Algorithmic Game Theory — Assignment Sheet 2

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Exercise 2.1. Argue that any pure Nash equilibrium of a non-degenerate bimatrix game is computed by the Lemke-Howson-Algorithm for an appropriate choice of the missing label.

Exercise 2.2. Determine all symmetric Nash equilibria of the following symmetric bimatrix game $(A, A^\top)$ with

$$A = \begin{pmatrix} 3 & 3 & 0 \\ 4 & 0 & 1 \\ 0 & 4 & 5 \end{pmatrix}.$$

Exercise 2.3. Run the Lemke-Howson-Algorithm for the game from Exercise 2.2 for any choice of the missing label. (As the game is symmetric, it suffices to consider missing labels $i \in \{1, 2, 3\}$.)

Exercise 2.4. Show that the points $(x, 0)$ and $(0, y)$ cannot be endpoints of a path during the course of the Lemke-Howson-Algorithm.

Exercise 2.5. Consider the bimatrix game given by the matrices

$$A = \begin{pmatrix} 3 & 3 \\ 2 & 5 \\ 0 & 6 \end{pmatrix}, B = \begin{pmatrix} 3 & 3 \\ 2 & 6 \\ 3 & 1 \end{pmatrix}.$$

Show that the game is degenerate. Apply the Lemke-Howson-Algorithm for the missing label 1 and discuss the problems that occur due to degeneracy.

Exercise 2.6. Give an example of a degenerate bimatrix game (A, B), $A, B \in \mathbb{R}^{m \times n}$ where all $2nm$ entries are distinct. Further give an example of a non-degenerate game where a column of A contains twice the same entry.