

#### IV Highway Merge Lanes During Rush Hour--A Prisoner's Dilemma Model

This is a drastic oversimplification, but let us pretend we can project the results of interacting strategies by representing populations on the highway as two people in a prisoner's dilemma game. There is a merge lane at the junction of highways 40 and 270 where people can either take turns and merge smoothly, or else pass everyone in the right hand lane (which ends) and cut into the front at the last minute. Of course, if people pursue this "me first" approach, all the cars approaching the forced merge have to slam on their brakes, and as a result, the highway is jammed up with stop-and-go traffic for miles. Once someone starts the aggressive game, anyone who is courteous ends up being constantly cut off and pushed back. The paradox is that if traffic merged smoothly, this part of the highway could be traversed at a steady speed of about 40 mph by everyone. In the discourteous mode, everyone suffers. Here is a table that might represent speeds achieved by each type of player for different combinations of strategies. Joe controls rows. His speeds are the upper left. Sally controls columns. Her speeds are in the lower right. If you are the only one being overly aggressive, you may get arrested, which will slow you down a little. Sally is also a little more proficient in the aggressive-aggressive game than Joe is. Please note that each party wants to MAXIMIZE the speed of getting through this section of highway.

<i>Joe's and Sally's speed at the merge of highways 40 and 270</i>				
Joe / Sally	courteous	aggressive weaving	duels and cutting off	Sally's best speed
courteous	40 / 40	20 / 50	2 / 45	
aggressive weaving	50 / 20	30 / 30	5 / 25	
duels and cutting off	45 / 2	25 / 5	3 / 10	
Joe's best speed				

30 Use squares for Joe and circles for Sally to show which strategies would prevail if each party only chose to maximize their speeds in each situation. What is the **stable solution from this inconsiderate behavior?** (Big hint: if you get the result that both would be courteous, you are doing it wrong!) circle one for each: Answers must be consistent to get credit.

15 Joe would: be courteous      aggressively weave      duel and cut off other people

Sally would: be courteous      aggressively weave      duel and cut off other people

15 Show, by drawing lines through those rows and columns, which strategies are dominated and wouldn't be pursued by each player in any case in this application of the prisoner's dilemma model.

What would be a better solution for them both? What are three things that could be done to enforce a stable agreement on that better solution?

Better solution:

- 15
- 1.
  - 2.
  - 3.

Here is a modification of the plant expansion model from the website.