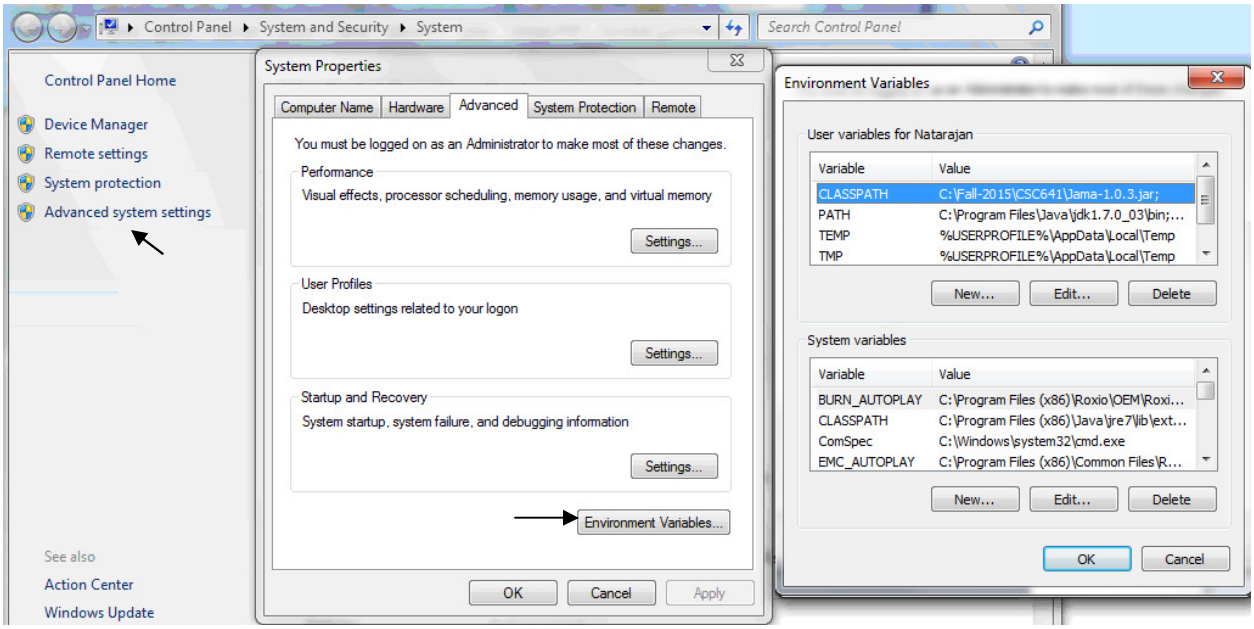
CSC 641 Network Science
Spring 2016
Dr. Natarajan Meghanathan

Assignment 1
Use of Eigenvalues and Eigenvectors for Complex Network Analysis

Due: February 23, 2016, 4 PM (hard deadline; no postponement) **Max. Points:** 100

1) Make sure Java is installed in your computer and the PATH variable is set for the JDK bin folder as shown in the screenshot below.

2) Download the Jama-1.0.3.jar file from http://math.nist.gov/javanumerics/jama/#Package and set the CLASSPATH variable for the User in Environment Variables under the Advanced Tab in Advanced System Settings as shown below.



3) Compile the EVC_AdjList.java program using the javac command in DOS prompt.

javac EVC_AdjList.java

4) Run the EVC_AdjList class as follows where graph.txt is the name of the adjacency list file assigned to you, 10 is the number of nodes and true as the argument to indicate the node IDs start with zero

java EVC_AdjList graph.txt 10 true

Q1 (45 points) Run the Eigenvector Java program to find the following for the graph-adjacency list assigned to you. Show the screenshots of your outputs and clearly show all the steps of your computation of the metrics determined. Each graph has 10 vertices with IDs from 0 to 9.

(1) Bipartivity index. Also show the two partitions with the edges crossing the two partitions as well as the frustrated edges
(2) Estrada index for protein folding of the graph as well as the Folding Effectiveness (in comparison to a chain of nodes 0 - 1 - 2 - ... - 9).

Andrew
0 3
0 4
0 5
0 8
0 9
1 4
1 8
2 4
2 6
2 7
3 5
3 8
3 9
4 7
4 9
5 9
8 9

Phillip
0 9
1 3
1 6
2 4
2 7
2 8
2 9
4 8
4 9
5 6
6 7
8 9

Keerthi
0 6
0 9
1 2
1 3
1 4
1 5
1 8
1 9
2 4
2 9
3 4
3 8
4 7
4 9
5 9
7 8

Mesafint
0 1
0 3
0 4
0 7
0 9
1 3
1 7
2 8
2 9
4 6
4 9
5 6
5 9
6 7
7 9

Deepak
0 2
0 3
0 4
0 9
1 2
1 6
1 8
1 9
2 3
2 5
2 7
2 8
2 9
3 6
4 9
5 8
6 8

Kranthi
0 4
0 9
1 4
1 5
2 4
2 6
3 6
4 5
4 8
5 8
5 9
6 7
6 9
7 8

Victoria
0 1
0 2
0 7
2 4
2 6
2 7
2 8
3 4
3 7
4 5
4 6
5 8
5 9
7 8
8 9

Nanda
0 5
0 8
1 9
2 3
2 4
2 8
2 9
3 6
3 8
3 9
4 6
4 7
4 9
6 9

Damon
0 1
0 6
0 9
1 3
1 4
1 6
1 7
1 8
2 4
2 8
3 4
3 7
3 8
4 6
4 7
4 8
4 9
5 7
5 8
5 9

Jerry
0 4
0 8
0 9
1 3
2 5
2 8
2 9
3 5
3 6
3 7
4 7
4 9
5 8
6 8
6 9

Harish
0 4
0 5
1 7
2 3
2 4
3 6
4 7
4 8
5 6
8 9

Q2 (55 points) Run the Eigenvector JAMA program to determine a partitioning of the graph (assigned to you) to two or more communities such that the overall modularity score is the maximum. Show the hierarchical partitioning of the network into communities as well as the computation of the modularity scores for each community. Also, show the values (along with the signs) of the eigenvectors used to decide the partitioning at each level. Each graph has 10 vertices with IDs from 0 to 9.

You need to show the computation of the modularity score for each pair of vertices in the communities detected. You could reuse the modularity score computed for a pair.

Note: There is no need to draw the graph as part of your solution. You can just list the vertices that are part of each community at every level.

Andrew	Phillip	Keerthi	Mesafint	Deepak	Kranthi	Victoria	Nanda
0 1	0 2	0 3	0 1	0 2	0 2	0 2	0 1
0 2	0 3	0 4	0 3	0 3	0 3	0 5	0 2
0 4	0 4	0 6	0 5	0 4	0 5	0 7	0 3
1 4	0 7	0 7	0 6	0 7	0 7	0 9	0 4
1 5	0 9	0 9	0 8	0 8	0 8	1 2	0 5
1 6	1 2	1 3	1 2	1 5	0 9	1 3	0 7
1 7	1 3	1 4	1 4	1 7	1 2	1 5	0 8
1 9	1 6	1 6	1 5	1 8	1 3	1 6	1 4
2 3	1 7	1 8	1 7	2 5	1 4	1 8	1 5
2 5	1 8	2 6	1 9	2 6	1 6	1 9	1 6
2 6	2 5	2 7	2 4	2 7	1 8	2 3	1 7
2 9	2 6	2 8	2 7	2 8	1 9	2 4	1 8
3 4	2 9	2 9	3 4	2 9	2 5	2 7	2 6
3 5	3 9	3 4	3 5	3 4	2 6	3 6	2 7
3 8	4 5	3 8	3 6	3 6	2 7	3 7	2 8
4 5	4 7	4 5	3 7	3 9	2 9	3 8	3 6
4 6	4 8	4 6	4 7	4 5	3 5	3 9	3 9
4 8	4 9	4 7	4 8	4 7	3 6	5 6	4 6
4 9	5 8	4 9	4 9	4 9	3 9	5 7	5 6
5 7	6 9	5 6	6 7	5 6	4 9	6 8	5 7
6 7	7 8	5 7	6 9	5 7	5 6	6 9	5 8
6 9	7 9	5 8	7 8	5 8	5 7	8 9	5 9
8 9		5 9	7 9	6 8	5 9		6 7
		8 9	8 9		6 7		6 9
					7 9		7 8
					8 9		

Damon
0 2
0 4
0 5
0 7
1 2
1 4
1 7
2 4
2 8
2 9
3 4
3 5
3 6
3 8
4 5
4 6
5 6
5 7
5 8
6 7
7 9

Jerry
0 1
0 2
0 4
0 5
0 8
0 9
1 2
1 3
1 8
1 9
2 5
2 8
3 4
3 6
3 8
4 5
4 6
4 9
5 7
5 8
6 7
6 8
6 9
7 9
8 9

Harish
0 5
0 6
0 7
0 8
0 9
1 2
1 3
1 5
1 8
1 9
2 4
2 6
2 8
3 5
3 6
3 7
3 8
3 9
4 6
4 9
5 8
6 7
6 9
7 8
8 9