

Guest Lecture

**Mid Sweden University,
Department of Economics, Geography, Law
and Tourism (EJT),
Sundsvall,
Thursday 2020-01-16, 13.00-14.30**

RECENT ADVANCES IN GENERAL GAME THEORY AND APPLICATIONS



By Peter Lohmander

Abstract:

In part 1 of this presentation, the two player zero sum games with diagonal game matrixes, TPZSGD, are analyzed. Many important applications of this particular class of games are found in military decision problems, in customs and immigration strategies and police work. Explicit functions are derived that give the optimal frequencies of different decisions and the expected results of relevance to the different decision makers. Arbitrary numbers of decision alternatives are covered. It is proved that the derived optimal decision frequency formulas correspond to the unique optimization results of the two players. It is proved that the optimal solutions, for both players, always lead to a unique completely mixed strategy Nash equilibrium. For each player, the optimal frequency of a particular decision is strictly greater than 0 and strictly less than 1. With comparative statics analyses, the directions of the changes of optimal decision frequencies and expected game values as functions of changes in different parameter values, are determined. The signs of the optimal changes of the decision frequencies, of the different players, are also determined as functions of risk in different parameter values. Furthermore, the directions of changes of the expected optimal value of the game, are determined as functions of risk in the different parameter values. Finally, some of the derived formulas are used to confirm earlier game theory results presented in the literature. It is demonstrated that the new functions can be applied to solve common military problems.

In part 2 of this presentation, four military decision problems, common and relevant to typical army and ranger units, at platoon, company and battalion levels, are described and analysed. It is found that fundamental game theory and methods can be used to determine optimal decisions. The optimal decisions are derived as mixed strategy Nash equilibria, via manual methods. It is found that considerable improvements of the expected outcomes of typical decisions can be obtained in a way that does not require high investment costs. It is argued that the methodology to some degree should be included in the education of all Swedish military officers, in particular in the army and ranger units intended for special operations.

In part 3, stochastic dynamic extensions of part 1 will be defined.

References with links: Page 2.

References

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Presentation of Peter Lohmander

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