

**CSC 641 Network Science, Fall 2018**

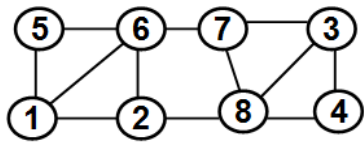
**Exam 4 (Take Home: Due: Nov. 6th, 2018: 7.30 PM)**

**Total: 100 pts**

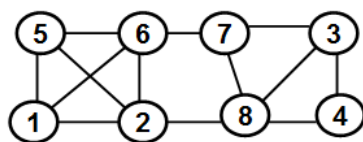
Print this Exam, Insert your answer sheets in between the questions and submit the final exam with all papers stapled.

1) (20 pts) Given a graph below, run the complete linkage clustering algorithm to determine a modular partitioning of the graph into communities.

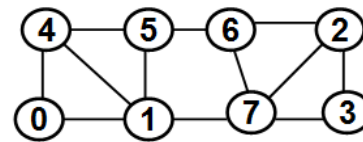
- (a) Show the entire hierarchy
- (b) Run the pairwise modularity program to compute the modularity of each of your clusters and prune the branches of the hierarchy and determine the modularity score of the final partition.
- (c) Determine the internal and external densities of each of the communities of the final partition.



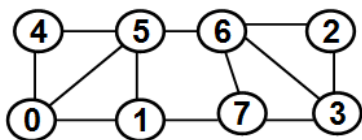
Dave, Hitanshu



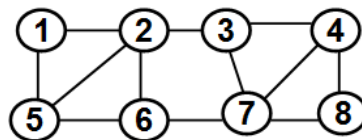
Davis, Carolyn



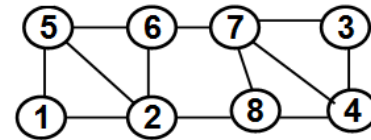
Evans, Rashad



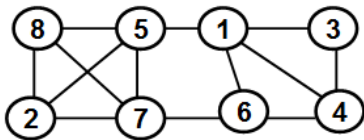
Fiesha, Temesgen



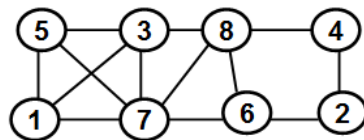
Ramos, Ciji



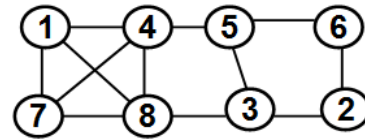
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Tutika, Raj



Whitfield, Nicholas

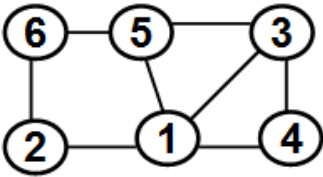


Faris, Amanuel

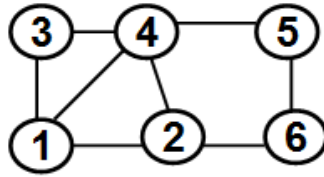
Student Name: \_\_\_\_\_

J#: \_\_\_\_\_

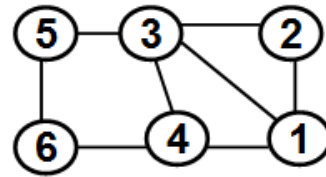
2) (25 pts) Run the BFS algorithm to determine the **betweenness of the edges** in the graphs assigned to you. Show in detail all the work [Note: You should NOT use the software to compute the edge betweenness]



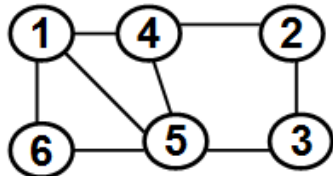
Dave, Hitanshu



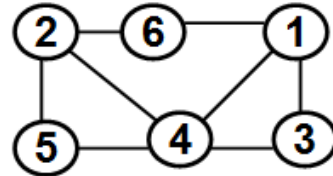
Davis, Carolyn



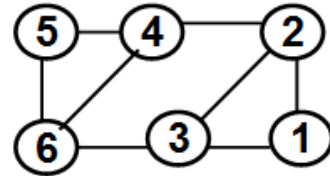
Evans, Rashad



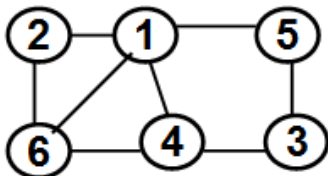
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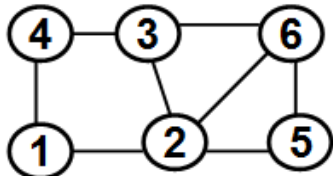
Ramos, Ciji



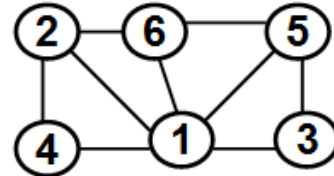
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Tutika, Raj



Whitfield, Nicholas



Faris, Amanuel

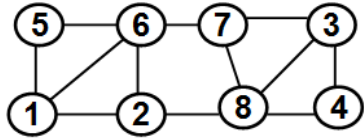
Student Name: \_\_\_\_\_

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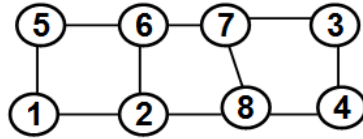
3) (25 pts) Run the Girvan Newman community detection algorithm based on (a) Edge betweenness and (b) Neighborhood Overlap: NOVER scores to determine a partitioning of the graph into communities.

For each of (a) and (b):

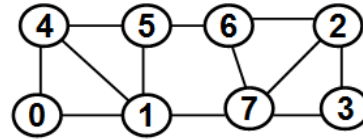
Determine the modularity score for each of the communities and the total modularity score. Also, draw the partitioning hierarchy and indicate the modularity score of the partitions/communities.



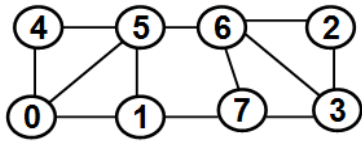
Dave, Hitanshu



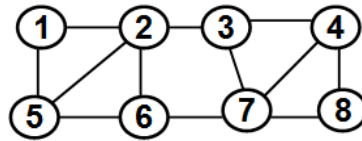
Davis, Carolyn



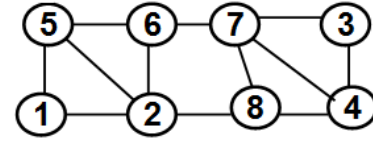
Evans, Rashad



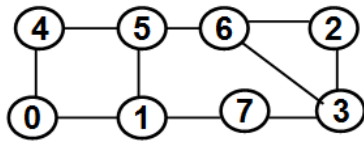
Fiesha, Temesgen



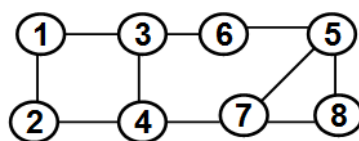
Ramos, Ciji



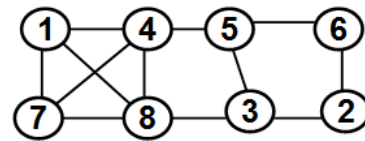
Sarker, Md Imran



Tutika, Raj

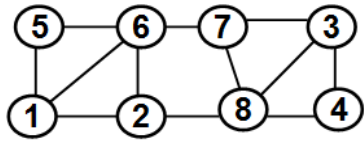


Whitfield, Nicholas

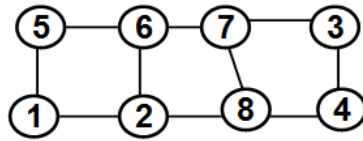


Faris, Amanuel

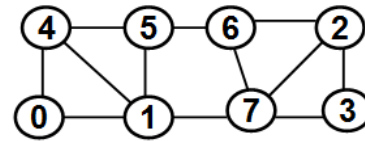
- 4) (20 pts) (a) Determine the threshold NOVER score (minimum NOVER score) that would guarantee the satisfaction of the **strong triadic closure** property for the edges in the following graph.
- (b) Using the threshold NOVER score determined, identify the strong and weak ties.
- (c) Determine a partitioning of the graph into communities based on the strong/weak ties identified.
- (d) Determine the modularity score for each of the communities and the total modularity score. Also, draw the partitioning hierarchy and indicate the modularity score of the partitions/communities.



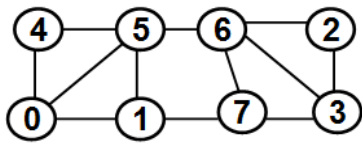
Dave, Hitanshu



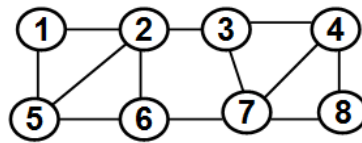
Davis, Carolyn



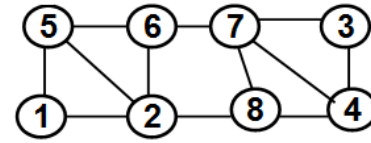
Evans, Rashad



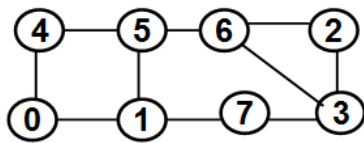
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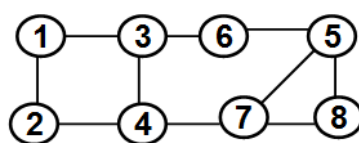
Ramos, Ciji



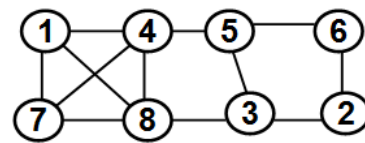
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Tutika, Raj



Whitfield, Nicholas



Faris, Amanuel

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J#: \_\_\_\_\_

5) (10 pts) Consider the graph shown below. If nodes 1, 2, 3 are of type A; nodes 4, 5, 6, 7 are of type B and nodes 8, 9 are of type C, determine whether or not the following types of nodes exist together as one community or separate communities: (i) A and B, (ii) A and C, (iii) B and C. Show all the work.

