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Sequential games and optimal strategies.

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In this talk I will describe a general notion of sequential (n rounds) game introduced in [1]. One of the main differences from the standard notion of sequential game is that we focus on the *objective* or *goal* of each round, rather than on the number of players – think of a lonely person playing both black and white in chess. If the objective at each even (respectively, odd) round is the same, but objectives at even and odd rounds are conflicting, we can think of this as a win-or-lose two-player game. If the objective at round i does not necessarily conflict with the objective at round j , then this can be thought of as an n -player game, as in the theory of Nash equilibrium. A *play* in such games is a sequence of moves, one for each round, and the *outcome function* computes the outcome of the game for each given play. In the case of a two-player game the outcome function determines who won the game, whereas in the n -player game the outcome function describes the payoff for each of the players.

The plan for talk is to (1) describe the theory selection functions, on which the definition of the game is based, (2) give the abstract definition of the game, (3) go through a few concrete instances of the game, and (4) describe how optimal strategies can be computed via the product of selection functions.

If time permits, we will also cover an even more general form of sequential game where the number of rounds is unbounded. In other words, the game carries on until a stopping condition is met. The particular case above corresponds to a constant stopping condition that simply checks whether round n has been reached or not. But in general the stopping condition might depend on how the game unfolds, so that plays in the game might be arbitrarily long (but always finite). As it turns out, the computation of optimal plays in the unbounded case is a form of bar recursion, which is strong enough to interpret full classical analysis, over Gödel's system T (cf. [2]). This talk is based on recent joint work with Martín Escardó.

[1] MARTÍN ESCARDÓ AND PAULO OLIVA, *Selection functions, bar recursion, and backward induction*, **Mathematical Structures in Computer Science**, vol. 20 (2010), no. 2, pp. 127–168.

[2] MARTÍN ESCARDÓ AND PAULO OLIVA, *Computational interpretations of analysis via products of selection functions*, **Proceedings of Computability in Europe 2010**, (F. Ferreira and B. Lowe and E. Mayordomo and L. M. Gomes, editors), Springer LNCS, 2010.