

Teaching CP systems in Java using Gecode/J

Mikael Z. Lagerkvist¹ and Guido Tack²

¹ ECS, ICT, KTH - Royal Institute of Technology, Sweden, zayenz@kth.se

² PS Lab, Saarland University, Saarbrücken, Germany, tack@ps.uni-sb.de

A course covering constraint programming (CP) systems should include at least four main topics: modeling, propagators (implementing constraints), branchings (non-deterministic choice), and exploration of the search tree. In order to deliver a hands-on experience to the students, we have developed Gecode/J [2], a Java interface to the Gecode C++ library [3]. Using Gecode/J, students can get acquainted with all four aforementioned topics in a programming language they are familiar with. Both Gecode and Gecode/J are open source software. The full source code, an API reference and some example programs are available from the project web pages. Gecode/J has been used for teaching CP courses at KTH and at Uppsala University in Sweden, and at Université Catholique de Louvain in Belgium.

The Gecode constraint programming library is designed to enable the implementation of highly efficient components. This, necessarily, exposes quite some complexity to the user. For teaching, a less complex system at a higher level of abstraction is desirable.

Gecode/J lifts most of the functionality of Gecode to Java, trading some of the efficiency of the C++ library for a simplified interface and Java's automatic memory management. Thus, while providing the essential functionality for implementing all major components of a CP system in Java, it reduces the complexity to a level suitable for teaching. Students can implement their own propagators, branchings, or exploration engines, and freely mix them with the standard components that Gecode/J provides.

For showing search in action, Gecode/J features an interactive visual exploration tool, similar to the Mozart/Oz Explorer [1]. The tool is implemented in Java using Gecode/J. Having such a component in an educational system greatly helps students understand the exploration process.

Our demonstration covers modeling, implementing propagators, and the visualization tools. Following the syllabus of the CP course at KTH, we demonstrate Gecode/J as an educational CP system in practice.

References

1. C. Schulte. Oz Explorer: A visual constraint programming tool. In L. Naish, editor, *Proceedings of the Fourteenth International Conference on Logic Programming*, pages 286–300, Leuven, Belgium, July 1997. The MIT Press.
2. The Gecode team. Gecode/J, a Java interface for Gecode. www.gecode.org/gecodej.
3. The Gecode team. Generic constraint development environment. www.gecode.org.