# Four-Lane Cellular Automata with 3 different passing rules

## Team No. 31664

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## Summary

There is a question of whether there is a rule that optimizes driving flow and safety. Worldwide, 65% of countries employ the Right Hand Rule, 35% employ the Left Hand Rule, and not much is known about other rules. To study the flow and safety of traffic rules we developed a multi-lane cellular automata model of freeway traffic with a modified version of Nagel Schreckenberg driving strategy. Each vehicle on this freeway is represented by one unit with a varying velocity of 0 to 5 units per time step that travels along a circular lanes of 300 units.

In the experiment, we varied 3 variables: the rule applied, the loopback, and the population density. The possible rules that can be applied are the right hand rule which vehicles shift to the left lanes as they speed up; no rule which vehicles move forward but change lanes randomly; and the fast rule which vehicles have a tendency to move faster and pass either left or right. The loopback is the measurement of how willing vehicles are to shift lanes based on how far behind a vehicle is on the lane they are shifting to. The population density represents how filled up the whole freeway is in general. Prior to official experiments we adjusted other variables but found that their effects were not as significant, thus we only varied these variables.

In our results, we measured safety by analyzing variability in speeds and passing frequency, but we did not parameterize safety; in conjunction we used Illner and Bohun's definition of flow as a product of average velocity and density. Finally our results suggested that the right hand rule was the rule with the most flow and safety in between the fast rule and the no rule which worked under low density, high velocity conditions, and high density, low velocity conditions respectively.