HodgeRank

Testing and exploring the HodgeRank method. Initial code source from ctralie.

```
In [1]:    from Hodge import *
```

```
In [2]:    import networkx as nx
```

Load file of preferences

```
In [3]:    def test_HodgeRank(x):
               '''
               x: string representing the filename of
               '''
               R = np.loadtxt("example/" + x + ".txt")
               Z = R.copy()
               [R, Y] = [R[:, 0:2], R[:, 2]]
               print(Y)
               W = np.ones(len(Y))
               (s, I, H) = doHodge(R, W, Y)
               print("scores are: " + str(s))
               print("I vector is:" + str(I))
               print("H vector is:" + str(H))
               getConsistencyRatios(Y, I, H, W, verbose=True)
               # When drawing the graph, you cannot use negative weights so I need to swop i and j
               # when the weight happens to be negative. This is connected to a broader problem
               # in the HodgeRank algorithm which requires the i j to all be in the same order.
               print(Z)
               if len(Z[Z<0])>0:
                   Z[Z[:,2]<0] = Z[Z[:,2]<0,[1, 0, 2]]
                   Z[Z<0] = Z[Z<0]*-1
               G = nx.from_edgelist(Z.astype(int).tolist(), create_using=nx.MultiDiGraph)
               plt.figure(figsize=(3, 3))
               nx.draw(G, with_labels=True, pos=nx.spring_layout(G), node_size=600)
```

Test HodgeRank

The algorithm requires that the nodes always be ordered with the lower number first.

```
In [4]:    test_HodgeRank("ex1")
```

```
[1. 1. 1.]
The exact solution is  x = 0
scores are: [-1.5 -0.5  0.5  1.5]
I vector is:[0. 0. 0.]
H vector is:[-4.4408921e-16  0.0000000e+00 -4.4408921e-16]
|D0s/Y| = 1
Local Inconsistency = 0
Global Inconsistency = 1.31477e-31
a + b + c = 1
[[0. 1. 1.]
 [1. 2. 1.]
 [2. 3. 1.]]
```
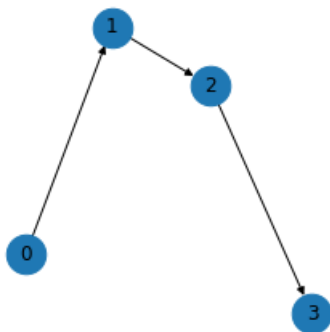

Note that there is a problem in the code of subtracting close to one or zero. The global inconsistency should be zero.

```
In [5]:    test_HodgeRank("ex2")
```

```
[ 1.   1.   1.  -1.]
scores are: [-0.75  0.25  0.25  0.25]
I vector is:[ 0.   1.   1.  -1.]
H vector is:[0.00000000e+00 1.11022302e-16 1.11022302e-16 0.00000000e+00]
|D0s/Y| = 0.25
Local Inconsistency = 0.75
Global Inconsistency = 6.16298e-33
a + b + c = 1
[[ 0.   1.   1.]
 [ 1.   2.   1.]
 [ 2.   3.   1.]
 [ 1.   3.  -1.]]
```
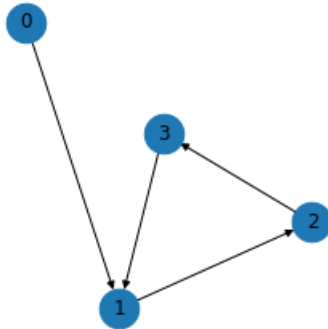
```
test_HodgeRank("ex3")
```

```
[ 1.   1.   1.  -1.]
The exact solution is  x = 0
The exact solution is  x = 0
scores are: [0. 0. 0. 0.]
I vector is:[0. 0. 0. 0.]
H vector is:[ 1.   1.   1.  -1.]
|D0s/Y| = 0
Local Inconsistency = 0
Global Inconsistency = 1
a + b + c = 1
[[ 0.   1.   1.]
 [ 1.   2.   1.]
 [ 2.   3.   1.]
 [ 0.   3.  -1.]]
```
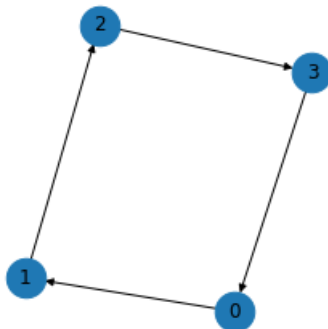
```
test_HodgeRank("ex4")
```

```
[1. 1. 1.]
scores are: [-0.66666667  0.          0.66666667]
I vector is:[ 0.33333333  0.33333333 -0.33333333]
H vector is:[-1.66533454e-16 -1.66533454e-16 -5.55111512e-17]
|D0s/Y| = 0.888889
Local Inconsistency = 0.111111
Global Inconsistency = 1.95161e-32
a + b + c = 1
[[0. 1. 1.]
 [1. 2. 1.]
 [0. 2. 1.]]
```