1154-M5-1147 **R. Teal Witter*** (rwitter@middlebury.edu) and **Alex Lyford** (alyford@middlebury.edu).

Applications of Graph Theory and Probability in the Board Game Ticket to Ride.

In the board game Ticket to Ride, players race to connect cities and build railroads on a map of the U.S. Unfortunately, the scoring system is arbitrary and simplistic. The reward for building a railroad between a pair of cities is simply the fewest number of trains needed to do so, ignoring the number of paths and the ease of building them. The points for owning a railroad increase exponentially relative to its size, even though train cards are collected at a constant rate. Luckily, we can enhance our approach by using math, thinking of the board as a graph where the cities are vertices and the railroads connecting them are edges. We explore the underlying graph theory and probability to improve players' strategies and the game itself. First, we calculate the effective resistance between pairs of cities—taking into account the difficulty and number of paths—so that players can connect the most cost-effective pair. We then apply a martingale to the railroad-building process and argue that the points for a railroad should be linear, not exponential, in relation to its size. Finally, based on graph-theoretic measures like the number of incident paths and betweenness centrality, we identify the most strategic railroads for players to build. (Received September 13, 2019)