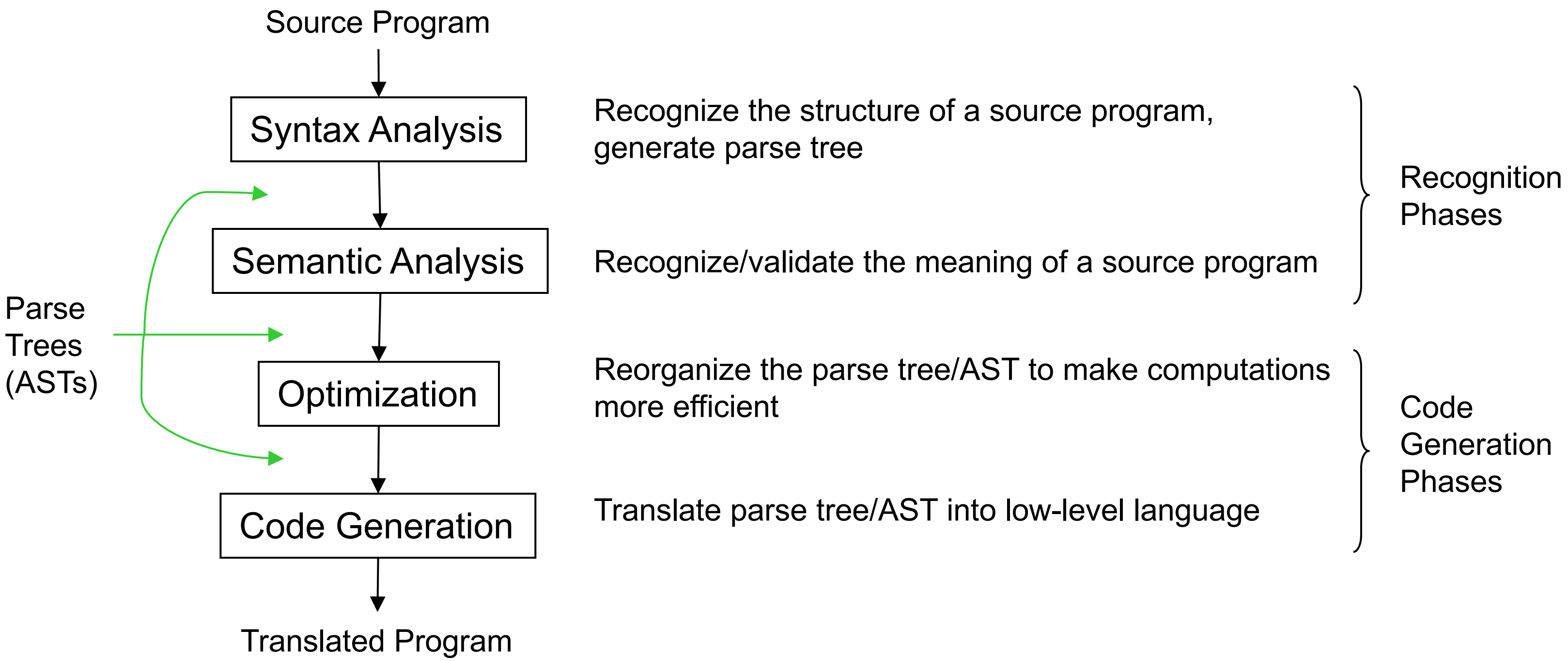
The Anatomy of a Compiler



Source Program

Syntax Analysis

Semantic Analysis

Optimization

Code Generation

Translated Program

Parse Trees (ASTs)

Recognize the structure of a source program, generate parse tree

Recognize/validate the meaning of a source program

Recognition Phases

Reorganize the parse tree/AST to make computations more efficient

Translate parse tree/AST into low-level language

Code Generation Phases

Observations:

-Language definitions have two parts: syntax and semantics

-Compilers have two phases which deal with each of these language definition components: syntax analysis, semantic analysis.

Compilation Example

Translating a C-like language to assembly language

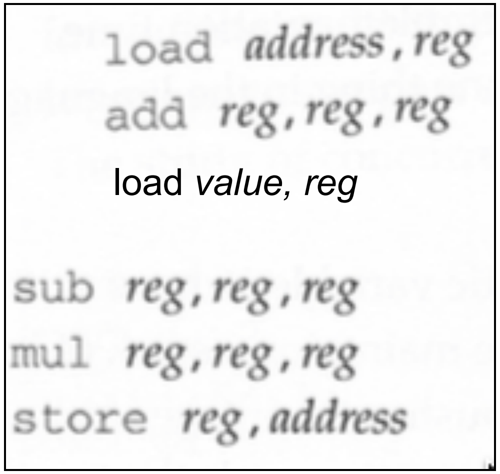
```
int i;

void main () {
   for (i = 1; i <= 100; i++)
       fred(i);
}
```

```
         ...
i:       data word 0
main:    move 1 to i
L1:      compare i with 100
         jump to L2 if greater
         push i
         call fred
         add 1 to i
         goto L1
L2:      return
fred:    ...
```

Compilation Example

Assembly Language



load *address*, *reg*

add *reg*, *reg*, *reg*

load *value, reg*

sub *reg*, *reg*, *reg*

mul *reg*, *reg*, *reg*

store *reg*, *address*

Three registers: *r1, r2, r3*

consider: 3*2+5

Assembly Code:

load 3,r1
load 2,r2
mul r1,r2,r1
load 5,r2
add r1,r2,r1

Assignments

- Read chap 4
- HW #3 – see the website