Question 1

What is the cooperative ping pong effect described in Rickert et al. (1996) and why does it happen?

The ping pong effect is a phenomenon in which in a relatively high-density locality, cars see no other cars on the other in front and in the back, so they all decide to switch together. This happens since the states are updates simultaneously when `p_change = 1`, so the car in front will not know the car in the back is planning to change lanes, so as long as there is space on the other lane at the current moment, the cars will switch.

Question 2

If we keep `p_change = 1`, how can we modify the two-lane model to avoid the ping pong effect in high-density localities?

We can perform linear updates from back to front. Then, the cars that are in the front, if there are cars in the back, would not switch lanes if the gap is less than 5. This way, we can view it has every 2nd/3rd/4th/5th car will switch lanes, depending on the local density.

Reflection

A good model should have as few rules as possible, while still capturing important aspects of the real world. Based on the discussion in your breakout group or during the debrief session, describe **one** rule in the traffic model that you would modify, add, or remove to either simplify the model or to make it possible to capture a new aspect of the real world. Motivate why your answer would improve the model by simplifying or extending it.

A rule I would change to this model is that the look back on the other lane can be min(v_max, v_car_behind + 1) so that we can encourage more lane changes. This is because using the lookback as v_max can make two lanes very unbalanced in terms of density since it'd be rarer when cars can switch. To the other end, we should put at v_car_behind + 1 because the acceleration at most can be 1, so we have to be careful that the car behind wouldn't move into the slot that we move in.