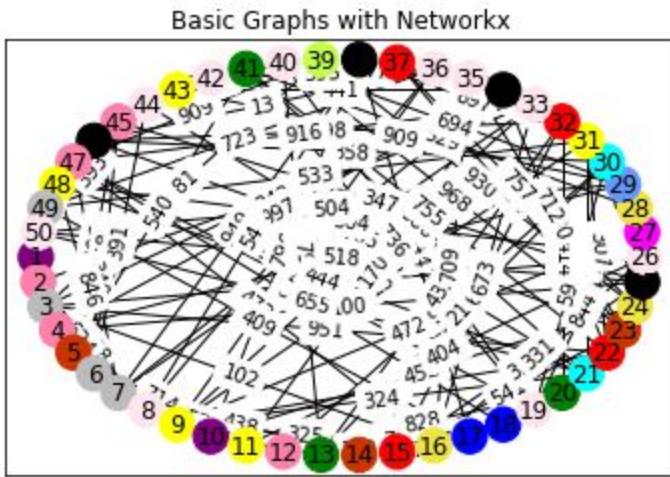
Entropy = 2.2260044989229586

FMeasure= 0.49847883597883597

K = 15

|   |   |    |    |    |    |   |   |   |   |   |   |   |   |    |    |   |   |   |   |    |   |   |    |
|---|---|----|----|----|----|---|---|---|---|---|---|---|---|----|----|---|---|---|---|----|---|---|----|
| 7 | 1 | 2  | 1  | 3  | 2  | 2 | 0 | 9 | 7 | 9 | 1 | 5 | 3 | 4  | 12 | 6 | 6 | 0 | 5 | 11 | 4 | 3 | 12 |
| 8 | 0 | 10 | 12 | 14 | 11 | 9 | 4 | 0 | 8 | 0 | 0 | 4 | 8 | 13 | 0  | 5 | 0 | 9 | 0 | 1  | 8 | 1 | 9  |
| 2 | 0 |    |    |    |    |   |   |   |   |   |   |   |   |    |    |   |   |   |   |    |   |   |    |

```
1 visualize(N,label)
```



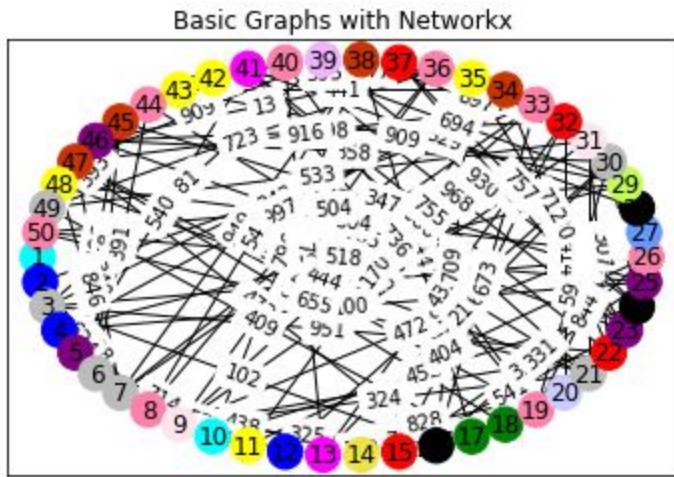
Entropy = 1.9340644880847542

FMeasure= 0.4733333333333333

K = 17

[11 6 2 6 7 2 2 1 0 11 9 6 10 12 4 8 5 5 1 15 2 4 7 8  
 7 1 14 8 13 2 0 4 1 3 9 1 4 3 16 1 10 9 9 1 3 7 3 9  
 2 1]

```
1 visualize(N,label)
```



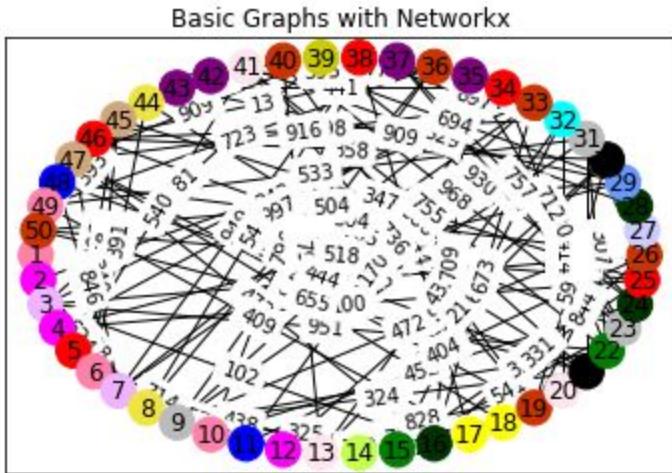
Entropy = 1.6925838096618162

FMeasure= 0.5725490196078431

K = 20

```
[1 10 16 10 4 1 16 12 2 1 6 10 0 13 5 18 9 9 3 0 8 5 2 18
4 3 15 18 14 8 2 11 3 4 7 3 7 4 19 3 0 7 7 12 17 4 17 6
1 3]
```

```
1 visualize(N,label)
```



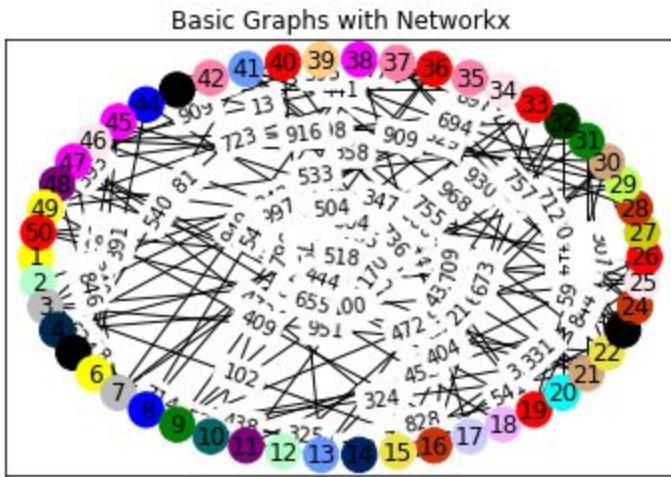
Entropy = 1.482779309748353

FMeasure= 0.5475000000000001

K = 25

```
[9 20 2 21 8 9 2 6 5 24 7 20 14 22 12 3 15 16 4 11 17 12 8 3
 0 4 19 3 13 17 5 18 4 0 1 4 1 10 23 4 14 1 8 6 10 0 10 7
 9 4]
```

```
1 visualize(N,label)
```



Entropy = 1.1607820003461544

FMeasure= 0.66

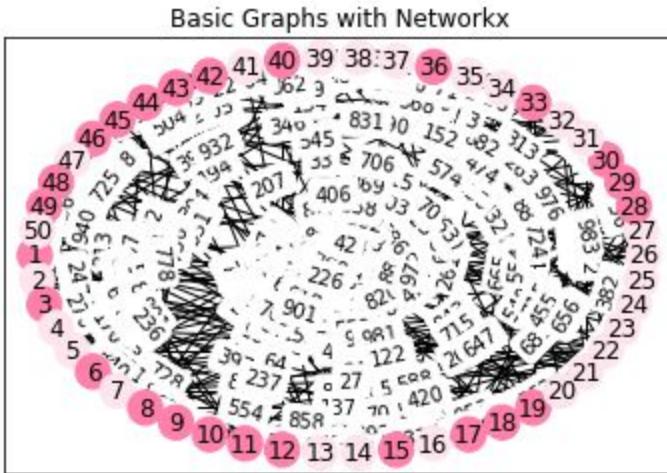
For t\_50\_2

K = 2



```
[1 0 1 0 0 1 0 1 1 1 1 0 0 1 0 1 1 1 0 0 0 0 0 0 0 1 1 1 0 0 1 0 0 1 0
0 0 1 0 1 1 1 1 0 1 1 0]
```

```
1 visualize(N,label)
```



```
y [24, 3, 0, 14, 15, 13, 6, 2, 3, 21, 12, 5, 16, 10, 1, 5, 22, 20, 9, 13, 23, 17, 9, 1, 7, 11, 11, 3, 19, 2, 7, 22, 16, 12,
x [1 0 1 0 0 1 0 1 1 1 1 0 0 1 0 1 1 1 0 0 0 0 0 0 0 1 1 1 0 0 1 0 0 1 0
0 0 1 0 1 1 1 1 0 1 1 0]
```

Entropy = 4.108758439731456

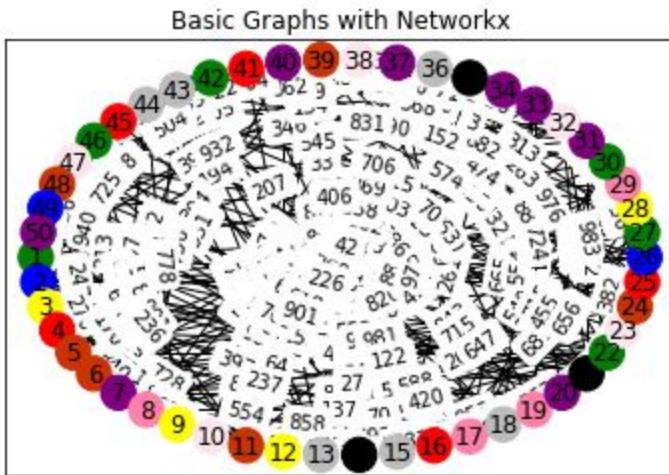
```
-->-->
max [2, 3]
numclass [0, 1]
sumClass [25, 25]
prec [0.08, 0.12]
rec [0.08, 0.12]
F1 [0.08, 0.12]
FMeasure= 0.1
```

```
W = [[228.15543532 551.46186539]
[551.46186539 232.39032559]]
WCC = [551.46186539 551.46186539]
NC = 1.4108773194662731
```

K = 10

[5 6 9 4 3 3 7 1 9 0 3 9 2 8 2 4 1 2 1 7 8 5 0 3 4 6 5 9 1 5 7 0 7 7 8 2 7  
0 3 7 4 5 2 2 4 5 0 3 6 7]

```
1 visualize(N,label)
```



Entropy = 2.2651676193236288

```
max [1, 1, 1, 1, 2, 2, 1, 1, 1, 2]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
sumClass [5, 4, 6, 6, 5, 6, 3, 8, 3, 4]
prec [0.2, 0.25, 0.1666666666666666, 0.1666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.125, 0.3333333333333333, 0.25, 0.1666666666666666, 0.1666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.125, 0.3333333333333333]
rec [0.2, 0.25, 0.1666666666666666, 0.1666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.125, 0.3333333333333333, 0.25, 0.1666666666666666, 0.1666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.125, 0.3333333333333333]
F1 [0.2000000000000004, 0.25, 0.1666666666666666, 0.1666666666666666, 0.4000000000000001, 0.3333333333333333, 0.3333333333333333, 0.25, 0.1666666666666666, 0.1666666666666666, 0.4, 0.3333333333333333, 0.3333333333333333, 0.125, 0.3333333333333333]
FMeasure= 0.2808333333333334
```

```

W = [[4.01203363 17.25540947 27.36383685 24.3572784 24.00680566 26.57937508
 12.04267666 35.18326867 10.16764304 19.00546167]
[17.25540947 1.26519732 20.02505752 20.27469147 17.14763528 20.02839195
 10.07685496 28.3796756 10.00813588 14.58698482]
[27.36383685 20.02505752 6.74096197 32.06854607 28.14230034 30.57415274
 14.04454643 40.25810547 14.02318579 21.52912632]
[24.3572784 20.27469147 32.06854607 5.03765998 23.52580929 30.14087561
 15.19768732 40.46734841 15.00948208 22.00223821]
[24.00680566 17.14763528 28.14230034 23.52580929 5.00409379 25.79158299
 12.25828339 33.78907564 11.04042763 18.21957067]
[26.57937508 20.02839195 30.57415274 30.14087561 25.79158299 8.21206437
 16.04952269 42.64863094 16.61894028 21.56552222]
[12.04267666 10.07685496 14.04454643 15.19768732 12.25828339 16.04952269
 1.00192258 19.98231624 8.06203851 11.13133552]
[35.18326867 28.3796756 40.25810547 40.46734841 33.78907564 42.64863094
 19.98231624 17.07708837 19.78106167 29.22181835]
[10.16764304 10.00813588 14.02318579 15.00948208 11.04042763 16.61894028
 8.06203851 19.78106167 1.00013271 11.0219278]
[19.00546167 14.58698482 21.52912632 22.00223821 18.21957067 21.56552222
 11.13133552 29.22181835 11.0219278 2.00182996]]
WCC = [195.9617555 157.78283695 228.02885754 223.04395688 193.9214909
 229.9969945 118.84526173 289.71130099 115.73284269 168.28398558]

```

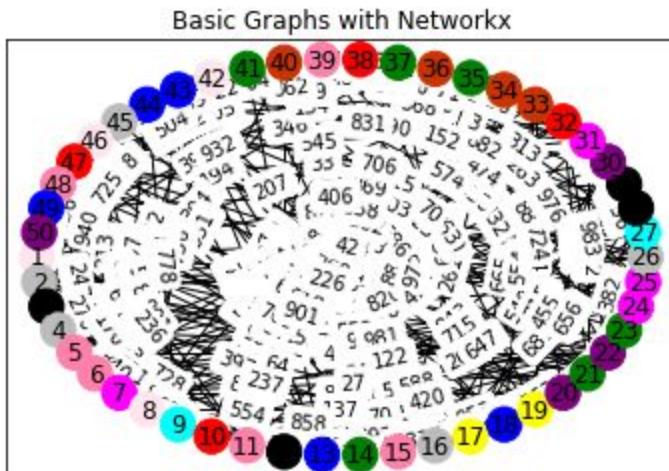
K = 12

```

[0 2 8 2 1 1 10 0 11 4 1 8 6 5 1 2 9 6 9 7 5 7 5 10
10 2 11 8 8 7 10 4 3 3 5 3 5 4 1 3 5 0 6 6 2 0 4 1
 6 7]

```

```
1 visualize(N,label)
```



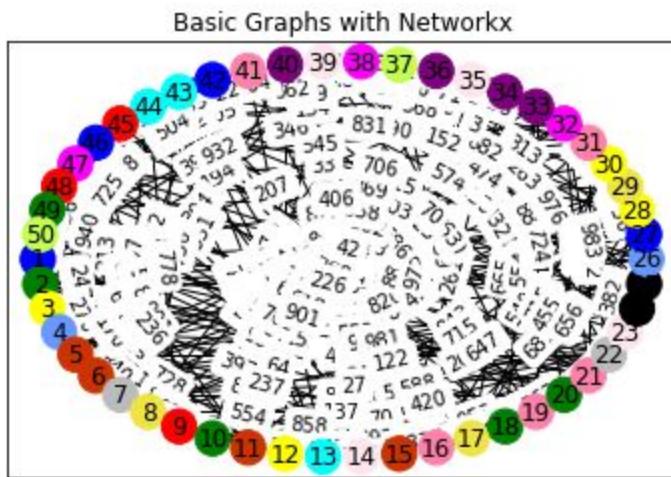
Entropy = 2.004776619150552

```
max [2, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1]
numclass [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
sumClass [4, 6, 5, 4, 4, 6, 5, 4, 4, 2, 4, 2]
prec [0.5, 0.1666666666666666, 0.2, 0.25, 0.25, 0.3333333333333333, 0.2, 0.25, 0.25, 0.5, 0.5, 0.5]
rec [0.5, 0.1666666666666666, 0.2, 0.25, 0.25, 0.3333333333333333, 0.2, 0.25, 0.25, 0.5, 0.5, 0.5]
F1 [0.5, 0.1666666666666666, 0.2000000000000004, 0.25, 0.25, 0.33333333333333, 0.2000000000000004, 0.25, 0.25, 0.5,
FMeasure= 0.325
```

$K = 15$

```
[6 5 9 14 3 3 2 12 4 5 3 9 11 0 3 1 12 5 1 5 1 2 0 8
 8 14 6 9 12 9 1 10 7 7 0 7 13 10 0 7 1 6 11 11 4 6 10 4
 5 13]
```

```
1 visualize(N,label)
```



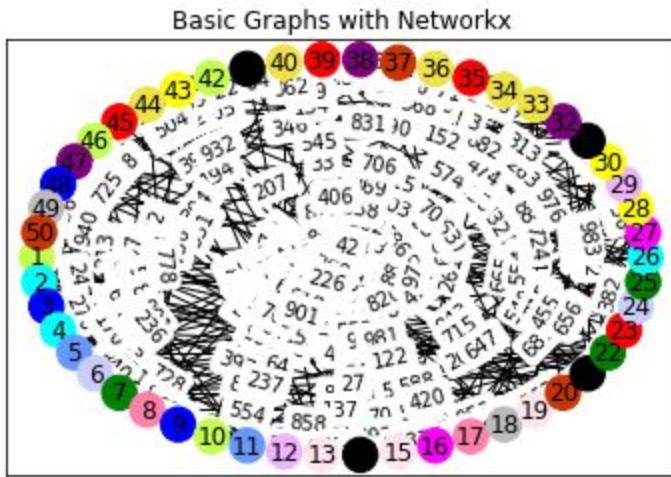
Entropy = 1.7647766191505507

FMeasure= 0.3488888888888889

$K = 17$

```
[13 11 6 11 14 15 5 1 6 13 14 16 0 8 0 10 1 2 0 3 8 5 4 15
5 11 10 9 16 9 8 7 12 12 4 12 3 7 4 12 8 13 9 12 4 13 7 6
2 3]
```

```
1 visualize(N,label)
```



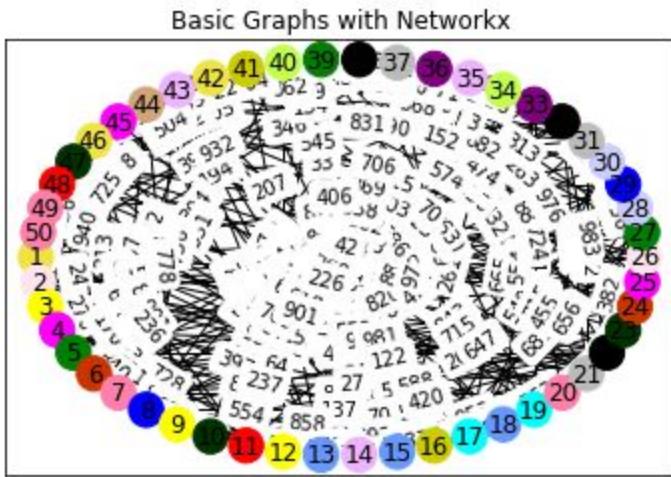
Entropy = 1.5778770597916214

FMeasure= 0.38431372549019605

K = 20

```
[12 0 9 10 5 3 1 6 9 18 4 9 14 16 14 19 11 14 11 1 2 8 18 3
10 0 5 15 6 15 2 8 7 13 16 7 2 8 5 13 19 12 16 17 10 12 18 4
1 1]
```

```
1 visualize(N,label)
```



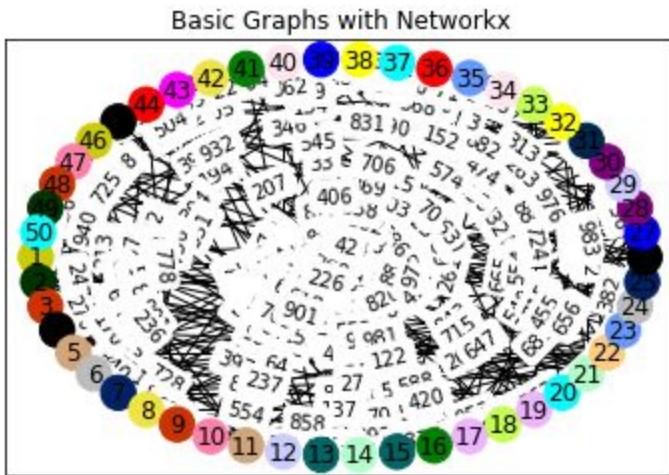
Entropy = 1.3358797503894237

FMeasure= 0.4541666666666667

K = 25

```
[19 18 3 8 17 2 22 12 3 1 17 15 24 20 24 5 16 13 16 11 20 23 14 2
22 8 6 7 15 7 21 9 13 0 14 4 11 9 6 0 5 12 10 4 8 19 1 3
18 11]
```

```
1 visualize(N,label)
```



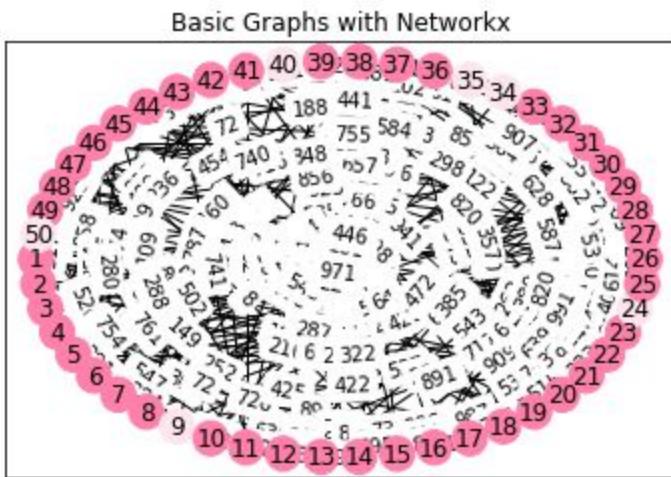
Entropy = 1.0052932501298084

FMeasure= 0.56

For t\_50\_3

K = 2

```
1 visualize(N,label)
```



Entropy = 4.259397574444091

```
max [1, 4]
numclass [0, 1]
sumClass [6, 44]
prec [0.1666666666666666, 0.0909090909090909091]
rec [0.1666666666666666, 0.09090909090909091]
F1 [0.1666666666666666, 0.09090909090909091]
FMeasure= 0.128787878787878
```

```

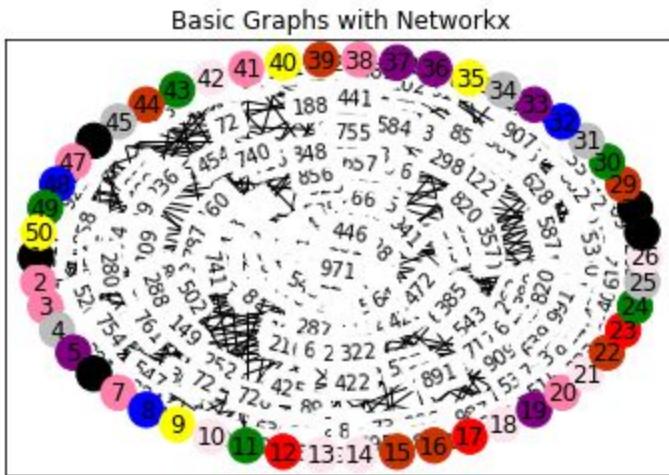
W = [[8.46049321 236.95502906]
 [236.95502906 759.87002295]]
WCC = [236.95502906 236.95502906]

```

$$K = 10$$

[8 1 1 2 7 8 1 6 9 0 5 4 0 0 3 3 4 0 7 1 0 3 4 5 2 0 8 8 3 5 2 6 7 2 9 7 7  
1 3 9 1 0 5 3 2 8 1 6 5 9]

```
1 visualize(N,label)
```



Entropy = 2.3752216163041524

FMeasure= 0.21690476190476193

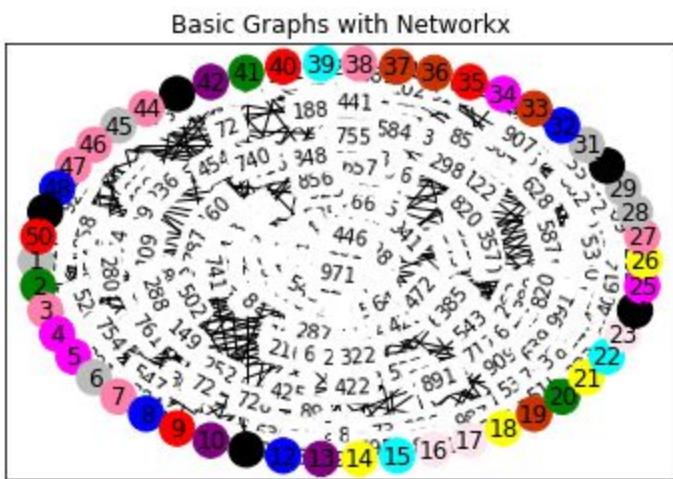
```
W = [[11.00302524 37.18067194 28.06317033 37.16770742 17.80634056 30.75948678
20.00049054 22.69285304 29.07530917 26.18744707]
[37.18067194 13.01153681 34.48190899 38.43928143 19.138537 28.36888019
16.87855443 31.32212311 27.1639391 27.09442022]
[28.06317033 34.48190899 2.15773545 24.4873426 13.13014599 22.0270407
13.0118289 22.81900774 16.4176789 18.39533076]
[37.16770742 38.43928143 24.4873426 9.0078448 16.00223006 24.22055384
13.40318318 27.10054851 21.93406865 22.21892579]
[17.80634056 19.138537 13.13014599 16.00223006 1.00675804 14.00213348
7.00897646 15. 13.04655958 11.8025188]
[30.75948678 28.36888019 22.0270407 24.22055384 14.00213348 3.03482098
13.65040639 20.05056547 22.00475748 17.07058956]
[20.00049054 16.87855443 13.0118289 13.40318318 7.00897646 13.65040639
1.00030273 13.48783311 13.02344674 12.]
[22.69285304 31.32212311 22.81900774 27.10054851 15. 20.05056547
13.48783311 3.18932058 19.18711338 18.64997916]
[29.07530917 27.1639391 16.4176789 21.93406865 13.04655958 22.00475748
13.02344674 19.18711338 4.00290216 18.44241051]
[26.18744707 27.09442022 18.39533076 22.21892579 11.8025188 17.07058956
12. 18.64997916 18.44241051 2.45500135]]
WCC = [248.93347686 260.06831641 192.83345492 224.97384147 126.93744194
192.1544139 122.46471976 190.31002354 180.2952835 171.86162187]
```



K = 12

```
[2 5 1 10 10 2 1 6 4 7 8 6 7 9 11 0 0 9 3 5 9 11 0 8
10 9 1 2 2 8 2 6 3 10 4 3 3 1 11 4 5 7 8 1 2 1 1 6
 8 4]
```

```
1 visualize(N,label)
```



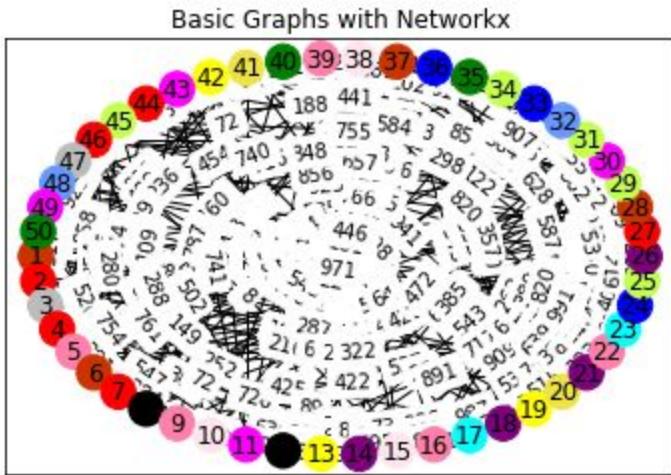
Entropy = 2.1158089988364175

FMeasure= 0.25773809523809527

K = 15

```
[3 4 2 4 1 3 4 8 1 0 10 8 9 7 0 1 11 7 9 12 7 1 11 6
13 7 4 3 13 10 13 14 6 13 5 6 3 0 1 5 12 9 10 4 13 4 2 14
10 5]
```

```
1 visualize(N,label)
```



Entropy = 1.8349721192370905

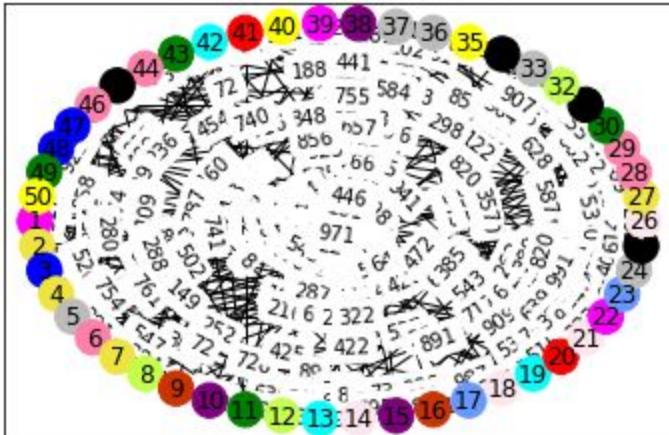
FMeasure= 0.3433333333333333

K = 17

```
[10 12 6 12 2 1 12 13 3 7 5 13 11 0 7 3 14 0 11 4 0 10 14 2
 8 0 12 1 1 5 8 13 2 8 9 2 2 7 10 9 4 11 5 1 8 1 6 6
 5 9]
```

```
1 visualize(N,label)
```

Basic Graphs with Networkx



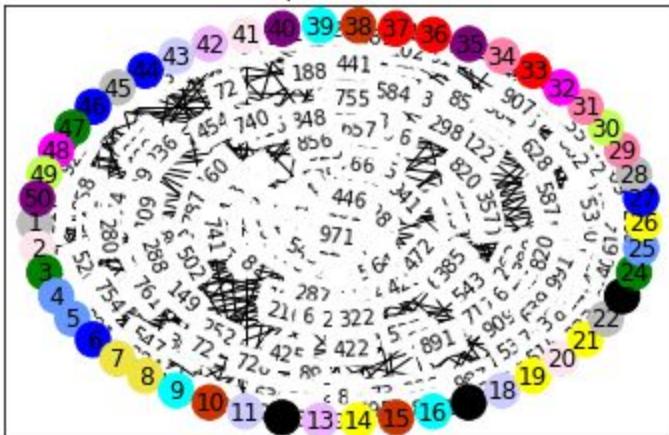
Entropy = 1.79497211923709

FMeasure= 0.3266666666666666

```
[2 0 5 14 14 6 12 12 11 3 15 8 16 9 3 11 8 15 9 0 9 2 8 5
 14 9 6 2 1 13 1 10 4 1 7 4 4 3 11 7 0 16 15 6 2 6 5 10
 13 7]
```

```
1 visualize(N,label)
```

Basic Graphs with Networkx





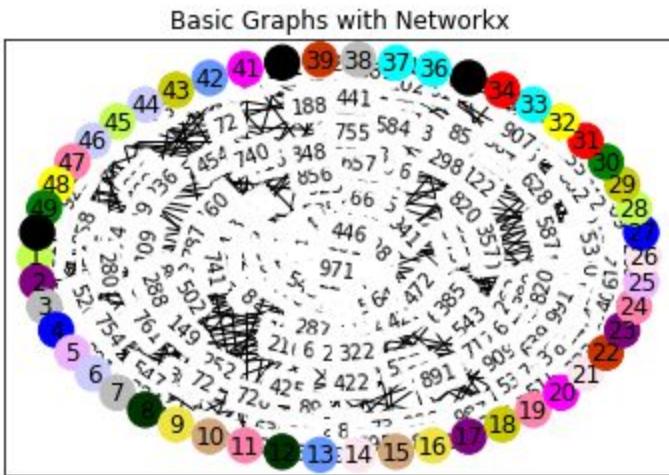
Entropy = 1.590977500432694

FMeasure= 0.35784313725490197

K = 20

```
[13 7 2 6 16 15 2 18 12 17 1 18 14 0 17 12 7 19 1 10 0 3 7 1
16 0 6 13 19 5 4 9 11 4 8 11 11 2 3 8 10 14 19 15 13 15 1 9
5 8]
```

```
1 visualize(N,label)
```



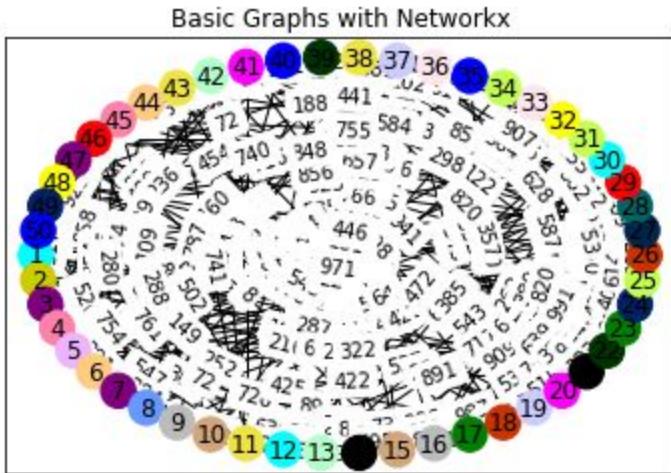
Entropy = 1.3207820003461554

FMeasure= 0.4375

K = 25

```
[11 19 7 1 16 23 7 14 2 17 12 11 20 8 17 2 5 3 15 10 8 18 5 22
13 3 21 24 4 11 13 9 0 13 6 0 15 12 18 6 10 20 12 23 1 4 7 9
22 6]
```

```
1 visualize(N,label)
```



Entropy = 1.0754887502163468

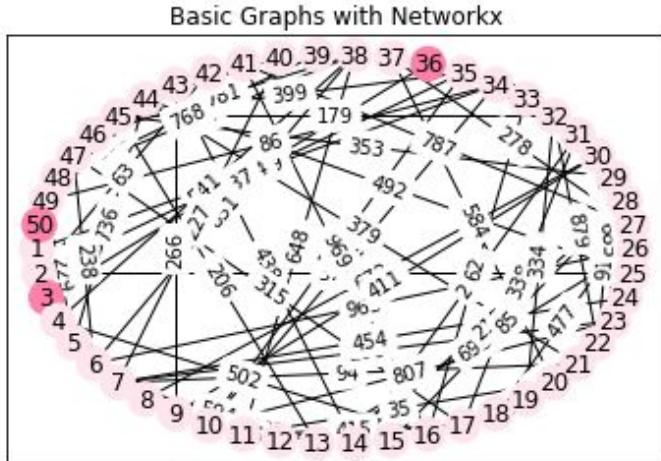
FMeasure= 0.5666666666666667

For t\_50\_4

K = 2

[0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1]

```
1 visualize(N,label)
```



Entropy = 3.333058913601292

FMeasure= 0.39716312056737585

```
W = [[1018.55970593 141.
 [141. 2.03438964]]]
```

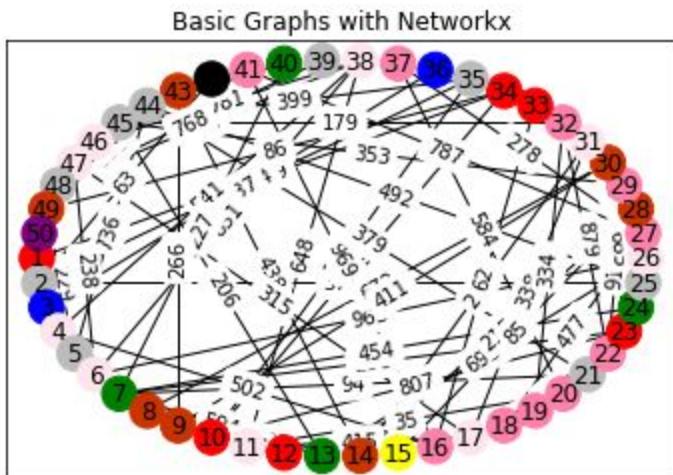
```
WCC = [141. 141.]
```

```
NC = 1.1073747978023443
```

K = 10

```
[4 2 6 0 2 0 5 3 3 4 0 4 5 3 9 1 0 1 1 1 2 1 4 5 2 0 1 3 1 3 0 1 4 4 2 6 1
0 2 5 1 8 3 2 2 0 0 2 3 7]
```

```
1 visualize(N,label)
```



Entropy = 2.2687838086713104

FMeasure= 0.5513492063492064

```

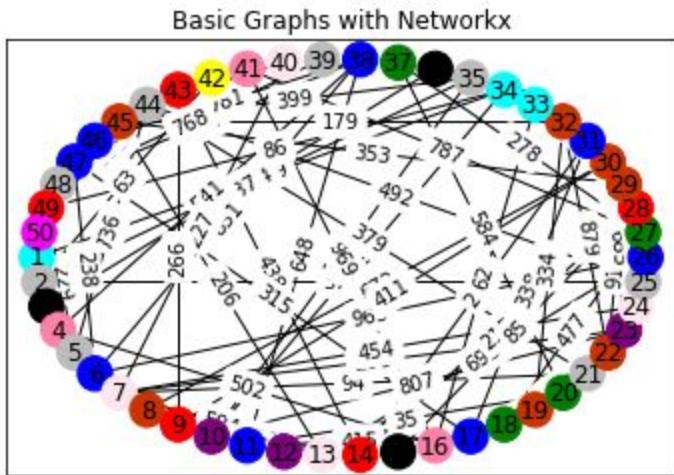
W = [[2.61935040e+01 8.69743017e+01 8.00352910e+01 6.29801987e+01
 5.30395575e+01 3.50009586e+01 1.80000000e+01 9.00000000e+00
 9.00000000e+00 9.00000000e+00]
[8.69743017e+01 3.32075924e+01 8.81962651e+01 6.90015034e+01
 5.95379444e+01 4.00000000e+01 2.00000000e+01 1.00000000e+01
 1.00000000e+01 1.00000000e+01]
[8.00352910e+01 8.81962651e+01 2.72113889e+01 6.16446173e+01
 5.21474803e+01 3.44504756e+01 1.80000000e+01 9.00000000e+00
 8.53259180e+00 9.00000000e+00]
[6.29801987e+01 6.90015034e+01 6.16446173e+01 1.42194997e+01
 4.04242215e+01 2.80000000e+01 1.40000000e+01 7.00000000e+00
 7.00000000e+00 6.42741493e+00]
[5.30395575e+01 5.95379444e+01 5.21474803e+01 4.04242215e+01
 1.01664623e+01 2.30518189e+01 1.20000000e+01 6.00000000e+00
 6.00000000e+00 6.00000000e+00]
[3.50009586e+01 4.00000000e+01 3.44504756e+01 2.80000000e+01
 2.30518189e+01 3.11661762e+00 8.00000000e+00 4.00000000e+00
 4.00000000e+00 4.00000000e+00]
[1.80000000e+01 2.00000000e+01 1.80000000e+01 1.40000000e+01
 1.20000000e+01 8.00000000e+00 3.43896373e-02 2.00000000e+00
 2.00000000e+00 2.00000000e+00]
[9.00000000e+00 1.00000000e+01 9.00000000e+00 7.00000000e+00
 6.00000000e+00 4.00000000e+00 2.00000000e+00 0.00000000e+00
 1.00000000e+00 1.00000000e+00]
[9.00000000e+00 1.00000000e+01 8.53259180e+00 7.00000000e+00
 6.00000000e+00 4.00000000e+00 2.00000000e+00 1.00000000e+00
 0.00000000e+00 1.00000000e+00]
[9.00000000e+00 1.00000000e+01 9.00000000e+00 6.42741493e+00
 6.00000000e+00 4.00000000e+00 2.00000000e+00 1.00000000e+00
 1.00000000e+00 0.00000000e+00]]
WCC = [363.03030753 393.71001469 361.00672115 296.47795591 258.20102271
 180.50325318 96. 49. 48.5325918 48.42741493]
NC = 9.683845339917792

```

K = 12

```
[11 2 8 1 2 6 0 3 4 7 6 7 0 4 8 1 6 5 3 5 2 3 7 0
2 6 5 4 3 3 6 3 11 11 2 8 5 6 2 0 1 9 4 2 3 6 6 2
4 10]
```

```
1 visualize(N,label)
```



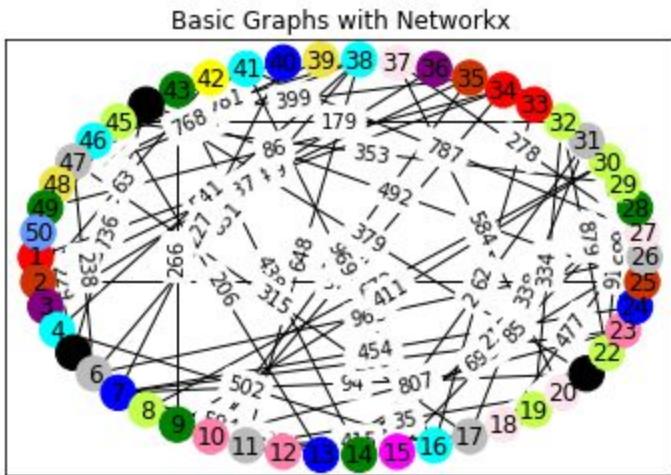
Entropy = 1.8705157487066097

FMeasure= 0.506547619047619

K = 15

```
[4 3 7 11 8 2 6 13 5 1 2 1 6 5 10 11 2 0 13 0 8 13 1 6
3 2 0 5 13 13 2 13 4 4 3 7 0 11 12 6 11 9 5 8 13 11 2 12
5 14]
```

```
1 visualize(N,label)
```



Entropy = 1.652904058281886

FMeasure= 0.5430158730158731

K = 17



Entropy = 1.5227793097483535

FMeasure= 0.592156862745098

K = 20



Entropy = 1.2603910001730787

FMeasure= 0.65

K = 25



Entropy = 0.9403910001730784

FMeasure= 0.693333333333332

For t\_50\_5

K = 2



Entropy = 3.361759277692929

FMeasure= 0.5918367346938775

K = 10



Entropy = 2.1611022489662255

FMeasure= 0.3374603174603174

K = 12



Entropy = 2.0234905585415004

FMeasure= 0.49093915343915345

K = 15

Entropy = 1.8251676193236306

FMeasure= 0.4792592592592593

K = 17

100



Entropy = 1.5667739285527484

FMeasure= 0.5588235294117647

K = 20



Entropy = 1.3456842503028872

FMeasure= 0.5541666666666667

K = 25



Entropy = 1.0203910001730794

FMeasure= 0.6633333333333333

### For t\_50\_6

K = 2

K = 10

K = 12

K = 15

K = 17

K = 20

K = 25

### For t\_50\_7

K = 2



$K = 10$

$K = 12$

$K = 15$

$K = 17$

$K = 20$

$K = 25$

### For t\_50\_8

$K = 2$

$K = 10$

$K = 12$

$K = 15$

$K = 17$

$K = 20$

$K = 25$

### For t\_50\_9

$K = 2$

$K = 10$

$K = 12$

$K = 15$

$K = 17$

$K = 20$

$K = 25$



## For topology sizes 100

### For t\_100\_0

K = 2

```
Label [0 0 0 0 1 0 0 0 0 1 1 0 1 1 1 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 1
0 1 0 1 1 0 0 1 0 1 0 1 1 0 1 0 1 1 0 1 0 1 1 0 0 1 0 1 0 1 1 0 1 1 0 1 1 0
1 1 1 0 0 1 1 0 1 1 0 0 1 1 0 0 1 0 1 1 0 0 0 0 0 1 0]
```

NC = 1.3815064799964212

K = 10

```
Label [4 6 7 3 9 5 4 1 3 0 6 2 9 1 0 9 6 3 7 2 1 8 3 6 6 0 1 5 1 2 0 5 5 0
5 8 4 6 2 3 3 0 5 0 4 0 7 2 1 7 1 9 8 0 5 0 1 3 5 2 4 2 8 2 7 1 8 6 1 7 7
9 1 5 2 2 6 8 1 7 0 2 8 1 8 6 6 7 8 0 5 2 9 6 4 5 7 8 7 4]
```

NC = 9.676087968176748

K = 12



**Label** [ 7 7 8 11 3 10 7 1 11 10 2 9 5 0 10 5 0 11 4 5 0 1 11  
4 4 10 6 8 5 5 7 8 5 8 1 7 0 5 11 11 10 2 3 7 0 6 9 2  
8 0 5 1 5 8 10 0 11 10 8 7 9 6 9 3 5 1 4 2 6 8 9 0 10  
9 9 2 1 2 6 5 9 1 3 2 4 2 8 1 1 8 10 5 4 7 3 6 1 6  
6 ]

NC = 11.698299204940975

K = 15

**Label** [14 14 0 8 11 6 14 10 12 10 2 1 11 9 1 11 9 8 7 3 3 4 8  
2 2 3 13 0 13 5 3 14 6 11 0 4 14 9 5 8 8 6 13 11 1 11 7 5  
13 0 12 11 4 3 13 5 14 8 6 3 5 9 7 1 5 13 4 2 13 3 0 1 12  
6 1 1 9 4 13 7 11 1 10 5 12 2 2 0 10 10 13 6 11 2 5 6 7 4  
7 7 ]



NC = 14.751707204254311

K = 17

Label [13 2 1 10 14 12 13 11 10 2 9 16 16 3 14 2 8 10 13 6 6 0 10  
2 9 6 11 4 11 3 6 4 12 3 1 0 13 8 3 10 10 9 9 7 14 7 5 14  
11 1 15 3 0 7 4 2 2 10 12 6 4 8 5 14 1 11 16 3 9 5 1 14 15  
12 16 16 8 0 11 16 3 14 15 15 15 14 9 1 7 7 9 12 7 2 2 12 5 0  
5 13]

NC = 16.769036835134802

K = 20

Label [16 15 4 18 17 11 16 8 5 8 0 1 17 13 17 14 13 5 7 2 2 9 10  
15 0 2 19 4 19 6 2 10 11 2 17 14 16 13 6 10 18 17 6 2 3 2 7 3



```

19 4 13 6 9 2 11 3 8 10 11 2 3 13 14 3 3 19 9 8 19 7 4 5
12 14 1 1 13 14 12 7 6 6 8 3 12 14 0 4 8 8 0 11 14 15 3 3
7 18 7 16]

```

NC = 19.796401235307272

K = 25

**Label** [13 13 6 9 15 1 17 16 15 16 23 10 21 14 21 21 14 9 7 5 19 11 9
13 8 19 12 6 12 5 0 18 19 21 4 11 17 19 5 4 9 7 18 0 3 7 2 9
2 6 20 5 11 0 18 3 20 4 1 19 3 14 2 15 3 12 11 16 22 2 6 15 20
1 24 10 14 11 22 24 21 10 16 3 22 7 23 6 0 16 23 1 5 13 3 1 2 11
2 17]

NC = 24.85080180273203

## For t\_100\_1

K = 2

**Label** [0 1 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 0 1 1 1 1 0 1 1 1 1 1 0
0 1 1 1 1 1 1 0 0 1 0 0 1 0 1 1 1 0 0 1 1 1 1 1 0 0 1 1 1 0 1 1 1 1 1 1 1 0
1 0 1 1 1 0 1 1 1 1 1 1 0 1 0 0 0 0 1 0 0 1 1 1 1 0 1 1 1 0 1 1 0]

NC = 1.321803762664576

K = 10

**Label** [9 0 7 3 3 4 9 6 9 7 6 1 6 4 5 3 2 1 0 4 8 8 0 9 4 1 2 2 8 5 3 4 6 8
6 4 1 1 4 1 3 4 6 5 7 6 9 2 4 8 8 1 4 1 2 9 9 0 0 9 0 8 8 0 0 1 2 2 9 1 9
2 5 4 2 4 6 8 1 2 9 3 0 0 5 2 6 9 9 6 2 6 9 4 1 3 3 6 3 6]



**NC = 9.630684355024618**

$$K = 12$$

```

Label [5 2 7 10 10 3 5 11 9 7 1 2 8 3 6 10 0 4 2 3 0 0 2
9 3 4 2 8 4 6 10 9 8 0 11 3 4 4 9 11 10 3 11 6 7 11 6 1
3 7 0 9 1 4 2 5 5 5 9 5 2 0 4 1 2 4 2 2 0 4 5 1 6 7 11 6 1
3 0 9 1 0 4 1 5 10 2 2 6 4 1 5 6 8 9 8 5 3 4 10 10 5
9 11]

```



NC = 11.666001635703829

K = 15

Label [ 10 4 13 7 8 4 4 5 6 13 7 12 5 11 14 8 1 3 4 11 9 9 4  
6 0 3 7 12 3 0 8 2 7 9 5 11 3 3 2 3 8 11 5 0 13 5 9 1  
0 13 9 3 1 3 12 6 6 4 2 10 4 9 3 1 4 3 2 12 6 3 10 1 14  
11 1 2 10 9 12 1 3 8 4 1 14 12 1 10 9 7 2 7 10 11 12 8 8 7  
2 5 ]



NC = 14.705601437449515

K = 17

Label [10 8 12 2 2 9 1 5 16 12 7 6 5 9 14 2 11 13 4 9 11 11 8  
16 9 1 3 0 6 14 2 16 7 11 5 9 13 13 16 2 15 9 5 14 12 5 4 3  
9 12 6 13 3 13 0 7 15 1 16 10 8 6 6 10 8 13 0 0 11 6 10 3 14  
9 11 16 10 6 13 3 1 2 8 3 14 0 3 10 4 7 16 0 1 3 0 15 4 7  
2 5]

NC = 16.74449523213059

K = 20

Label [13 1 0 15 7 6 11 16 14 0 3 15 3 14 17 15 10 8 1 6 19 4 1  
5 9 11 3 12 4 9 7 14 3 19 16 6 18 10 18 15 7 6 16 9 0 16 7 2



```
9 4 4 18 2 8 12 5 5 1 18 13 1 4 4 2 1 11 12 12 10 8 13 10 17
6 10 14 13 4 8 2 11 7 1 2 17 12 2 13 13 3 12 3 11 2 12 19 7 3
15 16]
```

NC = 19.764135997835677

K = 25

**Label** [ 9 2 12 13 17 3 11 21 6 12 18 20 5 6 15 17 19 10 2 3 10 1 2
16 14 22 0 20 4 14 17 6 5 1 21 8 16 22 16 10 7 3 11 14 12 21 7 0
4 4 10 16 0 22 24 18 18 11 16 8 2 4 4 9 23 22 24 24 19 10 8 19 15
3 19 6 9 4 20 0 11 7 23 24 15 20 0 8 7 5 13 5 11 13 20 7 7 13
13 21]

NC = 24.8137011294512

## For t\_100\_2

K = 2

**Label** [0 0 1 1 0 1 1 1 0 0 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 0 1 1
0 0 0 1 0 1 1 1 1 1 0 1 1 0 1 1 1 1 0 1 1 0 0 1 1 1 1 0 1 0 0 1 1
0 0 1 1 1 1 1 0 0 0 0 1 1 1 0 0 1 0 1 1 1 1 1 1 0 1 1]

NC = 1.3378670591203354

K = 10

**Label** [4 6 3 2 4 4 3 1 7 3 3 0 7 1 9 3 7 4 0 8 8 1 1 5 7 2 7 3 2 5 1 0 1 1
9 3 1 4 3 5 8 8 4 0 3 6 5 4 3 9 5 1 1 0 7 6 7 4 4 9 9 0 7 4 2 4 7 2 2 6 5
9 9 8 1 8 7 8 5 6 6 8 5 2 7 7 8 6 5 4 9 0 8 0 2 2 6 9 4 4]



NC = 9.663239456695361

K = 12

Label [ 7 5 4 0 2 7 4 6 1 4 4 5 1 3 5 4 1 3 9 2 10 0 8 4 7  
5 1 6 1 4 0 9 3 9 3 8 6 4 3 0 10 8 10 10 7 11 4 8 4 7  
4 6 8 3 11 9 1 8 5 2 7 5 6 11 1 7 0 2 11 6 6 0 4 5 5  
10 3 10 1 8 8 2 2 10 9 0 1 1 10 8 6 8 5 9 10 11 0 0 8 2  
9 9 ]

NC = 11.70260599220135

K = 15



**Label** [ 9 2 7 3 2 9 6 1 3 12 6 3 0 10 3 7 6 12 5 9 11 10 10  
 7 3 6 4 5 8 1 10 6 12 3 14 7 1 8 5 1 11 3 10 5 5 4 12 2  
 7 14 4 10 10 5 6 4 3 9 9 13 13 6 3 10 2 2 9 13 13 0 7 7 3  
 11 10 11 3 4 7 0 2 11 12 8 6 9 11 4 5 4 14 6 11 6 8 8 4 14  
 0 1 ]

NC = 14.73796748152235

K = 17

**Label** [ 8 13 12 3 0 8 1 5 9 0 16 9 15 4 9 12 1 0 11 6 0 5 5  
 1 3 15 5 15 7 2 4 16 16 4 6 13 2 7 11 2 14 3 16 11 1 13 12 11  
 1 6 14 5 4 11 15 13 9 8 8 9 10 11 3 5 7 0 4 10 10 7 12 4 9  
 14 16 14 4 14 12 1 13 14 2 7 15 1 3 13 12 11 6 15 10 15 7 7 14 6  
 15 2 ]

NC = 16.767389200118018

K = 20

**Label** [ 9 12 7 15 12 9 7 4 15 7 4 2 9 16 10 14 13 1 0 1 1 5 5  
 8 19 0 14 0 8 18 3 0 16 19 10 7 18 9 3 4 1 15 9 4 3 12 17 9  
 13 10 17 5 16 3 0 18 11 9 9 2 3 11 15 5 8 12 19 2 3 8 17 16 2  
 6 1 6 19 6 17 13 12 6 18 8 13 13 1 12 17 4 10 0 6 16 8 8 14 10  
 0 4 ]

NC = 19.784660974460053

K = 25

**Label** [ 17 4 16 5 12 2 4 9 5 16 23 19 2 22 19 16 3 17 24 19 6 9 9  
 10 14 23 9 24 10 7 1 13 13 14 19 4 7 2 1 11 6 5 13 22 1 4 11 2  
 4 17 15 9 22 8 0 7 14 21 3 8 20 8 5 9 23 12 22 20 20 10 11 22 0  
 18 8 21 14 15 11 18 12 21 7 6 3 4 6 15 11 3 0 24 18 8 10 10 15 17  
 24 13 ]

NC = 24.842282601035574

**For t\_100\_3**

K = 2

**Label** [ 1 1 0 0 0 1 0 0 0 1 0 1 0 1 0 1 0 0 1 0 1 0 1 0 1 0 1 0 1 1 0 0  
 1 1 1 0 1 1 1 0 1 0 1 1 0 0 1 0 1 0 0 0 0 0 1 0 0 0 1 1 1 1 1 1 0 1  
 0 0 0 0 0 1 1 0 0 0 1 1 0 0 1 0 1 0 1 1 0 0 0 0 0 1 1 1 0 ]



NC = 1.3814432016107765

K = 10

Label [1 1 5 1 2 7 9 9 8 6 2 0 4 8 5 0 2 4 2 9 1 4 3 4 7 8 6 2 7 2 3 1 5 9  
6 0 3 5 2 8 6 4 6 1 8 5 3 2 9 8 7 8 7 9 8 0 4 5 4 8 4 4 6 1 7 6 3 7 8 2 5  
5 1 2 6 8 7 3 5 9 5 3 7 9 2 6 0 6 9 0 7 2 5 8 1 5 0 0 0 2]

NC = 9.67061954941789

K = 12

Label [11 11 6 10 11 1 2 2 3 3 5 4 0 9 6 7 0 8 5 2 10 8 1  
0 1 9 4 7 4 5 1 11 6 2 7 4 1 6 5 9 7 0 7 11 3 9 11 5  
5 8 5 9 3 2 8 2 0 6 0 3 8 0 7 10 4 7 1 4 8 0 6 6 10  
5 7 3 4 1 6 2 6 1 3 2 11 3 8 3 2 7 4 5 6 9 10 6 11 2  
4 11]



NC = 11.694286985144977

K = 15

Label [ 2 0 13 5 5 1 7 12 1 9 8 4 6 0 0 4 6 12 9 7 11 12 2  
6 8 11 7 3 8 5 2 3 10 7 9 4 2 10 5 14 9 6 9 3 1 0 3 8  
3 12 1 11 1 8 12 7 6 10 0 1 6 6 14 11 7 9 2 7 11 2 1 12 5  
5 14 11 1 2 13 7 13 2 9 3 3 7 4 8 0 4 7 5 13 14 11 10 0 4  
0 13 ]

NC = 14.735918385328437

K = 17

Label [ 4 13 2 9 11 7 7 6 8 12 3 2 1 13 13 2 5 0 12 6 8 0 16  
1 3 8 7 14 3 3 16 4 10 6 12 7 16 10 3 15 12 1 9 13 5 15 14 3  
14 0 5 8 5 14 0 6 5 10 5 8 1 1 9 8 7 12 16 7 8 4 5 4 6  
3 9 8 8 16 11 14 15 16 12 14 14 10 2 3 15 2 0 5 11 9 8 5 13 6  
13 11 ]

NC = 16.772516491135068



$$K = 20$$

```

Label [3 7 14 10 4 5 11 16 1 6 4 8 2 7 7 8 17 16 4 13 10 16 9
2 12 13 11 15 5 4 9 3 18 13 2 8 9 18 4 19 2 2 10 3 1 2 3 12
3 0 11 19 6 12 0 13 11 18 17 6 0 11 10 10 13 2 9 5 0 15 19 15 10
4 14 1 5 9 1 12 14 5 17 12 3 13 8 12 19 14 5 15 14 19 0 15 7 8
7 14]]

```

NC = 19.80160079364541

$$K = 25$$

```

Label [14 23 16 17 15 10 19 18 22 24 21 1 13 8 8 1 6 18 24 4 3 18 7
11 22 4 19 2 21 0 2 14 13 4 2 10 7 13 0 8 24 11 5 14 0 16 14 9
21 18 0 11 12 21 18 4 6 13 6 12 11 7 5 17 12 2 7 19 3 20 12 20 17
21 5 22 19 7 15 22 16 7 12 9 9 4 1 9 4 15 19 20 16 5 3 20 23 1
23 15]

```

NC = 24.846051682906626

For t\_100\_4

K = 2

NC = 1.1175160130697193

$$K = 10$$



NC = 9.188960489652779

$$K = 12$$

```

Label [0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 4
0 0 0 0 0 0 0 9 0
0 1 0 0 2 0 8 0 11 0 0 5 0 0 0 0 0 6 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 3 0 0 0 10 0 0 0 0 0 1 0 0 0 0 0 0 7 1 0 0 0 0 0 0 0 0 0
0 1]

```



NC = 11.312485497221973

K = 15

| Label | 9  | 2  | 7  | 3  | 2 | 9 | 6  | 1  | 3  | 12 | 6  | 3  | 0  | 10 | 3  | 7 | 6  | 12 | 5  | 9  | 11 | 10 | 10 |    |
|-------|----|----|----|----|---|---|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|
| 7     | 3  | 6  | 4  | 5  | 8 | 1 | 10 | 6  | 12 | 3  | 14 | 7  | 1  | 8  | 5  | 1 | 11 | 3  | 10 | 5  | 5  | 4  | 12 | 2  |
| 7     | 14 | 4  | 10 | 10 | 5 | 6 | 4  | 3  | 9  | 9  | 13 | 13 | 6  | 3  | 10 | 2 | 2  | 9  | 13 | 13 | 0  | 7  | 7  | 3  |
| 11    | 10 | 11 | 3  | 4  | 7 | 0 | 2  | 11 | 12 | 8  | 6  | 9  | 11 | 4  | 5  | 4 | 14 | 6  | 11 | 6  | 8  | 8  | 4  | 14 |
| 0     | 1  |    |    |    |   |   |    |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |

NC = 14.73796748152235

K = 17

| Label | 6  | 10 | 14 | 0  | 2  | 10 | 0 | 2 | 2  | 14 | 10 | 0  | 5  | 0  | 14 | 6  | 11 | 5  | 3 | 5  | 0 | 5  | 1 |    |
|-------|----|----|----|----|----|----|---|---|----|----|----|----|----|----|----|----|----|----|---|----|---|----|---|----|
| 14    | 10 | 9  | 14 | 10 | 0  | 9  | 1 | 0 | 14 | 5  | 5  | 14 | 10 | 5  | 14 | 0  | 5  | 9  | 9 | 2  | 9 | 14 | 5 | 10 |
| 14    | 2  | 3  | 9  | 7  | 9  | 15 | 4 | 8 | 5  | 5  | 12 | 5  | 0  | 0  | 4  | 13 | 4  | 10 | 7 | 11 | 6 | 10 | 5 | 5  |
| 0     | 0  | 5  | 2  | 4  | 14 | 6  | 1 | 9 | 5  | 0  | 16 | 14 | 14 | 14 | 0  | 11 | 0  | 0  | 0 | 14 | 1 | 2  | 6 | 9  |
| 6     | 11 |    |    |    |    |    |   |   |    |    |    |    |    |    |    |    |    |    |   |    |   |    |   |    |

NC = 16.642719654072017



K = 20

**Label** [18 5 9 0 2 5 0 18 2 9 5 16 12 0 1 0 15 1 1 12 0 12 4  
1 9 18 9 5 16 19 13 0 1 1 12 9 5 12 9 18 12 3 19 2 3 1 12 5  
9 8 4 3 6 19 4 7 17 1 12 11 12 0 18 7 10 7 9 6 15 9 0 1 1  
16 0 1 2 7 1 0 14 19 12 16 4 1 9 9 18 8 0 0 0 9 4 2 9 19  
18 8]

NC = 19.698157306694537

K = 25

**Label** [17 8 6 0 17 8 2 17 15 6 8 12 4 1 1 0 13 1 1 4 2 5 20  
1 3 17 6 8 12 10 4 2 0 1 5 6 3 5 6 18 5 9 10 11 9 3 4 8  
1 15 4 9 19 10 4 0 16 1 5 24 5 0 18 14 22 14 3 19 13 3 3 1 1  
12 18 1 11 14 1 0 21 10 5 12 7 1 1 6 18 15 2 2 2 1 23 11 3 10  
17 15]

NC = 24.74143356048346