Date: February 27, 1978

Project Title: Relative Complexity of Programming Systems

Project No: G-36-626

Project Director: Dr. Nancy A. Lynch

Sponsor: National Science Foundation, Washington, D.C. 20550

Agreement Period: From 1/1/78 Until 6/30/80*
*Includes 6 mos. flexibility period

Type Agreement: Grant No. MCS77-15628

Amount: $46,300 NSF Funds (G-36-626)
20,573 GIT Contribution (G-36-327)
$66,873 Total

Reports Required: Annual Summary Reports; Final Technical Report

Sponsor Contact Person(s):

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Defense Priority Rating: n/a

Assigned to: Information & Computer Science (School/Laboratory)

Copies To:

Project Director
Division Chief (EES)
School/Laboratory Director
Dean/Director—EES
Accounting Office
Procurement Office
Security Coordinator (OCA)
Library, Technical Reports Section
EEG Information Office
EEG Reports & Procedures
Project File (OCA)
Project Code (GTRI)
Other

CA-3 (3/78)
GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: 12/17/80

Project Title: Relative Complexity of Programming Systems

Project No: G-36-626

Project Director: Dr. Nancy Lynch

Sponsor: National Science Foundation

Effective Termination Date: 6/30/80

Clearance of Accounting Charges: 6/30/80

Grant/Contract Closeout Actions Remaining:

- Final Invoice and Closing Documents
- Final Fiscal Report via FCTR
- Final Report of Inventions
- Govt. Property Inventory & Related Certificate
- Classified Material Certificate
- Other

Assigned to: Information & Computer Science (School/Department)

COPIES TO:

- Project Director
- Division Chief (EES)
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Library, Technical Reports Section
EES Information Office
Project File (OCA)
Project Code (GTRI)
Other

C. E. Smith

CA-4 (1/79)
Relative Complexity of Programming Systems

Formal models are developed for measuring the complexity of any algebra (i.e., data type and associated operations) relative to any other algebra. Particular focus is on algebras of interest in computing, such as those used for numerical computation, or for string manipulation. Efficient codings of various high-level algebras relative to other, more basic, algebras are described, and in many cases the optimality of these codings is demonstrated. Results are obtained describing how the relative complexity of certain algebras depends on the choice of an underlying class of programs.

These basic results are extended in two directions. First, the approach leads naturally to consideration of questions about tradeoffs between the complexity of various operations on the same algebra. Two interesting results are obtained, one demonstrating such a tradeoff for insertion and searching in a data base, and one for the time and space required for sorting. Second, the approach is extended to models for asynchronous parallel computation. Appropriate formal models are developed for this situation, and several parallel algorithms are described via decomposition into levels, with complexity analysis of each entire algorithm composed from relative complexity analyses performed at the different levels. Some of these algorithms are so difficult that a presentation without such a decomposition seems infeasible.
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Nancy A. Lynch