Following previous work by Abramsky (2007), Tulenheimo and Venema (2007) (for full references, see [1]) and ourselves [1], we develop a multi-player logic \( MPL_R \) for rational players. The syntax of \( MPL_R \) is as follows:
\[
\phi ::= p \mid (\phi \lor_i \psi) \mid \neg_{ij} \phi,
\]
where \( i, j \in A \), the set of players. Formulas of \( MPL_R \) describe games, where \( \lor_i \) is a choice operator for player \( i \) and negations, of the form \( \neg_{ij} \), permute the roles of players \( i \) and \( j \). A valuation assigns to each proposition letter a set of winners.

\( MPL_R \) can be seen as a generalization of two-player game semantics of propositional logic. We show that the complexity of \( MPL_R \) is linear in the general case, but if we impose some (reasonable) restrictions to the valuation function, it becomes \( NP \)-complete. Also, a completeness result for a functionally complete extension, \( MPL_R^+ \), of \( MPL_R \) will be shown. The logic \( MPL_R^+ \) contains two families of negations that are the same in the classical two-player setting.

The fact that we assume rationality of the players allows us to study the logics from a game theoretical perspective. Each extensive form game can be described by a formula of \( MPL_R \) and we compare our semantics to various solution concepts from game theory. In particular, we will show that if a backward induction solution to the game exists, this will be the semantic value of its formula. We illustrate this point by analyzing some well-known games like the Centipede game within our framework.