Theme Park Simulation with a Nash-Equilibrium-Based Visitor Behavior Model

Andrew Spann
Daniel Gulotta
Daniel Kane
Massachusetts Institute of Technology
Cambridge, MA

Advisor: Martin Z. Bazant

Summary

We build from the ground up a computer simulation consisting of a fictional theme park, MATHCOT. We populate MATHCOT with visitors and define an "enjoyment function" in which visitors gain points for going on rides and lose points as they stand in line.

We propose two QuickPass systems. In the Appointment System, QuickPasses represent an appointment to visit the ride later that day. In the Placeholder System, a QuickPass represents a virtual place in line. We then choose test cases to represent both systems and run the computer simulation.

With each set of parameters, we adjust the probability weights that govern visitor behavior to fit a Nash equilibrium. The Nash equilibrium adapts the behavior of park visitors to a greedy equilibrium that is not optimal for the group but represents individuals weighing to decisions based on immediate benefit.

Our results suggest that it is in the park's best interest to allocate a high percentage of the rides to QuickPass. Reserving too few seats for QuickPass users can result in lower average visitor enjoyment than without a QuickPass system. Both the Placeholder System and the Appointment System (with 75% of ride capacity allocated to QuickPass users) show strong increases in visitor enjoyment.

Varying the length of the time window for the QuickPass has little effect on visitor enjoyment.

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