Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

283

D.H. Pitt A. Poigné D.E. Rydeheard (Eds.)

Category Theory and Computer Science

Edinburgh, U.K., September 7–9, 1987 Proceedings



Springer-Verlag

Berlin Heidelberg New York London Paris Tokyo

Editorial Board

D. Barstow W. Brauer P. Brinch Hansen D. Gries D. Luckham C. Moler A. Pnueli G. Seegmüller J. Stoer N. Wirth

Editors

David H. Pitt
Department of Mathematics, University of Surrey
Guildford, Surrey GU2 5XH, U.K.

Axel Poigné
Department of Computer Science
Imperial College of Science and Technology, University of London
180 Queen's Gate, London SW7 2BZ, U.K.

David E. Rydeheard
Department of Computer Science, The University
Manchester M13 9PL, U.K.

CR Subject Classification (1987): D.2.1, D.3.1, D.3.3, F.3, F.4.1

ISBN 3-540-18508-9 Springer-Verlag Berlin Heidelberg New York ISBN 0-387-18508-9 Springer-Verlag New York Berlin Heidelberg

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its version of June 24, 1985, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1987 Printed in Germany

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr. 2145/3140-543210

PREFACE

Category theory arose in the 1940s as an attempt to give a unified treatment to constructs which appear in various guises in algebra, set theory and topology. More recently, logical aspects of category theory have come to the fore. Also in the 1940s were the first attempts at programming electronic computers using sequences of machine instructions. Despite the apparent distance between these two subjects, category theory has become of increasing importance in understanding the process of computer programming.

This volume is a collection of research papers describing some of the links being established between category theory and computer programming. It is the proceedings of a conference held at the University of Edinburgh, 7th-9th September 1987. This conference was arranged as a sequel to that held at the University of Surrey in 1985, whose proceedings are published as number 240 in this series. For those interested in this topic, mention should also be made of the American Mathematical Society conference on Categories in Computer Science and Logic, held in Boulder, Colorado in June 1987.

D.H.Pitt

A. Poigné

D.E.Rydeheard

Organising and Program Committee

S. Abramsky, P. Dybjer, P. L. Curien, H. D. Ehrich, M. Fourman, D. H. Pitt, A. Poigné, D. E. Rydeheard, D. T. Sannella, E. Wagner.

Referees

S. Abramsky, P. Degano, P. Dybjer, P. Ciuffotti, P. L. Curien, R. Dyckhoff, H. D. Ehrich, M. Fourman, W. Harwood, Y. Lafont, G. Longo, V. Manca, I. Mason, D. MacQueen, E. Moggi, B. Monahan, I. C. Phillips, D. H. Pitt, A. J. Pitts, A. Poigné, D. E. Rydeheard, M. Sadler, D. T. Sannella, R. Shaw, P. Taylor, E. Wagner.

The Organising Committee would like to thank the University of Edinburgh for hosting the conference and in particular D.T.Sannella, J.M.Ratcliff and G.L.Cleland for their indispensable contribution.

CONTENTS

G. Rosolini Categories and Effective Computations	1
A.M.Pitts Polymorphism is Set Theoretic, Constructively	12
Th. Coquand, Th. Ehrhard An Equational Presentation of Higher Order Logic	40
S. Kasangian, A. Labella, A. Pettorossi Enriched Categories for Local and Interaction Calculi	57
D.B. Benson The Category of Milner Processes is Exact	71
G. Winskel Relating Two Models of Hardware	98
D.E.Rydeheard, J.G.Stell Foundations of Equational Deduction: A Categorical Treatment of Equational Proofs and Unification Algorithms	114
T. Hagino A Typed Lambda Calculus with Categorical Type Constructors	140
L.S. Moss, J. Meseguer, J. A. Goguen Final Algebras, Cosemicomputable Algebras, and Degrees of Unsolvability	158
G.Bernot Good Functors are Those Preserving Philosophy	182
C.Beierle, A.Voss Viewing Implementations as an Institution	196
S. Martini An Interval Model for Second-Order Lambda Calculus	219
E. Robinson Logical Aspects of Denotational Semantics	238
M. Proietti Connections Between Partial Maps Categories and Tripos Theory	254
S. Vickers A Fixpoint Construction of the p-adic Domain	270
J.M.McDill, A.C.Melton, G.E.Strecker A Category of Galois Connections	290