TRINITY COLLEGE DUBLIN

Abstract

Simulation of Mathematical Games using Functional Programming

by David Murphy

May 2015

In this work, a program was created to play the combinatorial game Dots and Boxes at an advanced level using functional programming in order to demonstrate the finesse and practicality of the functional programming approach to solving difficult problems. The program uses a simple, flexible architecture of functional data structures for effective representation and analysis of the game, sophisticated and elegant functions to perform actions such as chain detection, lookahead analysis, pattern recognition, and decision making, as well as an effective action policy which allows it to select actions consistent with the advanced gameplay strategies it was intended to follow. In order to achieve this advanced level of play, sophisticated theory, framework and strategies were invented based on the work of Elwyn Berlekamp, one of the founders of combinatorial game theory. An interactive user interface was also implemented to allow users to play the game and test the program.

The program is flexible enough that it supports further implementation and development of more sophisticated analytical methods and gameplay strategies.