

# Structured Programming Research Outline - Le

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## Paper #1

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Title: Study of Unstructured Programming Using Symbolic Expressions

- Introduce Symbolic Expressions
- Synthetic/real-world case studies
- Show the ability of identification of unstructured programs with symbolic expressions

## Introduction

1. Original concepts/definitions of Structured Programming
2. Development of Structured Programming (debates between Dijkstra, Knuth, and many others)
3. Roadblocks of studying Structured Programming:
  - Lack of mathematical models to identify program structures
  - Lack of practical ways to detect unstructured program code pieces

## Symbolic Expressions in Solving Structured Programming Problems

The behavior of a software program is the ultimate collection of sequences of executions. We need a comprehensive and efficient algorithm of denoting software sequence of executions to help us better study the structure of programs.

1. Basic rules of Symbolic Expressions
  - Follow basic Algebraic Multiplication rules
  - Distributive law:  $A1A2(A3+A4) = A1A2A3 + A1A2A4$
  - Factorization
2. Symbolic expressions of basic code structures
  - Linear Structure
  - Branch Structure
  - Loop Structure

### 3. Symbolic Expressions and Structured Programming

- Repeated terms and the meaning behind it
- How we identify unstructured programs with repeated terms in factorized symbolic expressions

## Synthetic Case Studies

1. One-Entry-One-Exit
2. One-Entry-Multi-Exit
3. Multi-Entry-One-Exit
4. Multi-Entry-Multi-Exit

## Real-World Case Studies

shows that it is useful in real-world cases, the rules previously presented hold

## Conclusions and Future Work

- We presented a novel way of mapping software programs into math expressions
- Symbolic expressions are useful in identification of structured programs
- After identify unstructured programs, further works needs to be done if we want to alter/fix the unstructured programs

## Paper #2

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Title: Handling Unstructured Programs With The Help Of Path Expressions

- The factorization of path expressions
- The algebra of path expressions
- Prefix and suffix repetitions
- Math theories of path expressions
- Remove repetitions in path expressions <-> remove duplicate code in programs
- Case studies of turning unstructured programs into structured programs using path expressions