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Programming with High-Level Abstractions

Proceedings of the 3rd Workshop on Logic and Practice of Programming (LPOP)

December 13, 2022

Editors: David S. Warren and Yanhong A. Liu

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Preface

High-level abstractions are essential for improving program correctness and programming productivity. The focus of the 2022 Logic and Practice of Programming workshop is programming with high-level abstractions, especially including sets and logic rules.

Programming with sets, started with SETL in 1969 [1], is central to relational database programming using SQL as well as NoSQL database programming using high-level languages such as Python. Programming with logic and rules, started with QA3 in 1969 [2] and Prolog in 1972 [3], is central to deductive database and knowledge base programming. For building large applications with modular components, programming with objects, such as supported in Python, is also essential.

The goal of this workshop is to bring together the best people and best languages, tools, and ideas to help improve programming with high-level abstractions for the practice of programming. Of particular interest are programming with sets (including relations and dictionaries), with general objects (including high-level types), and with logic rules (including constraints), with an eye to where programming is, and should be, going.

The workshop program consists of invited talks, presentations of position papers, an invited special session on SETL, and an invited panel on future directions.

Potential workshop participants were invited to submit a position paper (1 or 2 pages in PDF format). Because we intend to bring together people from a diverse range of language and programming communities, it is essential that all talks be accessible to non-specialists.

The program committee invited attendees based on their position paper submissions and attempted to accommodate presentation requests in ways that fit with the broader organizational goal. Each submitted paper, except for invited talks, was reviewed by at least three program committee members, and almost all accepted papers received an average score of 'accept', or three 'accept's or even higher.

LPOP 2022 is a followup to two previous successful LPOP workshops held as part of the Federated Logic Conference (FLoC) in Oxford, UK in 2018 and the ACM SIGPLAN conference on Systems, Programming, Languages, and Applications: Software for Humanity (SPLASH) in Chicago, USA, Virtual, in 2020. LPOP 2018 focused on the integration of logic programming with imperative programming. LPOP 2020 broadened to the practical use of logic as a crosscutting discipline through many areas of computer science. LPOP 2022 focuses on core high-level abstractions around sets and logic rules, to help bring them to the general practice of programming.

LPOP 2022 includes invited talks by four distinguished researchers and practitioners:

- Robert Kowalski (Imperial College London) describes a way to combine logic programs, reactive systems, and imperative programs in a single system, LPS (Logic Production System).
- Peter Norvig (Google) considers the use of machine learning with Large Language Models for programming, to examine its promise and pitfalls for programming in the future.
- Ed Schonberg (NYU and Adacore) traverses the wide span from SETL prototyping to Ada2022, tackling expressiveness and complexity in language design and evolution.
- Guido van Rossum (Microsoft) leads a discussion on language design with many different goals, driven by the goal of the ability to evolve amid formidable practical challenges.

The program includes eleven presentations by authors of contributed position papers, whose authors and titles are:

- Fritz Henglein and Mikkel Kragh Mathiesen – Synthetic Algebraic Programming
- Marc Denecker – Knowledge Representation and Reasoning in the FO(.) Knowledge Base paradigm with IDP-Z3
- Bharat Jayaraman – Subset-logic Programming: a Declarative Approach to Sets
- Maximiliano Cristia and Gianfranco Rossi – {log}: Programming and Automated Proof in Set Theory
- Michael Gelfond – Sets in Logic Programming and Principles of Language Design
- Michael Leuschel – Programming in B: Sets and Logic all the Way Down
- Pavle Subotic and Bernhard Scholz – Designing a Datalog Engine for Industrial-Grade Static Analysis
- Paul Tarau – An Organic Diet for Python: devouring a Logic-based Language
- Yanhong A. Liu – Alda: Integrating Logic Rules with Everything Else, Seamlessly
- Benjamin Grosof – Logic Programming in AI: Some Directions
- Michael Hanus – A Set-Oriented View of Logic Programming

An invited special session on SETL is organized. It has two invited speakers, Micha Sharir (Tel Aviv University) and Eugenio Omodeo (University of Trieste), looking back at the critical optimization work as well as ambitous mathematical proofs project carried out with the vision of SETL creator Jack Schwartz, among a large collection of SETL publiations and software; and it brings up a panel discussion about essential language features for supporting programming with sets in large applications.

An invited panel is organized at the end, with a discussion focused on logic, knowledge, and where programming should be going. The idea is to bring together experts from different programming traditions to discuss views on how practical programming might evolve in the coming years to take better advantage of abstract constructs such as sets and rules.

The overall organization, combining invited talks, paper presentations, and panels, is structured to encourage a deeper understanding of the various approaches and how they might mutually interact. We hope you enjoy the variety of talks and discussions!

We thank all LPOP program committee members for providing timely helpful and insightful reviews. Special thanks to Paul McJones for excellent help that made the SETL session possible, especially through his marvelous work at the Computer History Museum for creating the SETL Historical Sources Archive [1], as well as ALGOL, LISP, Prolog, and other historical software archives.

December 2022

David S. Warren
Y. Annie Liu

[1] https://www.softwarepreservation.org/projects/SETL/index.html#Introduction
[2] https://www.ijcai.org/Proceedings/69/Papers/023.pdf
[3] https://www.softwarepreservation.org/projects/prolog/index.html#Marseille

Program

Tuesday December 13, 2022
Displayed time zone: Eastern Time (US & Canada)

10:00 **Opening and Introduction** (David Warren and Annie Liu)

10:10-11:45 **From Programming with Sets**
(Chair: Ana Milanova, Invited Talk Chair: Fritz Henglein)

10:10 **Invited Talk: From SETL Prototyping to Ada2022: A Lesser-Known Passage up the Tower of Babel**
Ed Schonberg

10:50 **Synthetic Algebraic Programming**
Fritz Henglein and Mikkel Kragh Mathiesen

11:00 **Invited Session on SETL: Sets, Abstractions, and Programming Language Perspectives**
Ed Schonberg, Fritz Henglein, Micha Sharir, Eugenio Omodeo, Guido van Rossum
(Chair: David Bacon)

11:00 **On SETL Optimization Work and Memories of Jack**
Micha Sharir

11:15 **AEtnaNova, An Alter Ego of SETL**
Domenico Cantone, Eugenio Omodeo, and Alberto Policriti

11:25 **Panel: Sets, Abstractions, and Programming Language Perspectives**

11:45-12:00 **Break: Discussion on Programming with Sets** (Host: David Bacon)

12:00-13:20 **From Programming with Logic Rules and Sets**
(Chair: Peter Van Roy, Invited Talk Chair: Michael Kifer)

12:00 **Invited Talk: Combining Logic Programs and Imperative Programs in LPS**
Robert Kowalski

12:40 **Knowledge Representation and Reasoning in the FO(.) Knowledge Base paradigm with IDP-Z3**
Marc Denecker

12:50 **Subset-logic Programming: a Declarative Approach to Sets**
Bharat Jayaraman

13:00 **{log}: Programming and Automated Proof in Set Theory**
Maximiliano Cristia and Gianfranco Rossi

13:10 **Sets in Logic Programming and Principles of Language Design**
Michael Gelfond

13:20-13:40 **Break: Discussion on Programming with Logic Rules and Sets** (Host: Martin Gebser)

13:40-15:00 **Programming with Sets, Logic Rules, and More**
(Chair: Tuncay Tekle, Invited Talk Chair: Annie Liu)

13:40 **Invited Talk: Q&A: Language Design for Usability and Evolution**
Guido van Rossum

14:20 **Programming in B: Sets and Logic all the Way Down**
Michael Leuschel

14:20 **Designing a Datalog Engine for Industrial-Grade Static Analysis**
Pavle Subotic and Bernhard Scholz

14:40 **An Organic Diet for Python: devouring a Logic-based Language**
Paul Tarau

14:50 **Alda: Integrating Logic Rules with Everything Else, Seamlessly**
Yanhong A. Liu

15:00-15:20 **Break: Discussion on Programming with Sets, Logic Rules, and More** (Host: Joost Vennekens)

15:20-17:00 **Programming, AI, Promise, and Pitfalls**
(Chair: David Warren, Invied Talk Chair: Paul Tarau)

15:20 **Invited Talk: Programming with Machine Learning: Promise and Pitfalls**
Peter Norvig

16:00 **Logic Programming in AI: Some Directions**
Benjamin Grosof

16:10 **A Set-Oriented View of Logic Programming**
Michael Hanus

16:20 **Invited Panel: Logic, Knowledge, and Where Programming Should Be Going**
Ed Schonberg, Robert Kowalski, Guido van Rossum, Peter Norvig, Gopal Gupta, Neng-Fa Zhou (Chair: David Warren)

17:00 **Closing** (David Warren and Annie Liu)

Organization

General Chairs

David Warren, Stony Brook University and XSB Inc.
Y. Annie Liu, Stony Brook University

Program Chair

Y. Annie Liu, Stony Brook University

Program Committee

Martin Gebser, University of Klagenfurt
Fritz Henglein, University of Copenhagen
Michael Kifer, Stony Brook University
Ana Milanova, Rensselaer Polytechnic Institute
Paul Tarau, University of North Texas
Tuncay Tekle, Stony Brook University and Columbus Consulting
Peter Van Roy, Catholic University of Louvain
Joost Vennekens, KU Leuven
Neng-Fa Zhou, City University of New York

LPOP Website

`https://lpop.cs.stonybrook.edu/`