Summary on my researches (The numbers of papers are correspond to "(3) List of my paper")

I have studied combinatorial game theory (CGT) for over ten years. Combinatorial game theory studies the mathematical structure of games that have no chances or hidden information. I have also worked on related areas such as algorithm theory and computational complexity, and have had more than ten peer-reviewed papers accepted in these fields. Furthermore, I have played a central role in Japanese CGT community like organizing a local conference every year since I was a Ph. D student.

Below I summarize my main results. In [2], I generalized two early results on multiplayer games in a single formula. In [9], I defined a new sum operator of games, and showed how to determine which player has a winning strategy if a given position is such a sum. [11] is a joint work with some other researchers, including Prof. Richard Nowakowski and Prof. Carlos Santos. Both are among the most active and productive researchers on CGT. In this study, we investigated a game called the "partisan chocolate game" and showed how to evaluate the positions by using dyadic numbers (rational numbers whose denominators are powers of two). [13] is also a joint work, including Prof. Hironori Kiya, who I would like to be my host professor and Prof. Urban Larsson, who is also one of the most active and productive researchers on CGT. In general, we consider operator on positions of games, but in this study, we considered operator on rulesets of games and we found a distributive lattice-like structure in the set of rulesets.

In addition, as researches other than CGT, in [16], we investigated computational complexity on lattice puzzles. In this study, we found that the puzzle's complexity can fall into P, become graph isomorphism complete, or become NP-complete, depending on small rule changes. This result is important because we obtain three (which are believed different) complexity class from a single puzzle by small rule changes and this paper was accepted to the international peer reviewed conference ISAAC. In addition, by utilizing knowledge on complexity theory, I joined a project on quantum computation and in [7], we proved that a problem on this field is NP-complete.

Finally, in [12], I studied universal rulesets. Universal rulesets are rulesets such that from the perspective of algebra, belonging the most complex class of rulesets. In this study, I have solved two open problems "To find universal ruleset other than Generalized Konane" and "To find universal dicotic ruleset". In addition, I introduced the method of reduction, which is used when proving computational complexity, to the proof of universality since I realized that universality can be considered as algebraic complexity, and in a sense, it is similar to computational complexity. I believe that this study was possible only because of my dual background on combinatorial game theory and computational complexity.