BiMatrix Games are the two-person games to which Nash's Equilibrium Theorem applies:

Given two “payoff matrices”, a matrix A whose rows are indexed by the set R of “pure girl strategies” and whose columns are indexed by the set T of “pure boy strategies”, and a matrix B whose rows indexed by T and whose columns are indexed by R.

The girls play a probability distribution, y on R, and the boys play a probability distribution, x on T. The expected payoff to the girls is yAx, and the expected payoff to the boys is xBy.

A pair (x,y) of distributions is called an equilibrium if the girls can not improve their expected payoff, yAx, by unilaterally changing their probability distribution y, and the boys can not improve their expected payoff, xBy, by unilaterally changing their probability distribution x.

Nash's Equilibrium Theorem says that an equilibrium exists. Lemke and Howson gave a lovely algorithm to find one.

Scarf has a theory and algorithm for a quite different purpose of solving a class of “cooperative games”.

Gurvich, Gaubert, Sanita, and I, use a combinatorial abstraction of the Lemke-Howson algorithm, called “room-partitioning in oiks”, to study the behavior of similar algorithms.

We show that the Scarf algorithm is in fact an instance of the Lemke-Howson algorithm,

and we show a sequence of inputs where the amount of work of the Scarf algorithm grows exponentially.