Compiler Optimizations and Program Analysis

Unnikrishnan C

July 31, 2019

Conteúdo

Overview

Course Overview

- Part1

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  - SSA form, CFG, Lattices, POSET, Abstract Interpretation
  - DFA theory, LLVM tutorial

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  - Some examples on the same.

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  - Introduction to Polyhedral Optimization, Optimization for cache locality
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  - Register Allocation, Instruction Selection, Runtime Environments.

Books and references

Books

Compilers: Principles, Techniques, and Tools, Alfred Aho, Monica Lam, Ravi Sethi, Jeffrey D. Ullman, Addison-Wesley; Second Edition, 2006, ISBN-13: 978-0321486813

Reference

Data Flow Analysis: Theory and Practice, Uday P. Khedker, Amitabha Sanyal, and Bageshri Karkare, CRC Press, USA (2009).

LLVM Assignment

You need to write an LLVM Pass. Tutorial available online

Overview

Comparison of Programming Languages

Gendration	Language(s)

Table: Comparison of Languages

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1^{st}	Machine Language

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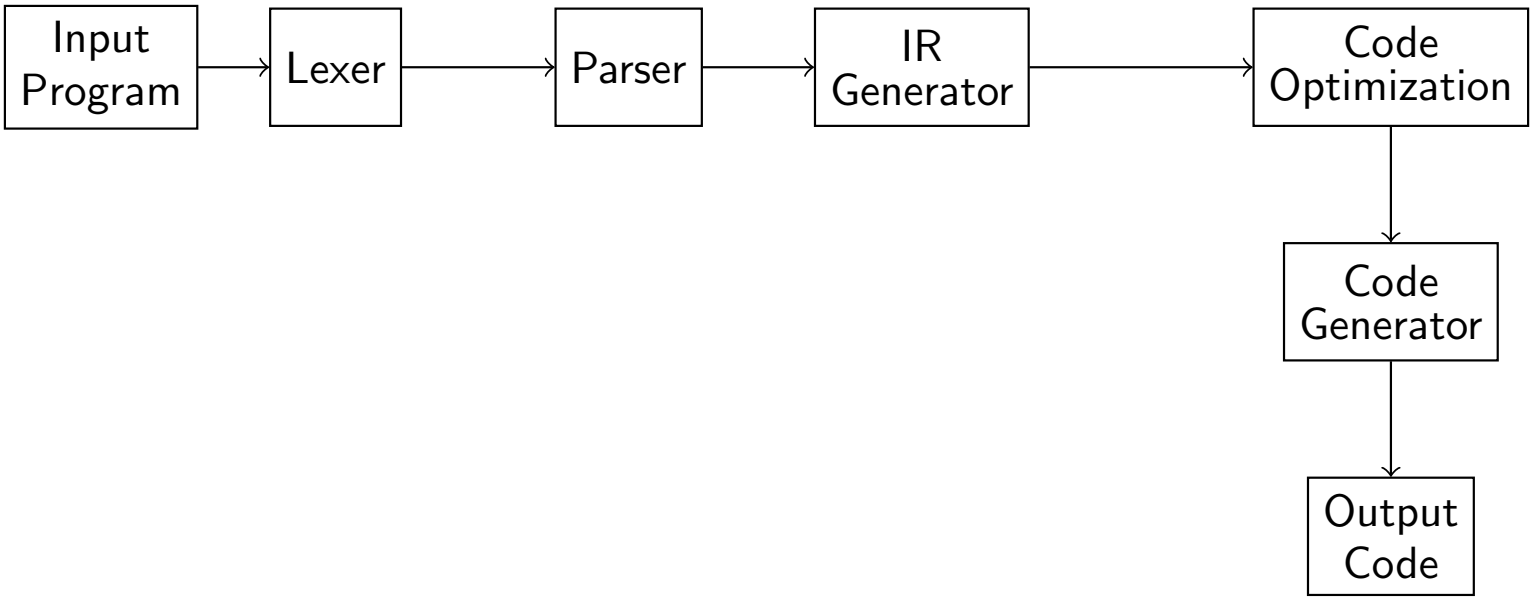
Compiler Overview



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- Code Optimization?
  - Program analysis, machine dependent and independent optimization.
- Code Generation?
  - Register Allocation, Instruction Selection.

Why Program Analysis?

Code fragment

```
main(){
    for(int i=0;i<SIZE;i++){
        .....
        if (i<0) printf( "System Crash");
        .....
    }
}
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Question

The above program will run successfully?

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Question

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Answer

only if $SIZE < 2^{(sizeof(int)*2-1)}$

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  - Year 2000 (Y2K) problem.
  - In 1996 first flight of Arian 5 launcher failed after 40 seconds.
  - Many defects get detected after product launch.

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  - Do not satisfy user requirements
  - Algorithm or Design errors.
  - Poor Performance.

- LLVM installation.

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- Install GCC from Source.

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