Problem Set #6: Abstract Equivalence

Adapted from original by Peter V. Marsden, Harvard University

This problem set gives you a brief overview of the portions UCINET that are useful for undertaking analyses focused on “role equivalence.” Many of the tools have been used previously, so I will not go into depth. These methods are somewhat arcane. We will try these routines on the Helping relation in the Wiring data (you will need to extract it from the Wiring dataset before using it). The Helping relation shows which members of the Bank Wiring Room got help and from whom and which members gave help and to whom. The data is dichotomous and directed, so it will produce non-trivial findings using all the major equivalence routines. You might want to think about the “helping” roles that one could conceptualize. For instance, some members of the room might be “loafers” who always ask for and get help; others might be “master craftsman” who share their expertise broadly. Still others might be “isolates” who neither give nor receive help.

Automorphic Equivalence

We’ll start with the MaxSim routine found in the Network/Roles & Positions/Automorphic menu. Other routines incorporated in UCINET (such as the “all permutations” approach in the Automorphic submenu) can be too computationally intensive, depending on your hardware. For instance, I tried to partition a network of 15 nodes using all permutations. After 20 billion permutations and about six hours of run time, the software gave up.

The basic idea of MaxSim is that two automorphically equivalent actors should have identical types of relationships in their immediate neighborhoods. The distributions of valued relationships touching them should be identical. For binary data, MaxSim treats the reciprocal of geodesic distance as the valued relationship; so the idea is basically that two actors who are automorphically equivalent have the same distributions of geodesic distances touching them. (The fact that some of the geodesics may be infinite should not concern us greatly, since those will be near zero after reciprocals are taken, even when N is substituted for infinity.)

MaxSim generates a dissimilarity matrix which can be cluster-analyzed. A partition of actors into classes is selected based on the clustering; this is superimposed onto the original data and can subsequently be dichotomized into image matrices using the same routines used in the case of structural equivalence-based positional analysis. I recommend that you use low density values in creating image matrices from density matrices here, possibly as low as 0. In analyses that deal
with abstract equivalence, there is no reason to expect that “1-blocks” should be fully dense, even when a dataset satisfies the equivalence criterion exactly.

Submit the Helping relation of the Wiring dataset to the MaxSim routine. Use the complete link clustering routine to find a partition and then create an image matrix. Include a graph from NetDraw of your final image.

Regular Equivalence

This is the most abstract concept of equivalence implemented in UCINET. Measures of it can be obtained within the Networks/Roles & Positions/Maximal Regular menu. The REGE and CATREGE options are available. CATREGE is an implementation for categorical data; it works best if the data is re-coded to show difference in relations. However, we will use REGE, since the dataset does not include further categorization of the relations. Try these measures on the Helping relation of the Wiring data only after carefully reading the segments of Wasserman and Faust that deal with regular equivalence.

Each of these generates a similarity matrix which can be clustered. As before, partitions based on this measure of equivalence are used to convert the data into a density matrix, and subsequently dichotomized into an image matrix using the same routines used in the case of structural equivalence-based positional analysis. As before, I recommend that you use low density values in creating image matrices from density matrices, possibly as low as 0, since even exact regular equivalence does not imply fully dense submatrices within a density matrix that links elements of regularly equivalent subsets.

Submit the Helping relation to the REGE routine. Use the complete link clustering routine to find a partition and then create an image matrix. Include a graph from NetDraw of your final image.

Now choose a structural equivalence routine and run a blockmodel analysis for the Helping relation of the Wiring dataset. Create an image matrix and include a NetDraw diagram of your findings.

Now think creatively about the types of “positions” one might expect in a helping relation. Using the output from all three equivalence analyses, induce a set of positions in a “general” helping relationship (i.e., characterize the positions that the analytic routines identified by naming them and describing their structural importance). Would your characterization have been different if you had only run the structural equivalence routine? In other words, does automorphic or regular equivalence lead to a different induction of positions? Which equivalence model is most appropriate, theoretically speaking, for this exercise? Which did you find to be easiest to understand intuitively from the image matrices?