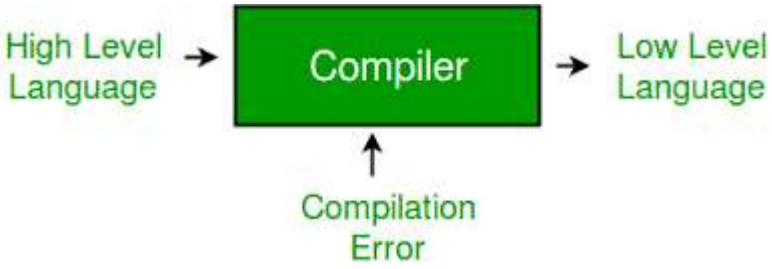
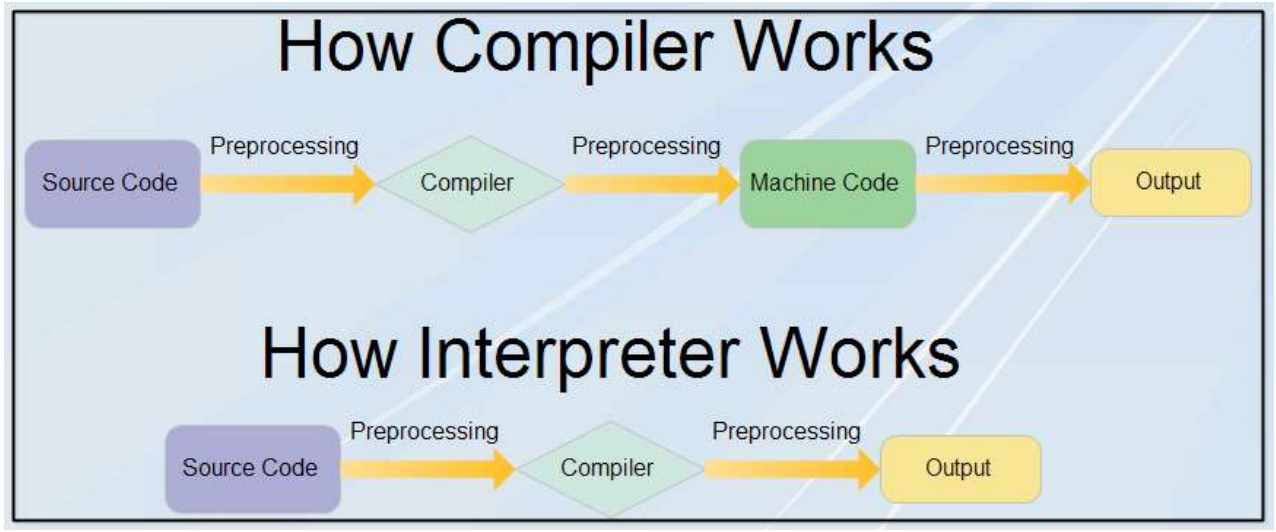
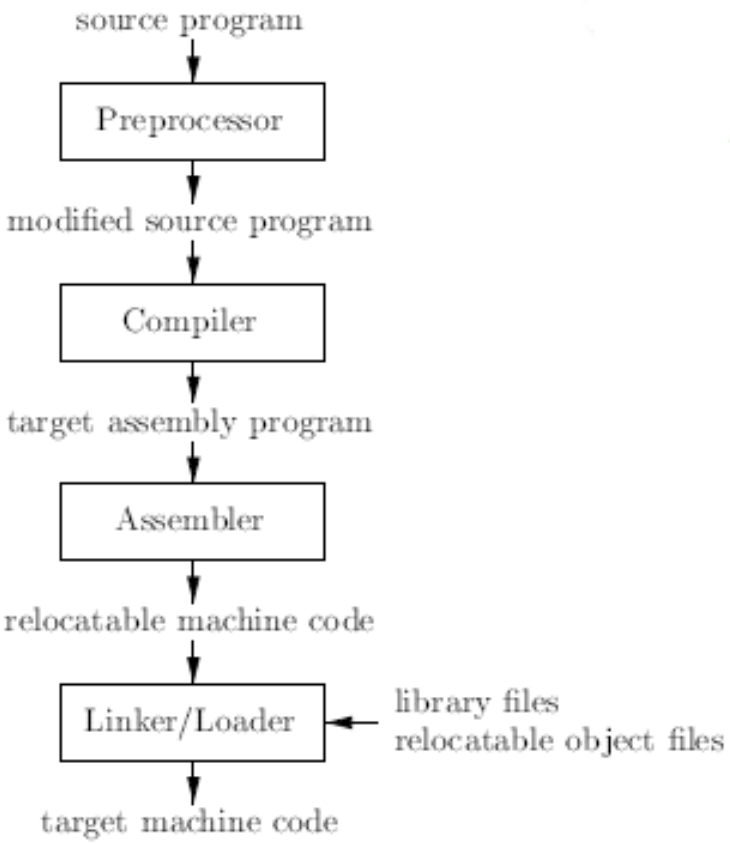
# UNIT II – Compiler & Lexical Analysis

- System Software
  - Compiler
  - Interpreter



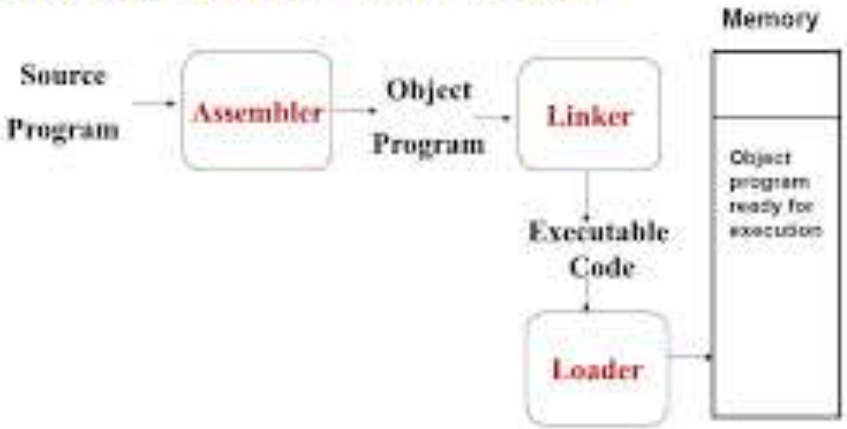



# Cousins of Compiler/language processing system





## Role of Loader and Linker



# Example

*High level language*

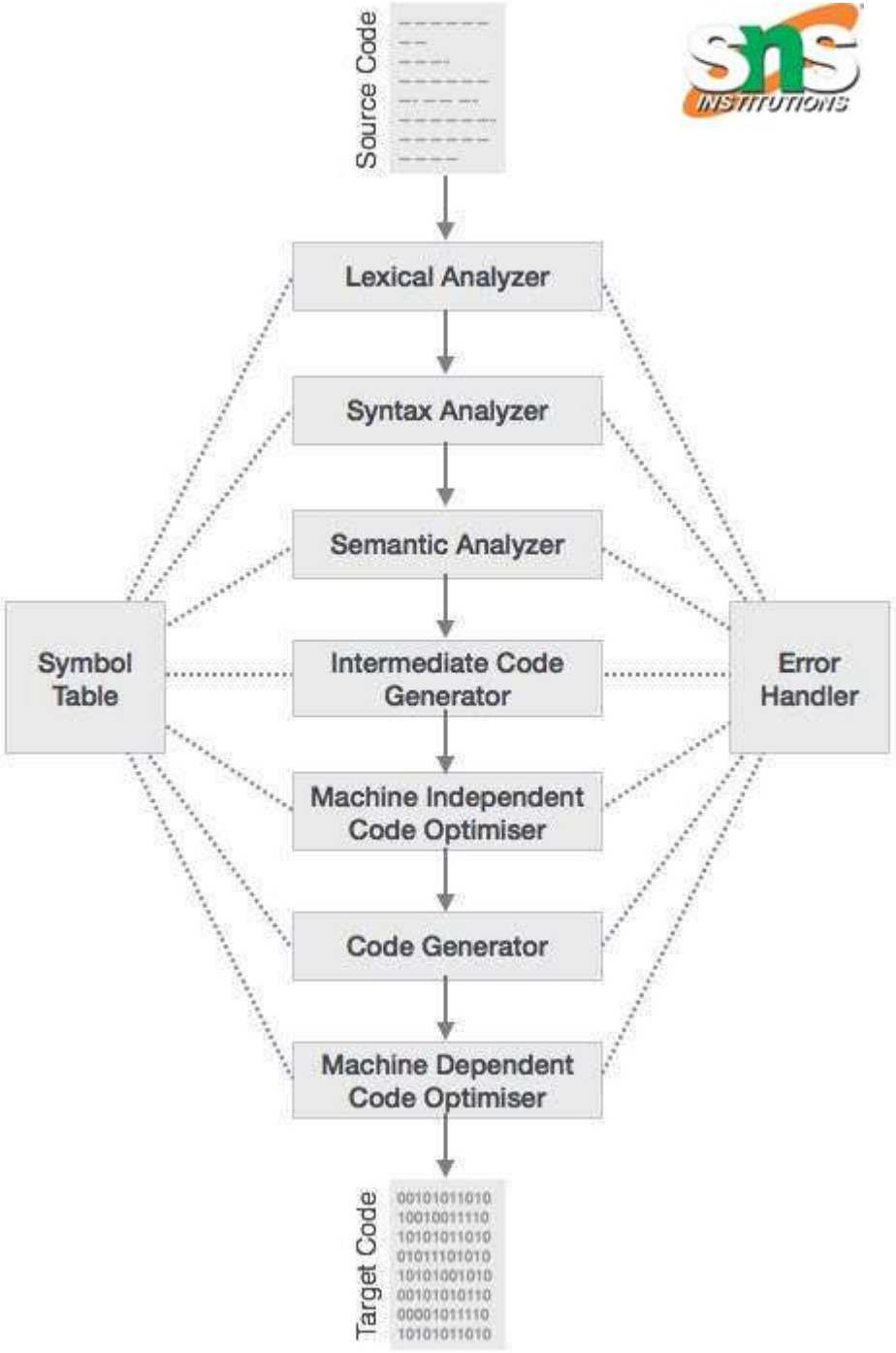
```
#include<stdio.h>
#define a 10
main()
{
int a,b=20,c;
c=a+b;
printf("\n Add is %d", c);
}
```

*Assembly language*

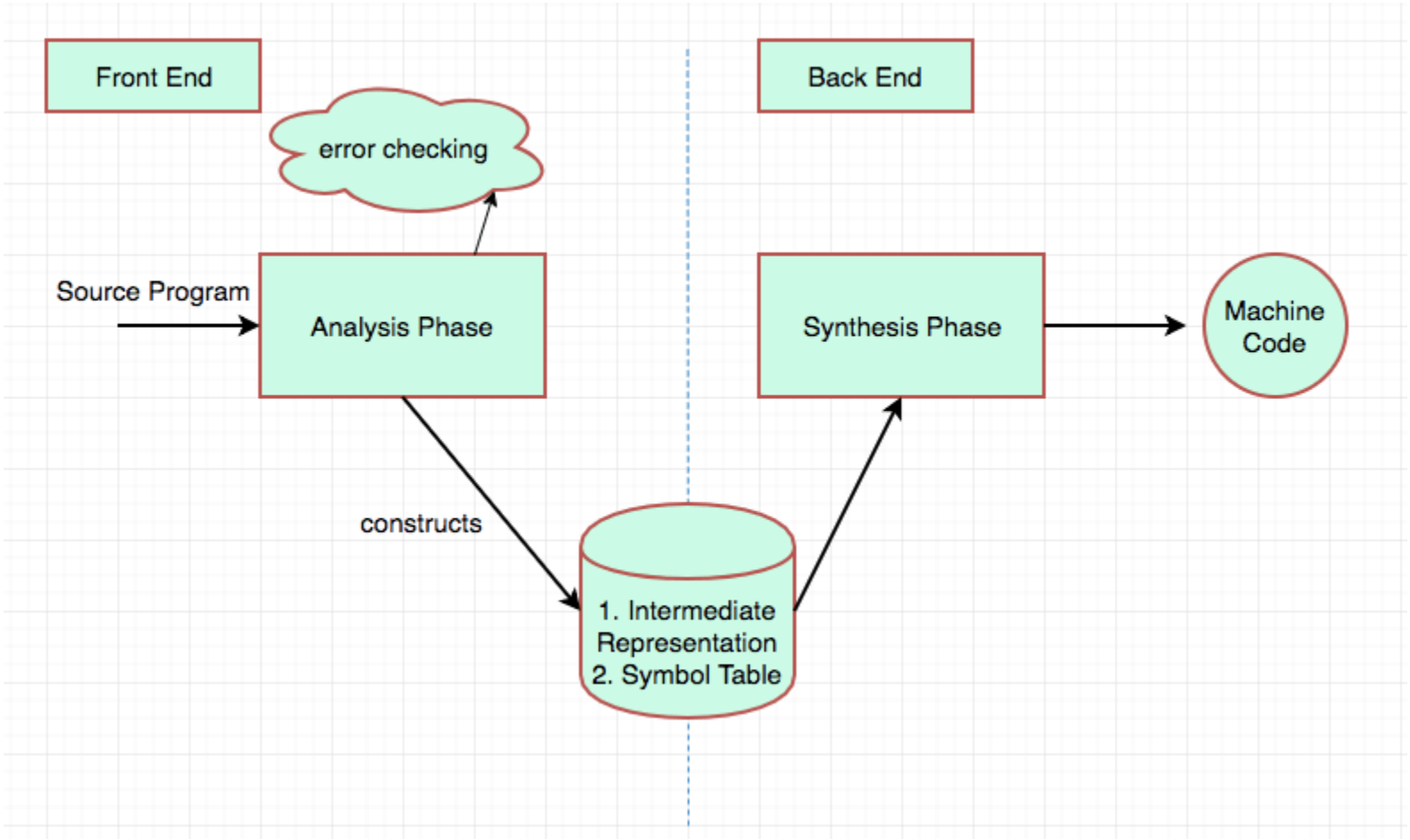
```
A 10
B 20
C=A+B
Display C
```

# Phases of Compiler

- COMPILING – 2 phases
  - Analysis (front – end)
    - Grammatical Structure
    - Intermediate code
    - Symbol table
  - Synthesis (back - end)
    - Target program



# Phases of Compiler – Analysis and Synthesis



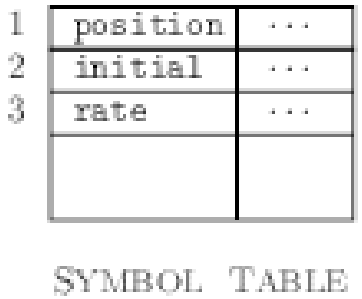
# *Lexical Analyzer/ scanning*

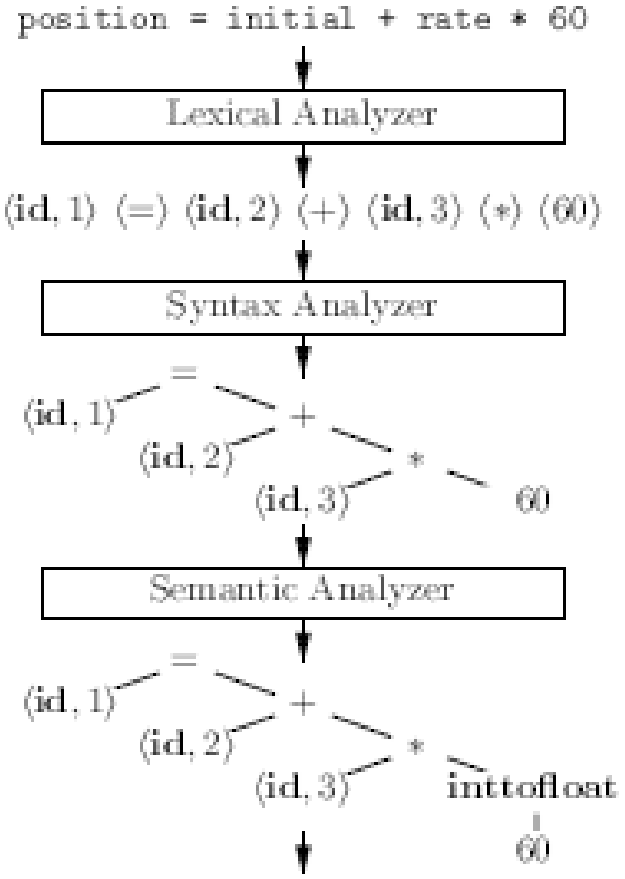
- Text scanner
- Source code → stream of characters → meaningful sequence (lexemes)
- Lexeme → token → ***<token-name, attribute-value>***
- Example
- Position=initial + rate*60
- Sequence of tokens
- <id,1><=><id,2><+><id,3><*><60>

| | |
|---|---|
| Position | <id, 1> |
| = | <=> |
| Initial | <id, 2> |
| + | <+> |
| Rate | <id, 3> |
| * | <*> |
| 60 | <60> |

# *Syntax Analysis / parsing*

- Intermediate representation – tree – syntax tree
- Intermediate node →operation
- Child node→ arguments



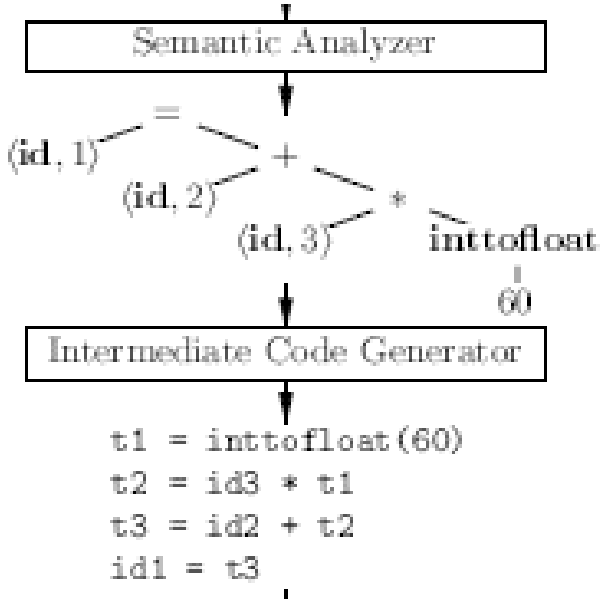



# *Semantic Analysis*

- Sematic Analysis
  - Intermediate representation
  - Symbol table
  - Semantic consistency of source program
  - ***Type checking***
  - Language specification → type conversion (coercions)
  - Example
    - Position, initial, rate ← floating point
    - 60 ← inttofloat

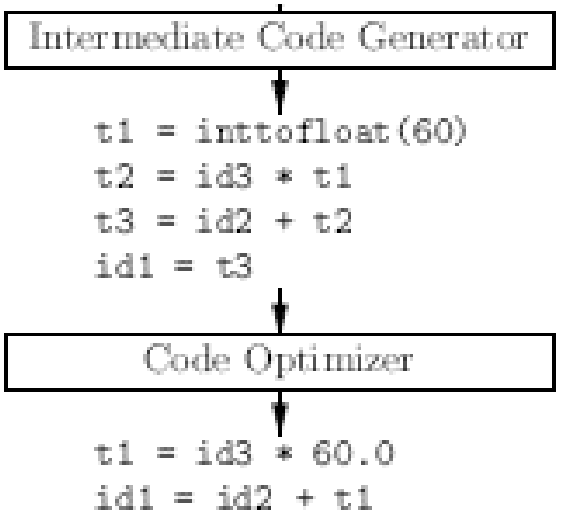
# *Intermediate code generation*

- Low-level/ machine-like intermediate representation



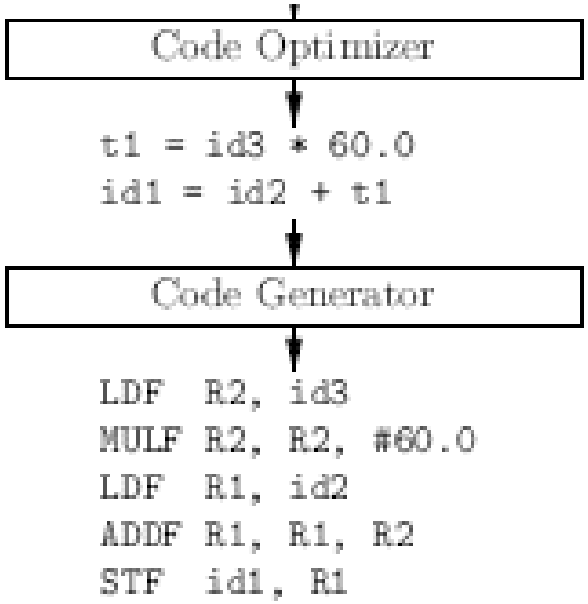
# *Code optimization*

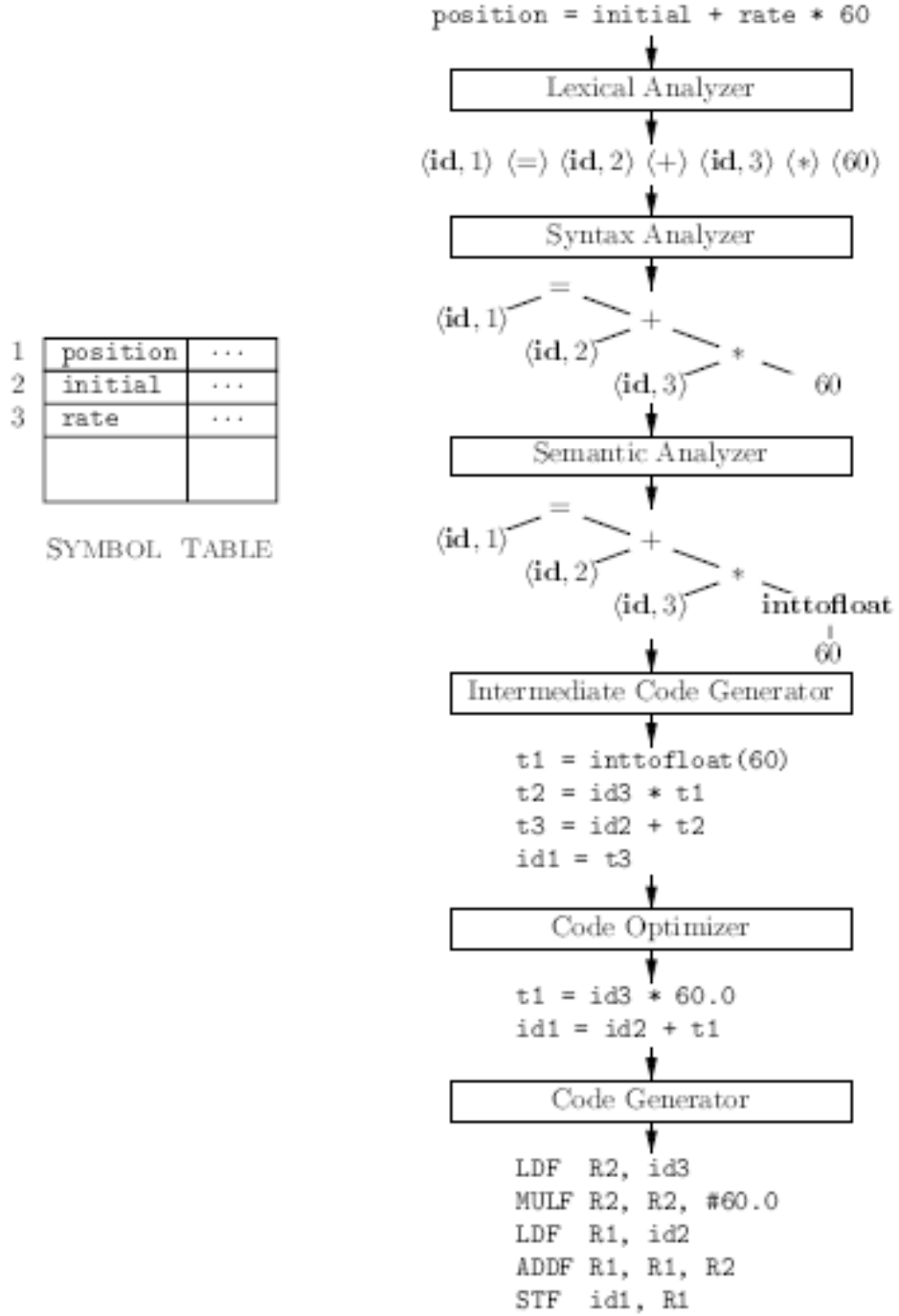
- Improves the intermediate representation to enhance the target code generation
- ***Good target code***
- Code generation
  - Each operator → single instruction
- Code optimization
  - inttofloat ← compile time (60 → 60.0)
  - Assignment operation



# Code generation

- Target code (for each variable)
  - Registers
  - Memory location
  - *LDF (load floating point value)*
- Example
- Position=initial + rate*60
- Sequence of tokens
- <id,1><=><id,2><+><id,3><*><60>
  - *R2=RATE =ID3=2.0*
  - *R2=120.0*
  - *R1=INTIAL = 5.0*
  - *R1=125.0 ← POSITION ←ID1*






| | | |
|---|---|---|
| 1 | position | ··· |
| 2 | initial | ··· |
| 3 | rate | ··· |
| | | |

SYMBOL TABLE

# *Grouping of phases into passes*

- One pass
  - Lexical analysis
  - Syntax analysis
  - Semantic analysis
  - Intermediate code generation
- Pass → Code optimization (optional)
- Pass →Code generation