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PRESENTATION OVERVIEW

- Introduction
- Language Features
- Architecture
- Conclusion
ABOUT POLYNOMIALS

What is A Polynomial?

- Mathematical expression written as the sum of products of numbers and variables

Practical Applications

- Model the projection of jet rockets
- Market pattern forecasting
- Drug Effectiveness
- Physical equation
- ...
INTRODUCTION TO POLYGO

- What is PolyGo?
  - A Symbolic Polynomial Manipulation Language

- Why is PolyGo?
  - Flexible Manipulation of Polynomials
  - Algorithmic Customization
  - Light-weighted and easy applicable
LANGUAGE FEATURES

- Ability to solve polynomial problems
  - Arithmetic operation
  - Evaluate, Find root…

- Supports for complex number $3 + 5i$
  - Modulo, conjugation, and equation solving.

- Loops & Breaks:
  - ‘for’ and 'while' loops supported
  - Body enclosed within a block
  - Break for jump out of the loop
DECONSTRUCTION OF POLYNOMIAL

- Coefficient → Float
- Exponent → Indices
- Polynomial → List of float number
- Therefore, for single variable poly type
  - record the length and the coefficient comes the solution.

\[
poly[2] p = \{2.0, 1.0, 3.0\} = 2 + x + 3x^2
\]
**Polygo Data Types**

- **Int, Float, String, Bool, Complex**
- Basic data types, complex stores as <1, 2.3>

- **Intarr, Floatarr, Boolarr**
- Array list for int, float and bool,
  e.g. int [2]a = [1, 2]

- **Poly**
- Store polynomial coefficient,
  poly [2]a = {3.0, 2.0, 5.0} as 3.0+ 2.0X +5.0X²
LANGUAGE FEATURES

- **Declaration:**
  - All local variables must be declared prior to any statements
  - Variables can be initialized when it is declared. E.g. `int a = 1;`

- **Strict type system:**
  - No automatic type conversion
LANGUAGE FEATURES

- Functions
  - `<return type>` `fname` (formals)
    `{locals; statement lists}

- Mathematical Driven

- Static scoping, Variable redefinable

- Built-in functions such as:
  `print, print_n, order`
SEMANTIC CHECKING

- Function declarations
- Global, formal and local declarations
- Variable initialization
- Type of operands
- Predicate of for and while loop
- Function calls
- Return and break statement
TESTING

- Unit Testing
  - Test for parser, AST and semantic checker

- Integrated Testing
  - Test complete flow once integrated

- Regression Testing
  - Make sure new features don't introduce bugs
ARCHITECTURE

Source Code → Scanner

Tokens

Parser → AST

AST → Semantic Checker

Output

Execute

Machine code

LLVM → IR

Code generation
What is the maximum volume of air inhaled into the lung?

**Derivation**

**Zero point**

**Evaluate**

The volume of air flowing into the lungs during a breath can be represented by the polynomial function:

\[ V(t) = -0.041t^3 + 0.181t^2 + 0.202t, \]

where \( V \) is the volume in liters and \( t \) is the time in seconds.

\[ t = 3.43 \]

\[ V(t) = 1.17 \]
APPLICATION EXAMPLE 2

- Velocity(t)
- Distance(t)
- Accelerated speed(t)
THANKS FOR YOUR ATTENTION!