Programming Languages and Compilers

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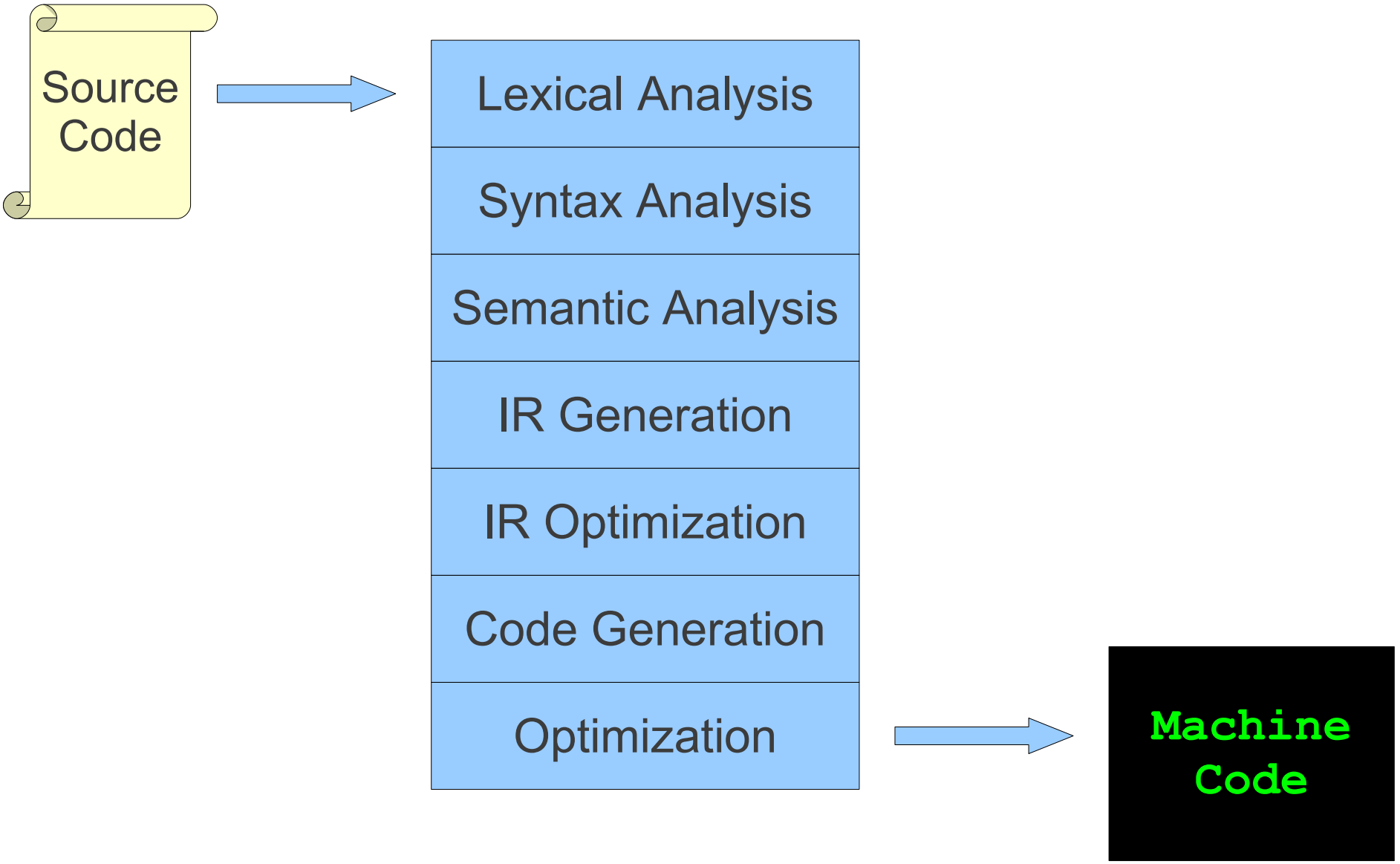
Primary Reference: Aho, Sethi, and Ullman. *Compilers: Principles, Techniques, and Tools*.

Introductory slides taken from Stanford's CS143 Compilers course: *http://www.stanford.edu/class/cs143/*.

From Description to Implementation

- **Lexical analysis (Scanning):** Identify logical pieces of the description.
- **Syntax analysis (Parsing):** Identify how those pieces relate to each other.
- **Semantic analysis:** Identify the meaning of the overall structure.
- **IR Generation:** Design one possible structure.
- **IR Optimization:** Simplify the intended structure.
- **Generation:** Fabricate the structure.
- **Optimization:** Improve the resulting structure.

The Structure of a Modern Compiler



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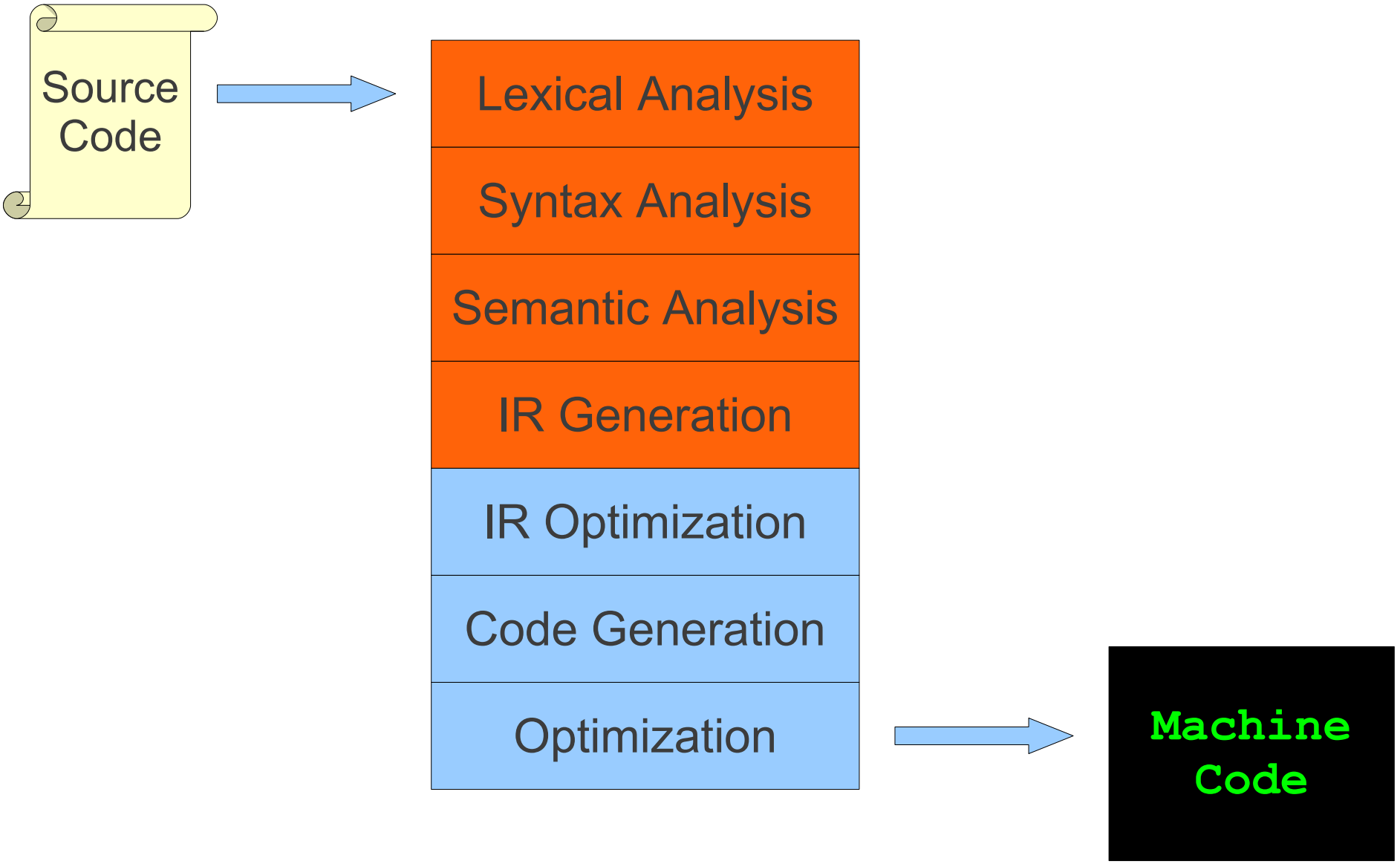

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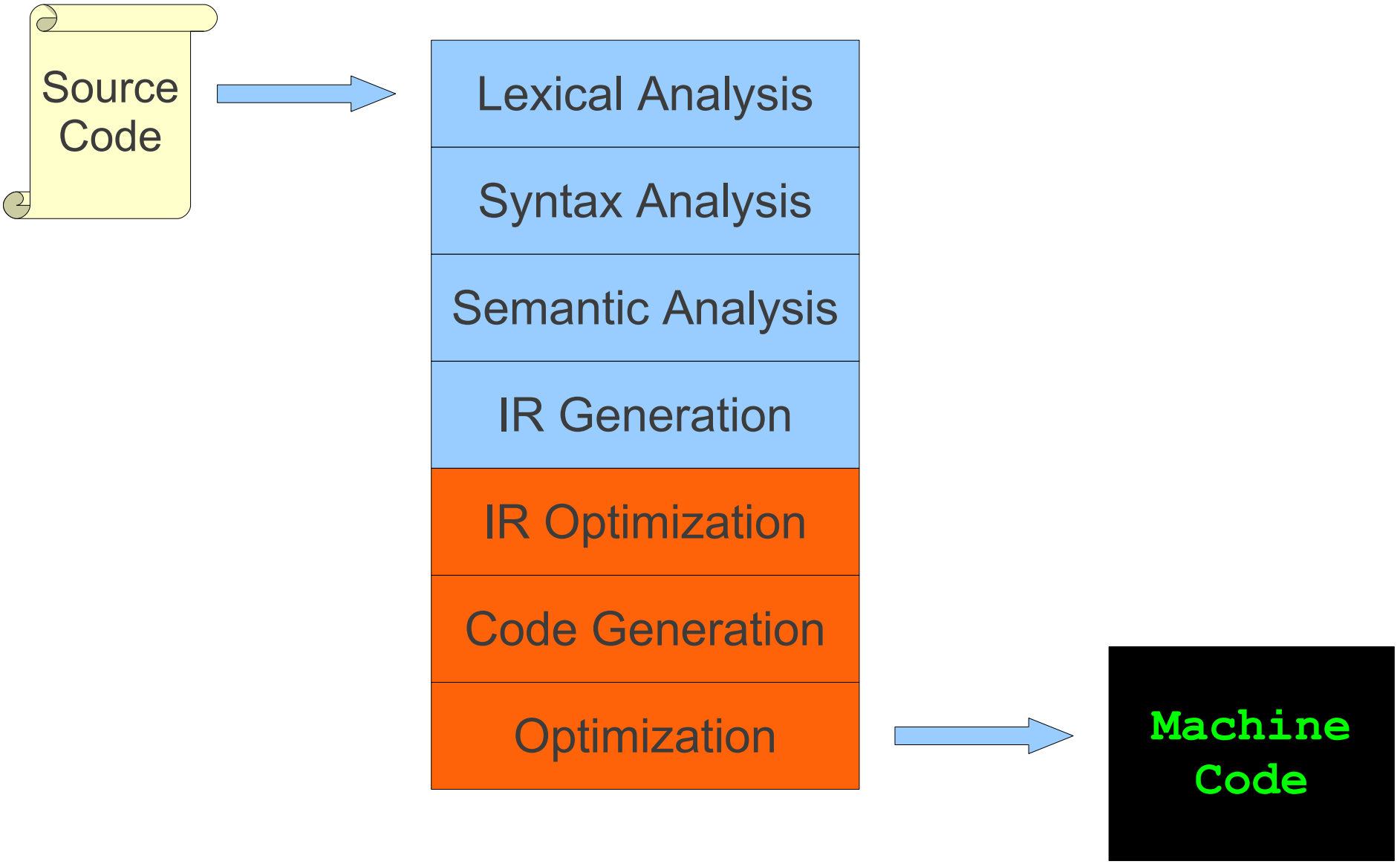

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    int x = a + b;
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T_While
T_LeftParen
T_Identifier y
T_Less
T_Identifier z
T_RightParen
T_OpenBrace
T_Int
T_Identifier x
T_Assign
T_Identifier a
T_Plus
T_Identifier b
T_Semicolon
T_Identifier y
T_PlusAssign
T_Identifier x
T_Semicolon
T_CloseBrace
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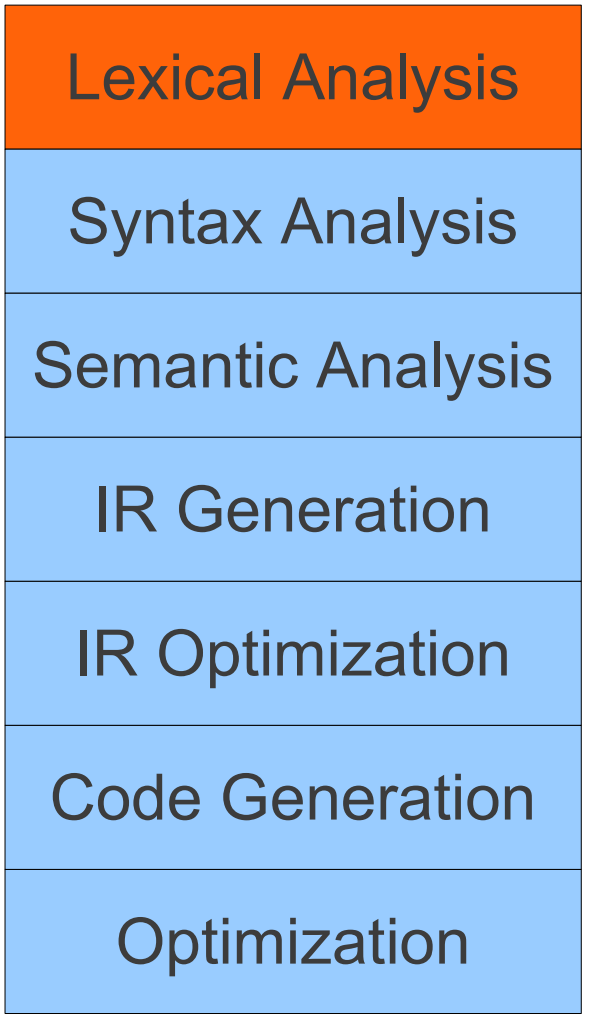

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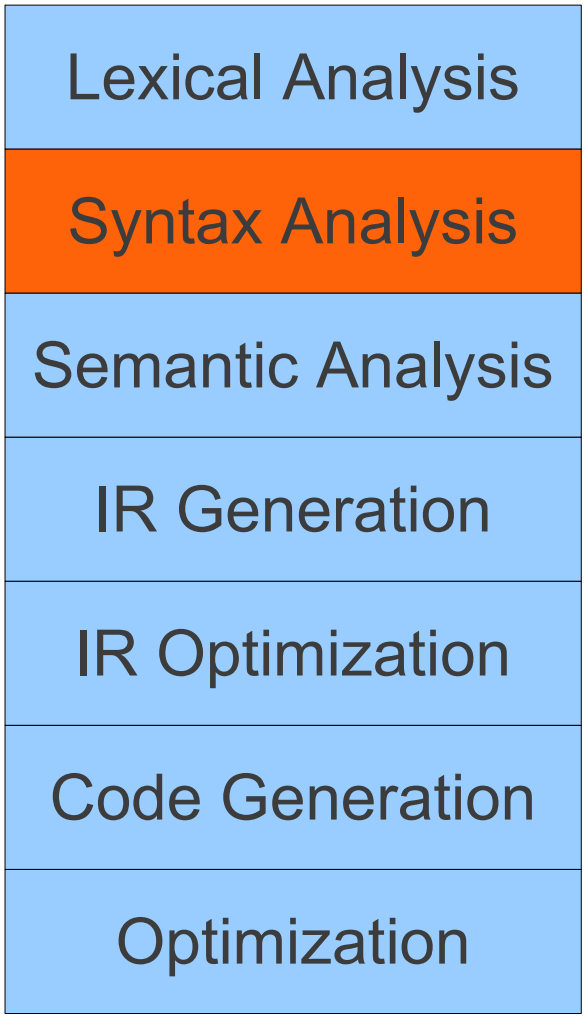

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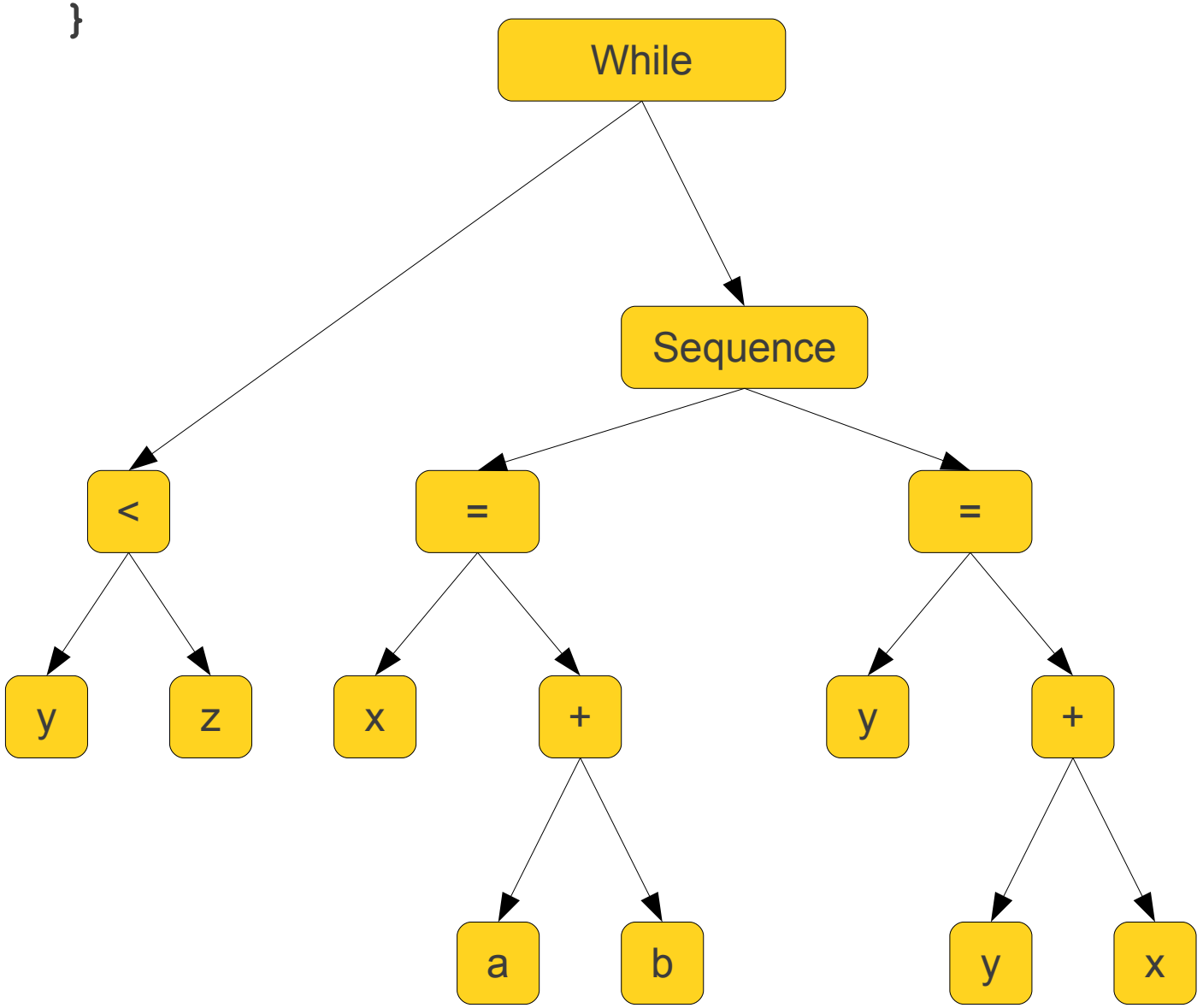

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- **Syntax Analysis**
- Semantic Analysis
- IR Generation
- IR Optimization
- Code Generation
- Optimization

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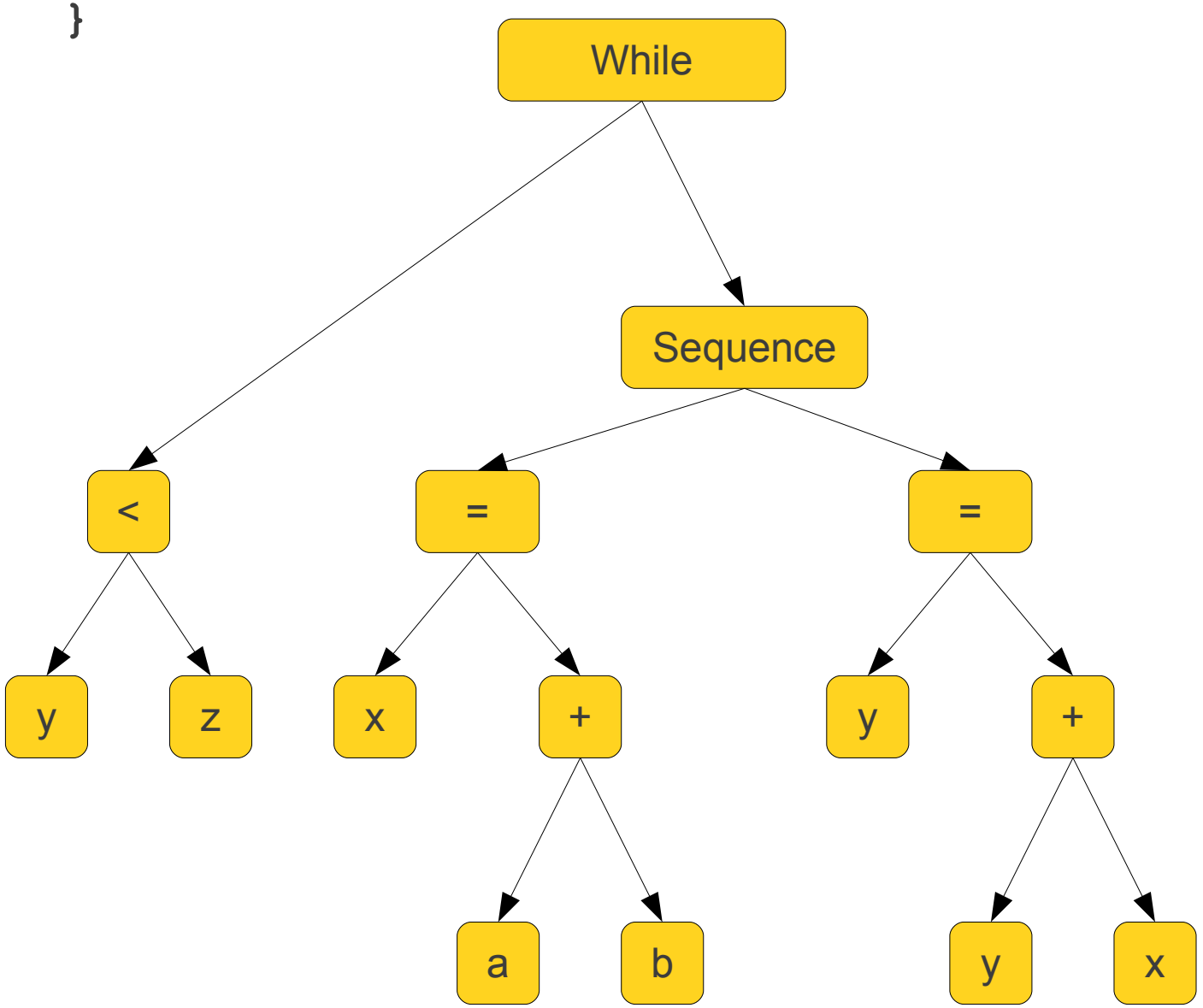

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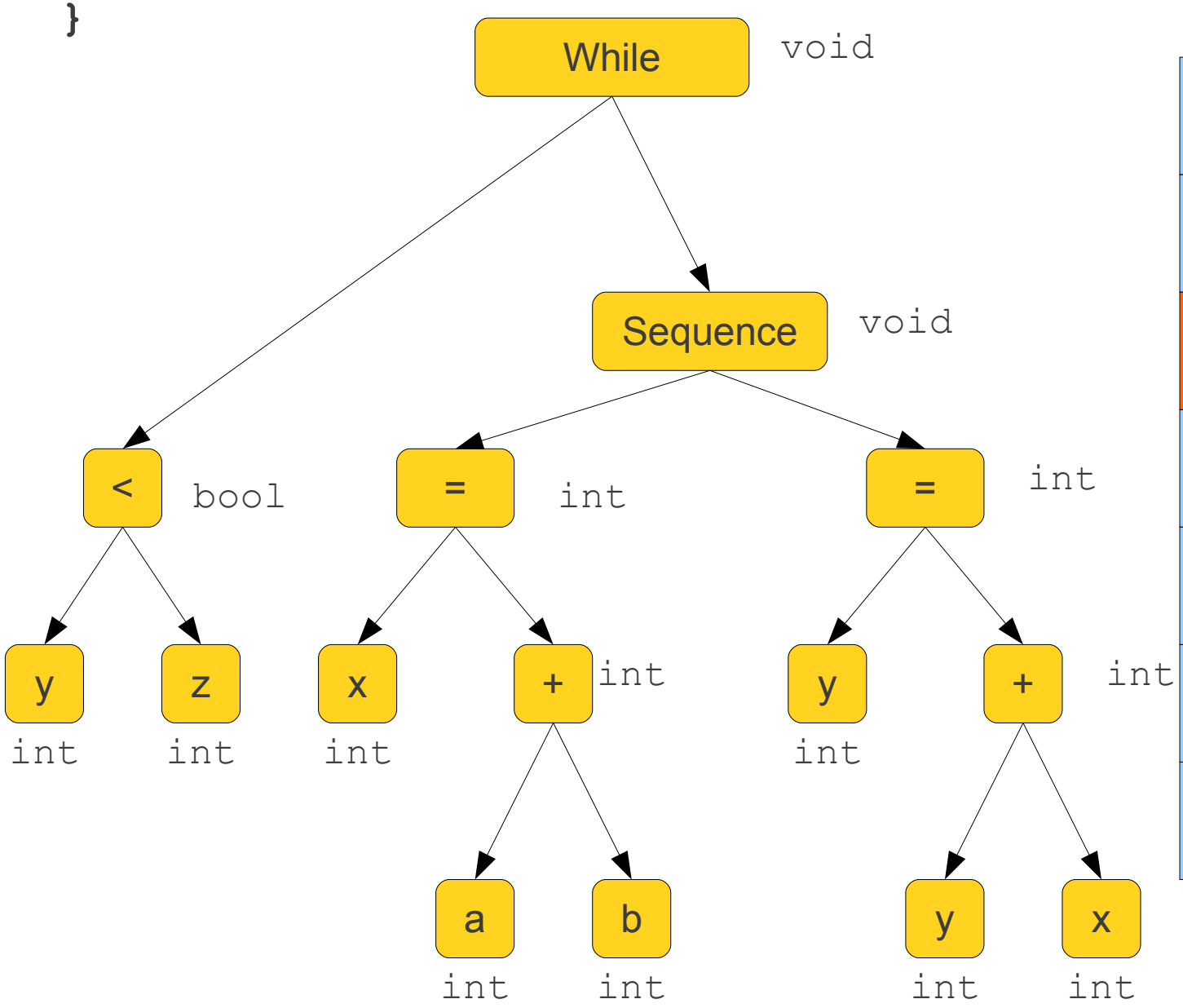

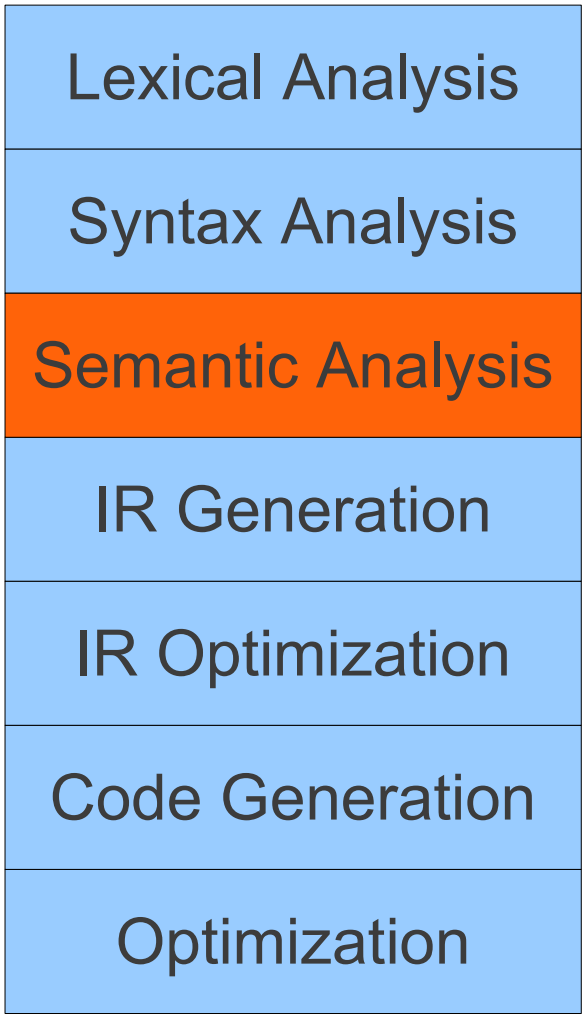

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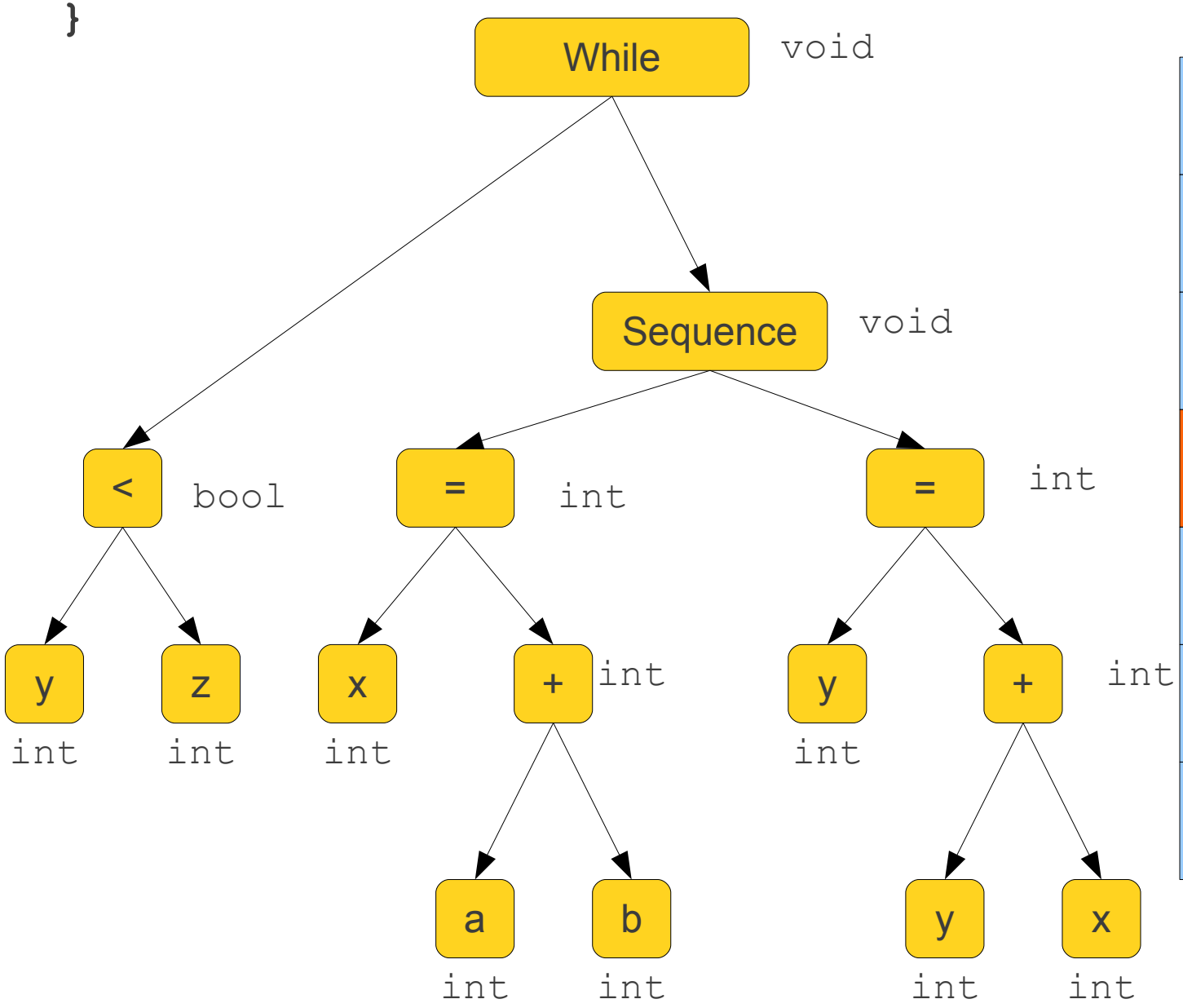

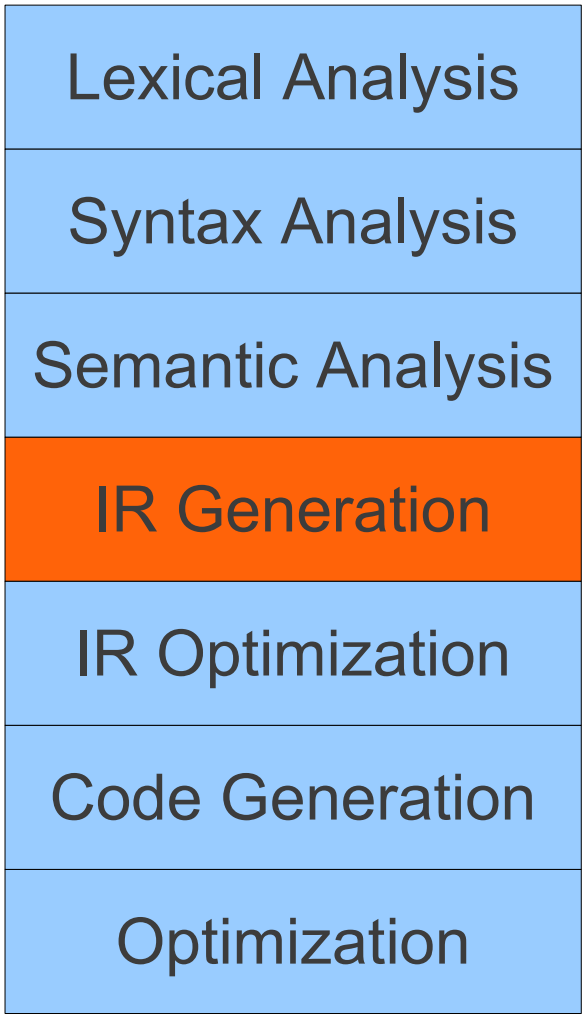

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Loop: x   = a + b
      y   = x + y
      _t1 = y < z
      if _t1 goto Loop
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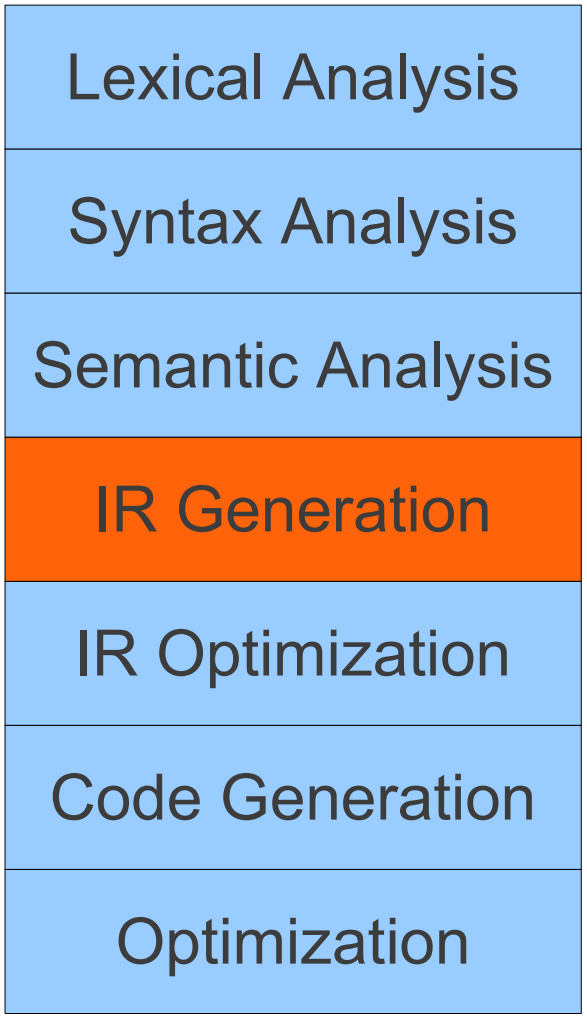

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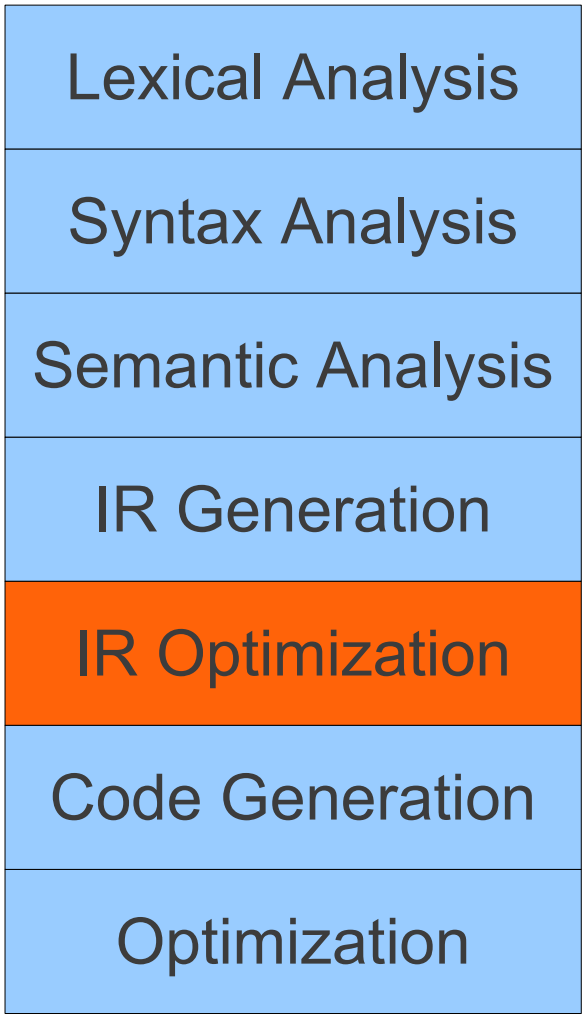

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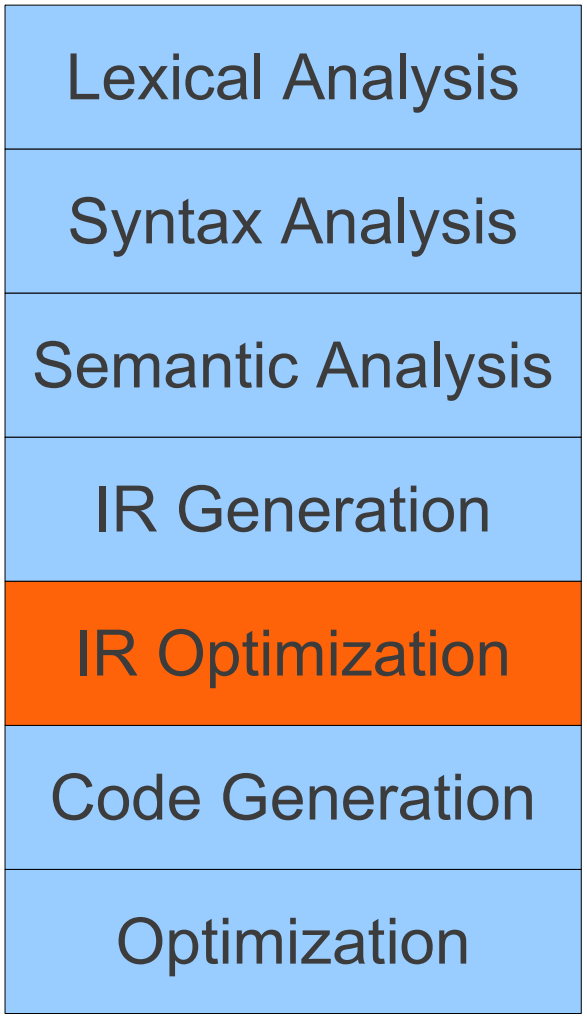

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        add $1, $2, $3
Loop:   add $4, $1, $4
        slt $6, $1, $5
        beq $6, loop
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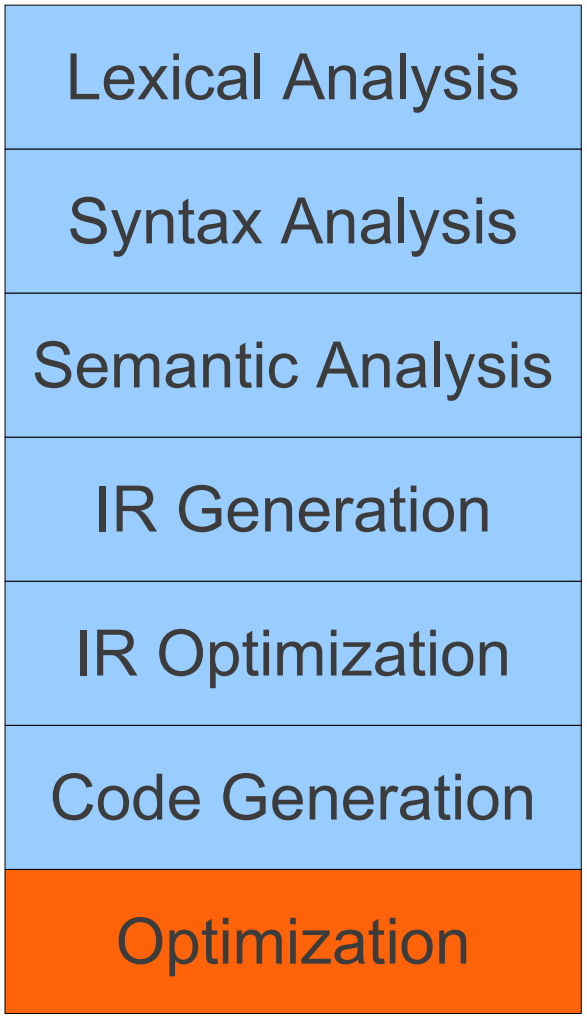

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