Triads and Transitivity in Group Exam Networks

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Abstract

Class design's influence on group formation on physics group exams, as well as the effect of student status on network meaures, has been studied before in the PER community. These studies have relied on individual and network wide measures like centrality and network density. In this project, we have been examining group formation from a perspective focused on two and three students; or dyads and triads. In these triads, two strong friendships have a tendency to form a third, closing the triad. This phenomenon is called transitivity, and its ability to create friendship from friendships is a key componnent to the theory of group formation. We believe that studying triads in our group exam networks can reveal a great deal about student collaboration as well as how scientific communities form in our physics classrooms.

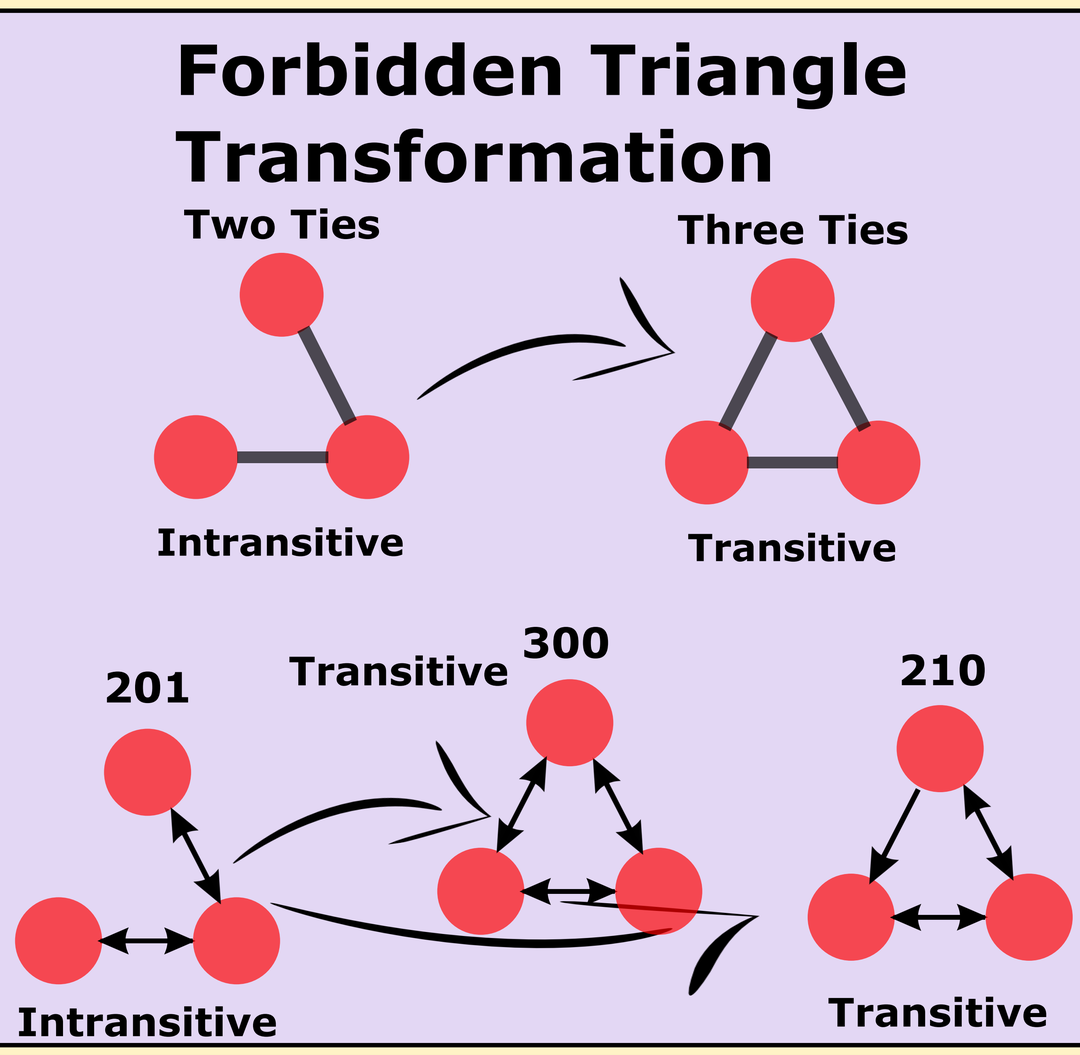
Triads

- Triads are the interactions of three people.
- As such, there are only three undirected triads. One, two, and three ties.
- Directed triads are classified by four numbers and a letter; indicating the number mutual, asymmetric, and null ties and the overall direction of the ties (Up, Down, Cyclic, Transitive).
- The triad census lists number of each triad by classification.
- Understanding meaning of each triad gives an idea of what interactions are common in the network.

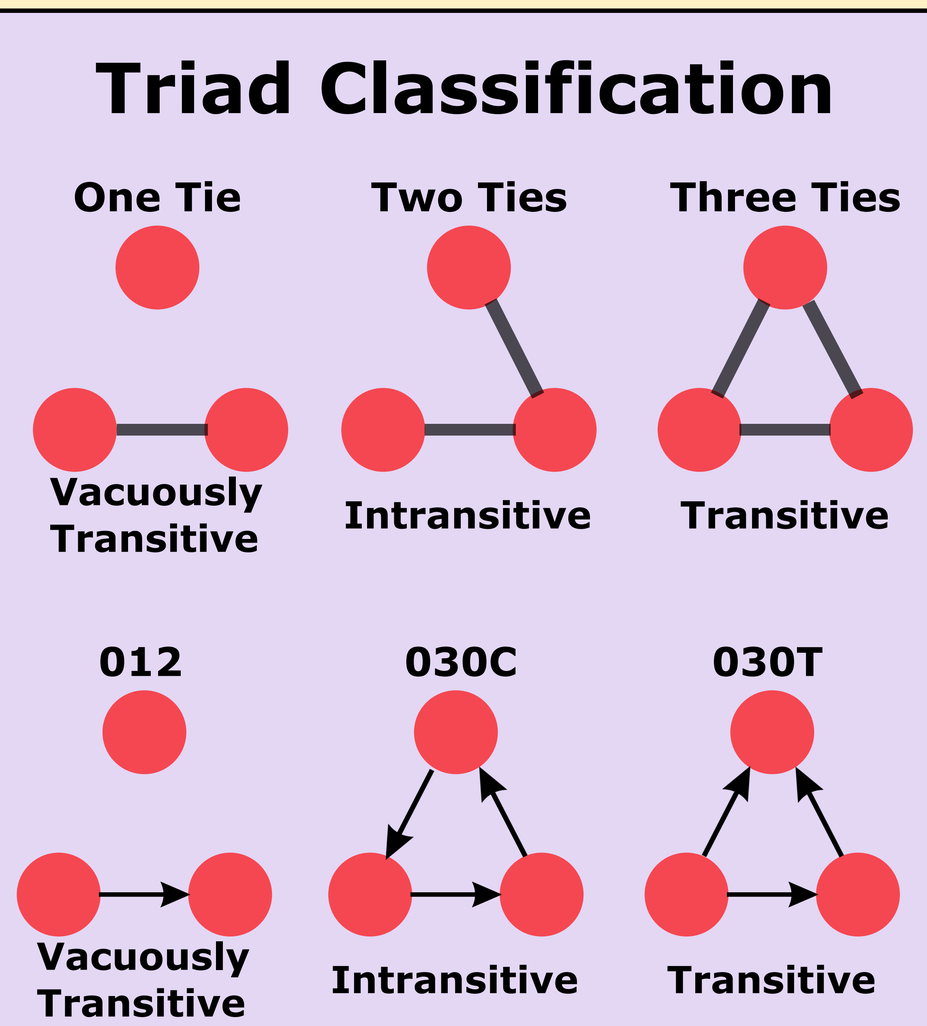
Transitivity

- Two strong friendships tend to create a third. 'the friend of my friend is my friend.'
- Intransitivity is the opposite; 'the friend of my friend is ***not*** my friend.'
- Transitivty makes networks more dense and well connected.
- As a network measure, undirected transitivty is the chance two of a node's neighbors are also connected.
- To definte directional transitivty, we use triples, or directional 'walks' through a triad.
- A single intransitive triple makes the triad intransitive.

Forbidden Triangle Transformation



Triad Classification



Fall 2015	Test 1	Test 2	Test 3	Test 4
Triad 201	12	12	10	13
Triad 300	101	36	59	97
Triad 210	60	29	74	104

Future Directions

We've been studying triads in our networks as a way to understand how student groups and scientific communities form in our classrooms. We plan to study the effects of transitivity and intransitivity on network status as well as network connectivity over a semester. Structural hierarchy at the triadic level may also give us a better picture of how students rank themselves in group exams.