

Characterising memory in infinite games

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Abstract: This paper is concerned with games of infinite duration played over potentially infinite graphs. Recently, Ohlmann (TheoretiCS 2023) presented a characterisation of objectives admitting optimal positional strategies, by means of universal graphs: an objective is positional if and only if it admits well-ordered monotone universal graphs. We extend Ohlmann's characterisation to encompass (finite or infinite) memory upper bounds. We prove that objectives admitting optimal strategies with ε -memory less than m (a memory that cannot be updated when reading an ε -edge) are exactly those which admit well-founded monotone universal graphs whose antichains have size bounded by m . We also give a characterisation of chromatic memory by means of appropriate universal structures. Our results apply to finite as well as infinite memory bounds (for instance, to objectives with finite but unbounded memory, or with countable memory strategies). We illustrate the applicability of our framework by carrying out a few case studies, we provide examples witnessing limitations of our approach, and we discuss general closure properties which follow from our results.

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