CS & IT ENGINEERING

compiler Design

Lexical Analysis & Syntax Analysis

Lecture No. 1

By- DEVA Sir

01 Introduction

02 → Compiler ?

03 → Phases of a Compiler ?

04 → Language Translation

05

Compiler Design

* ① Lexical Analysis

*** ② Syntax Analysis (parsing)

** ③ Syntax Directed Translations

* ④ Intermediate code

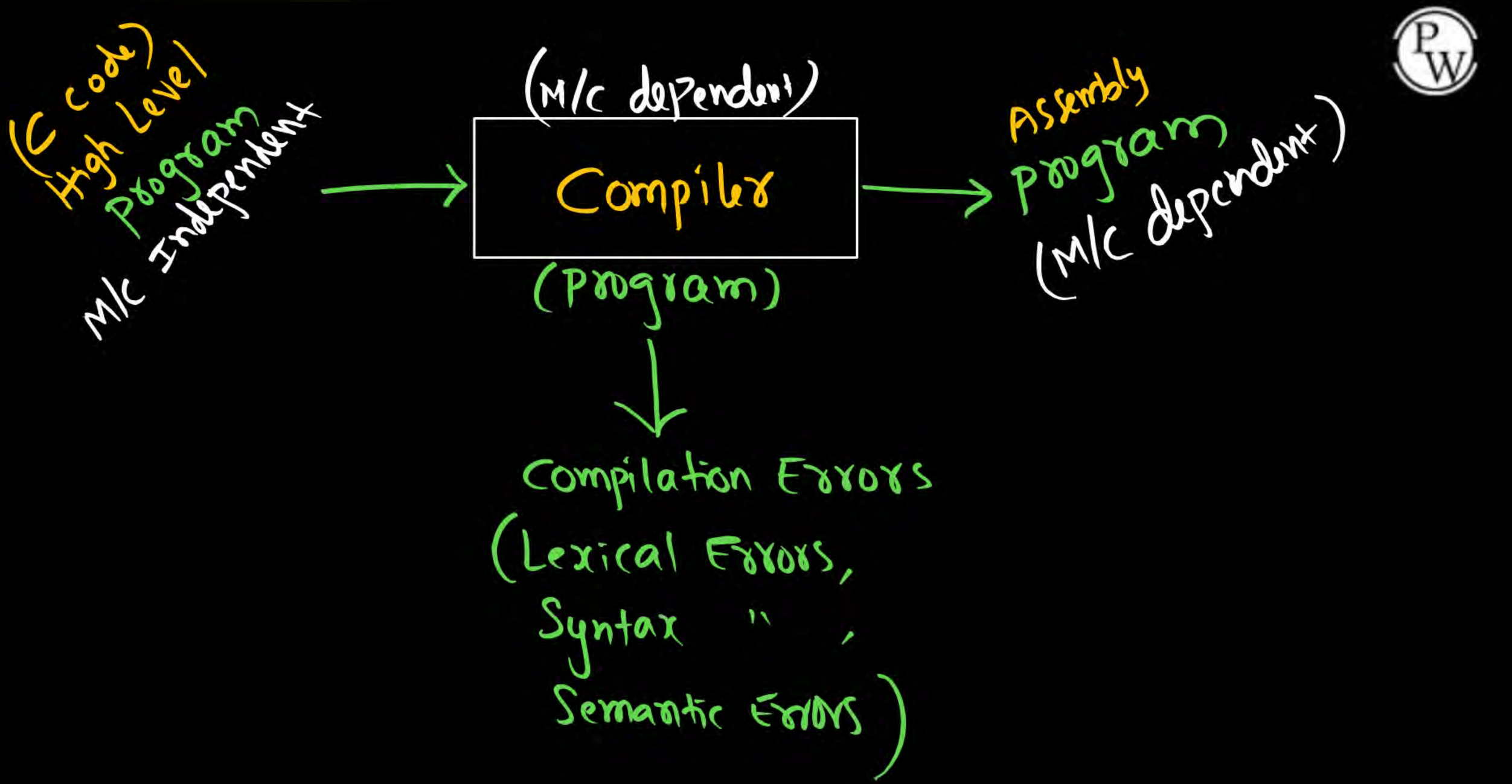
*** ⑤ Code optimization

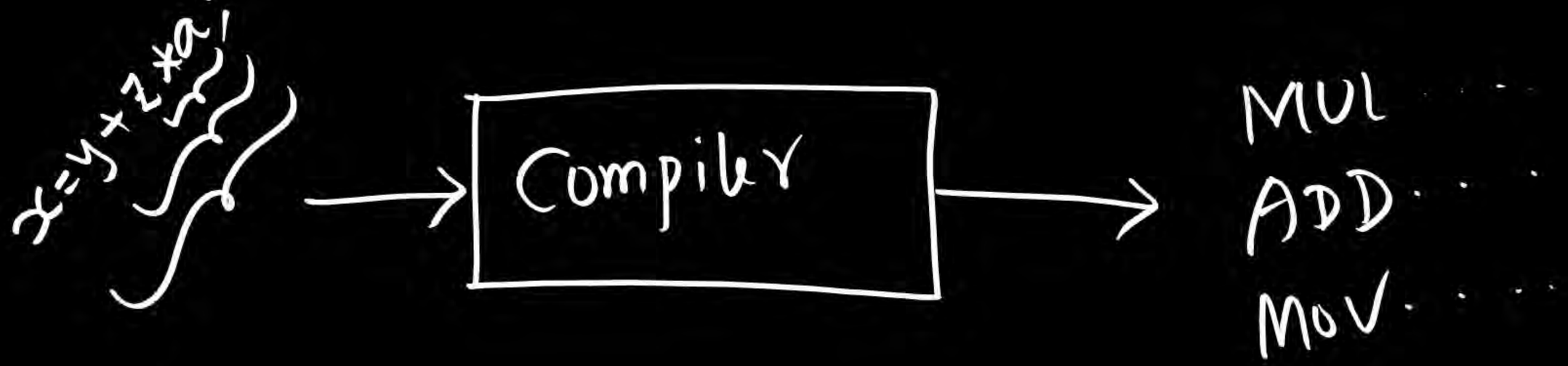
Weightage: 5M-7M

Textbook: Not required

Introduction :

Q1) What is Compiler ?


(C code)
High Level
Program
M/c Independent
(M/c dependent)
Compiler
(Program)
Assembly
Program
(M/c dependent)
Compilation Errors
(Lexical Errors,
Syntax "
Semantic Errors)


x=y+z*a;
Compiler
MUL
ADD
MOV

M/C Independent

- C
- C++
- Java

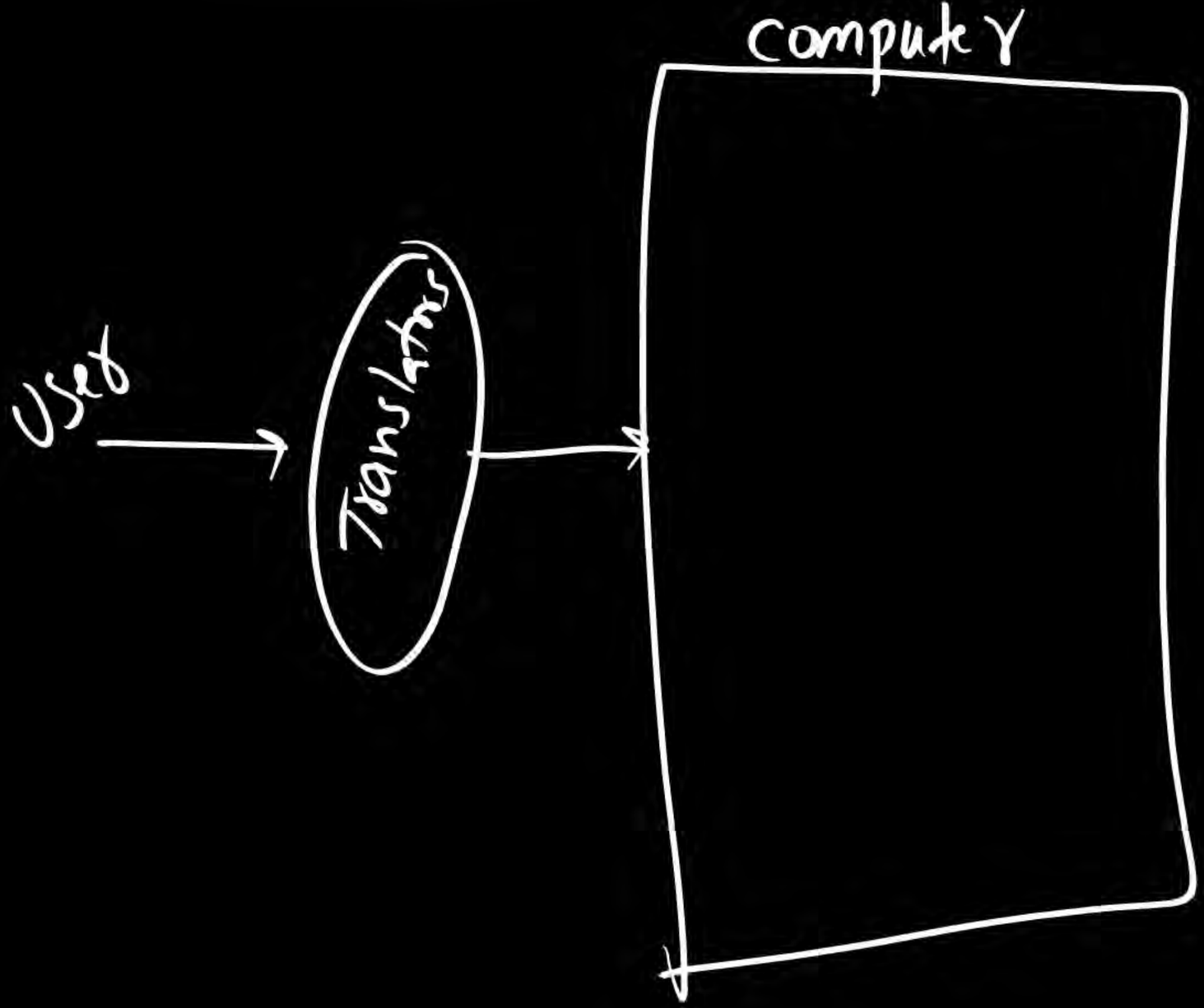
} High Level

- Intermediate code

} Intermediate

M/C Dependent

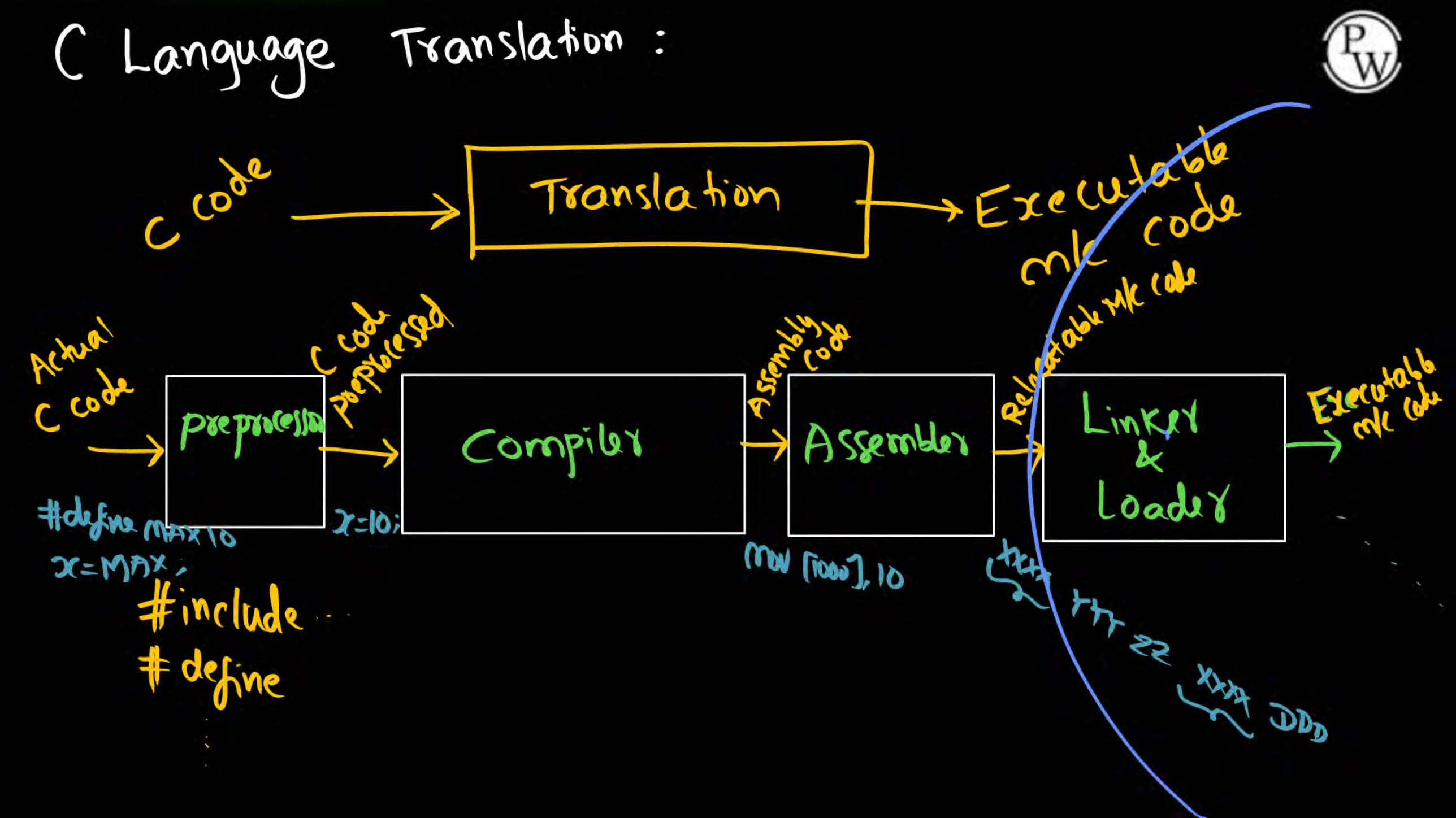
- Assembly code
- M/C code


Computer
User
Translator

Compiler

- It is Translator
- It translates HLL to LLL
- It can produce compilation errors if any

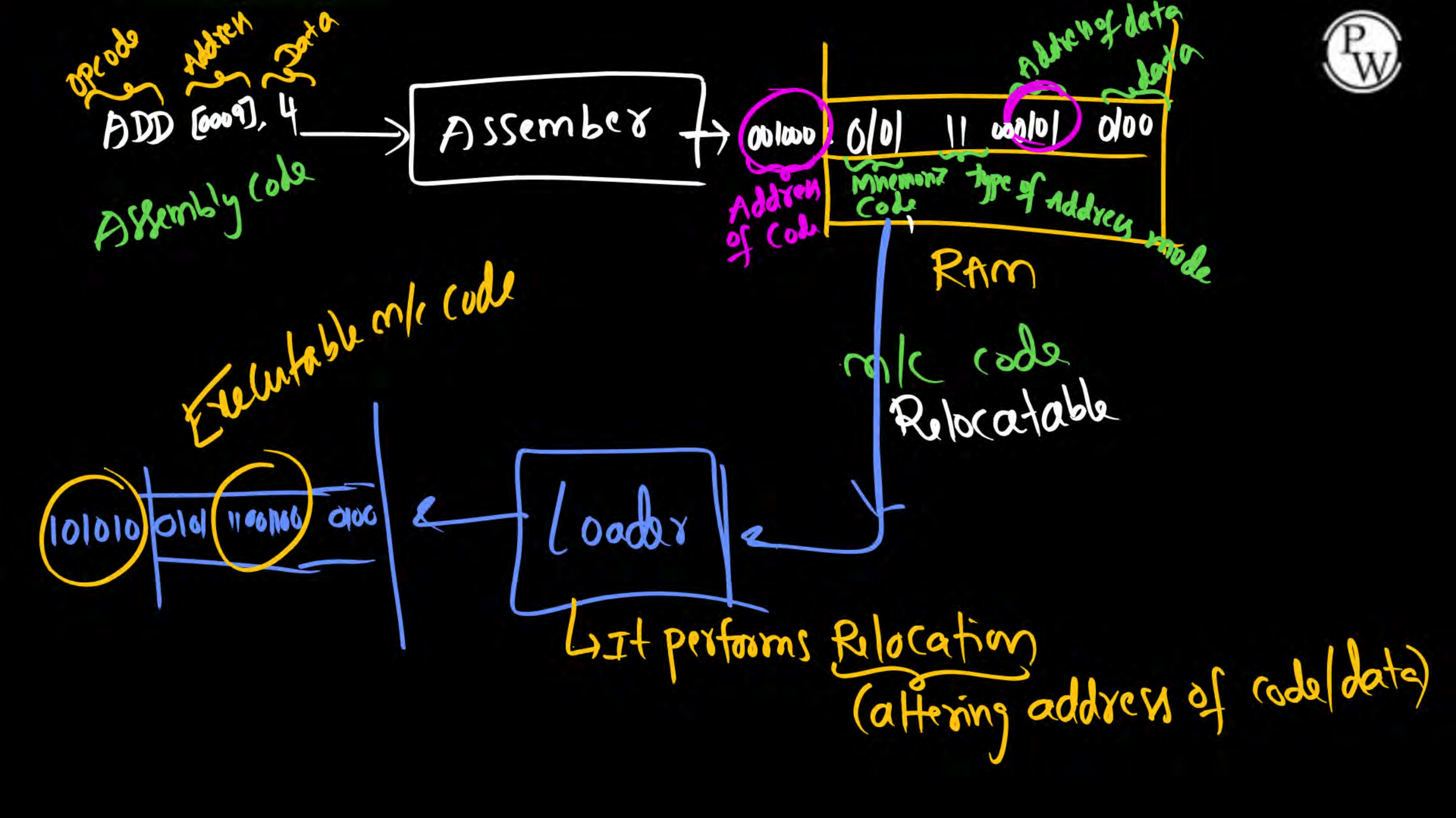
C Language Translation :



```
#include<stdio.h>
#define MAX 10
main()
{
   int x = MAX;
   printf("%d", x);
}
```


```
XXXX
main()
{
  int x = 10;
  printf("%d", x);
}
```

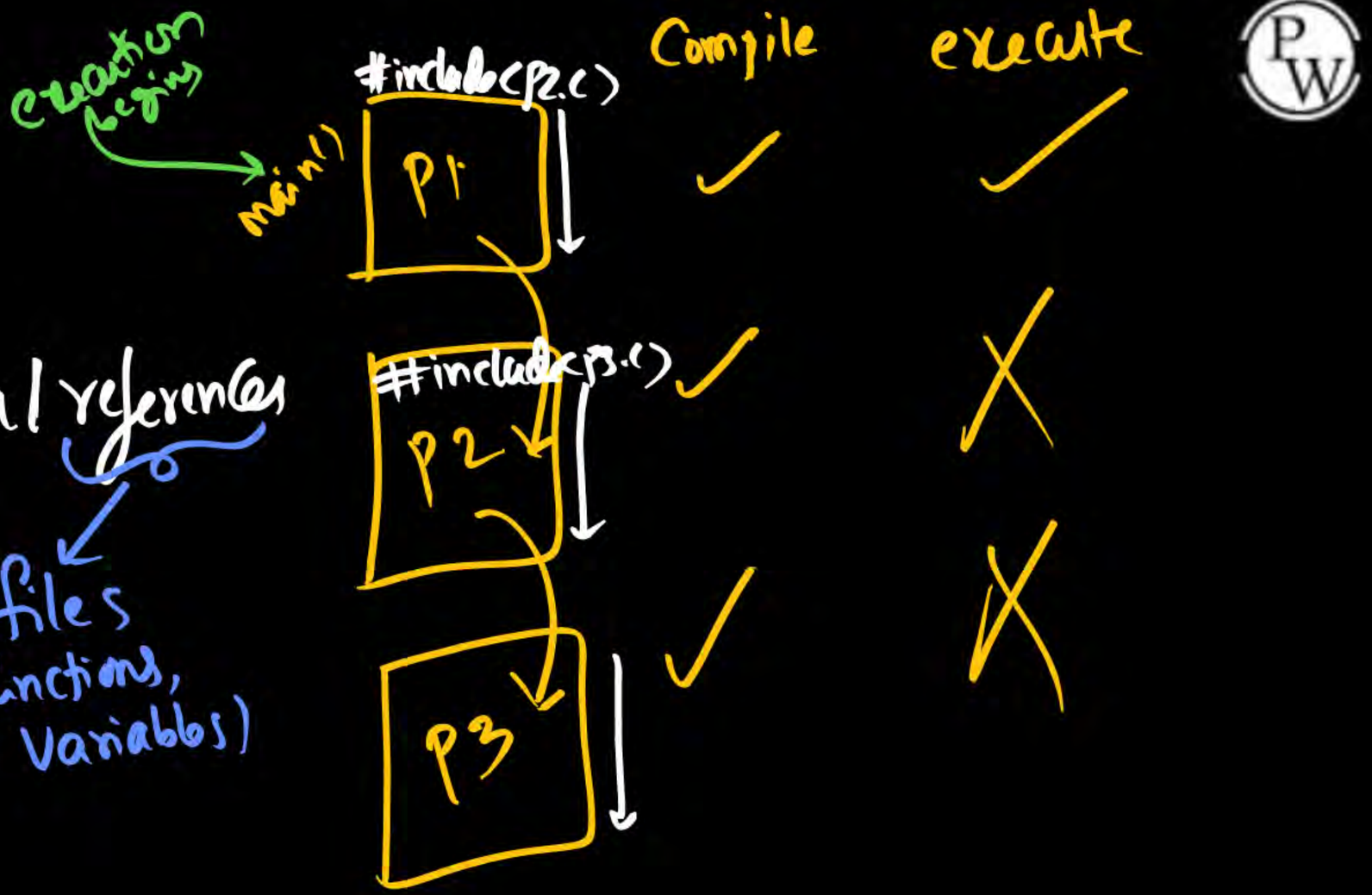
Any statement begin with #


Opcode
Address
Data
ADD [0009], 4
Assembly code
Assembler
001000 0101 11 000101 0100
Address of data
data
Address of code
Mnemonic code
Type of addressing mode
RAM
m/c code
Relocatable
Executable m/c code
101010 0101 11000100 0100
Loader
It performs Relocation
(altering address of code/data)

Linker :

→ It resolves all external references

→ files (functions, variables)



Q1) What is preprocessor ? (Translates every preprocessors statement)
- File inclusion #include
- Macros : #define

Q2) What is Compiler ? (Translates HLL to LLL)

Q3) What is Assembler ? (Translates Assembly code to M/C code)

Q4) What is Linker ? (It links all required modules by resolving all external references)

Q5) What is Loader ? (It relocates the address of code/data)

Compiler Basics:

1) Phases of a Compiler

2) Symbol Table

3) Types of Errors

Compiler phases :

↳ 7 phases

phase 1 : Lexical Analysis

phase 2 : Syntax "

phase 3 : Semantic "

phase 4 : Intermediate code Generation

phase 5 : Intermediate code optimization

phase 6 : Code Generator

phase 7 : Assembly code optimization

***

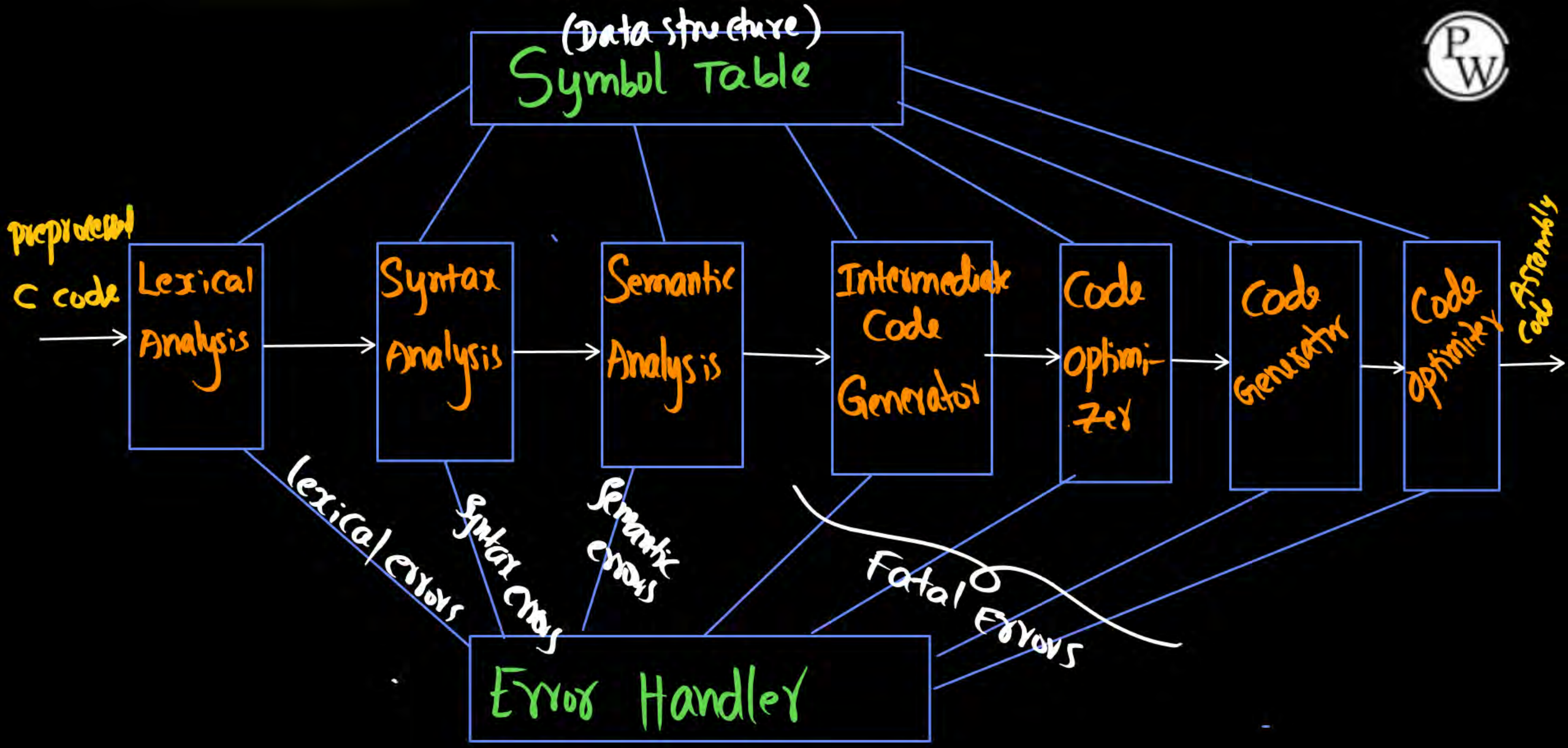
1 pass Compiler

2 pass Compiler

3 pass Compiler

4 pass Compiler

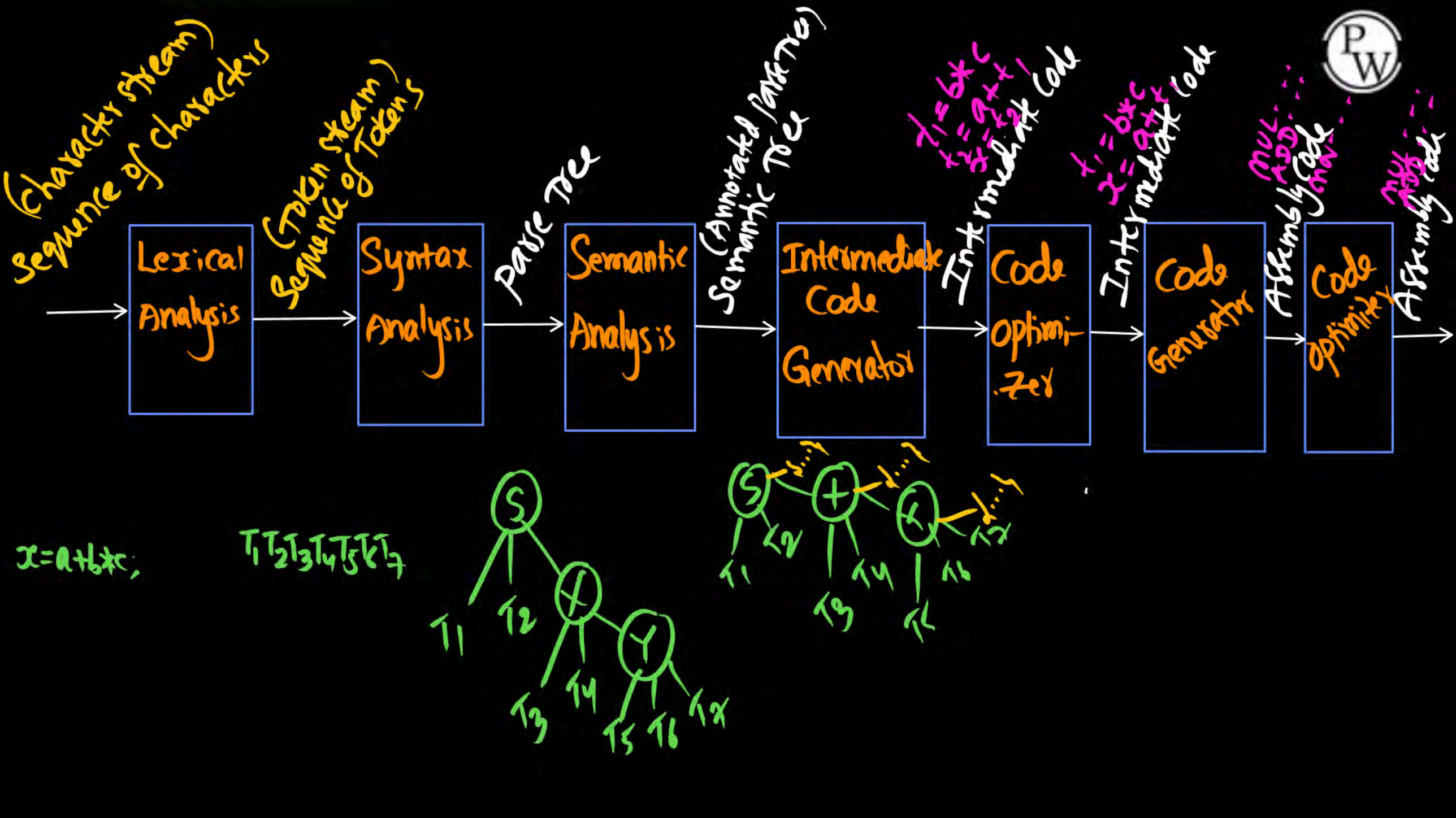
⋮

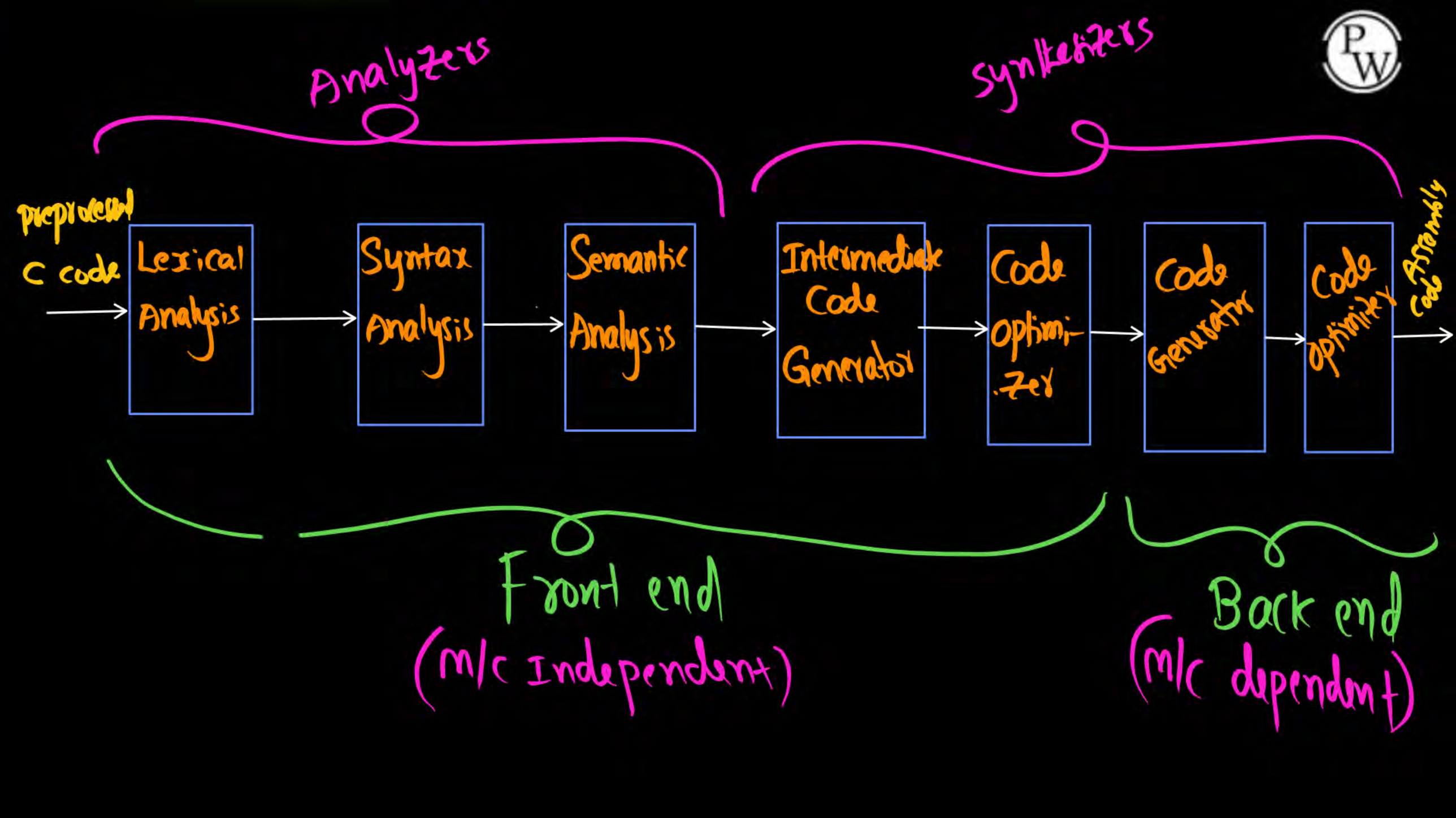

(Data structure)
Symbol Table
preprocessed
C code
Lexical Analysis
Syntax Analysis
Semantic Analysis
Intermediate Code Generator
Code optimi-zer
Code Generator
Code optimizer
Lexical errors
Syntax errors
Semantic errors
Fatal Errors
Error Handler

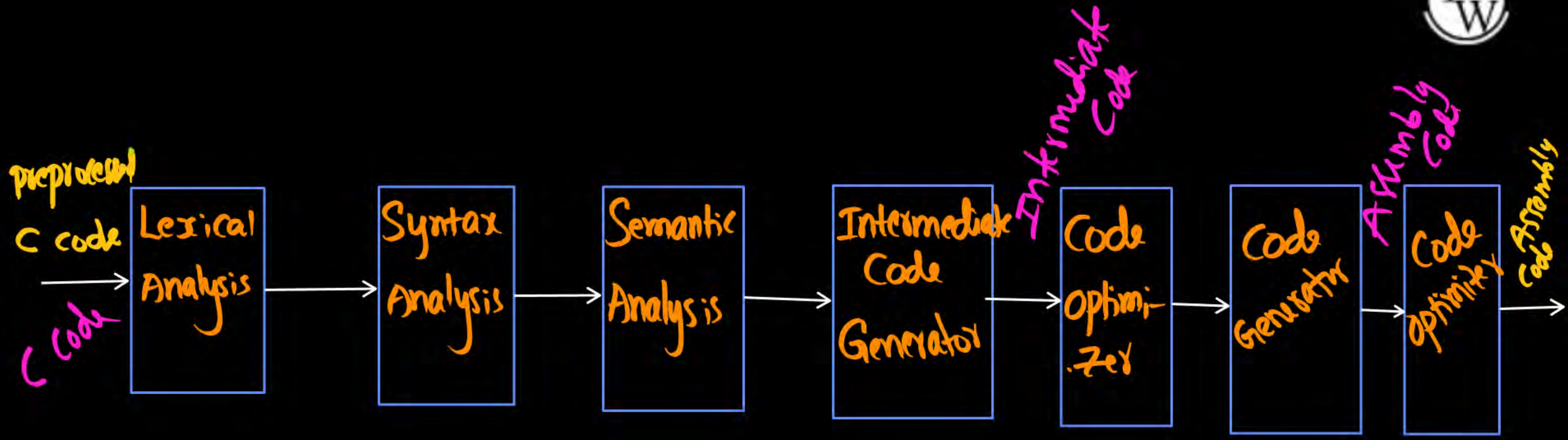
I) All phases of compiler can access/modify Symbol Table

II) Compilation Errors

↳ 1) Lexical
2) Syntax
3) Semantic


(Character stream)
Sequence of characters
Lexical Analysis
(Token stream)
Sequence of Tokens
Syntax Analysis
Parse Tree
Semantic Analysis
(Annotated parse tree)
Semantic Tree
Intermediate Code Generator
Intermediate code
Code optimizer
Intermediate code
Code Generator
Assembly code
Code optimizer
Assembly code
x=a+b*c;
T1 T2 T3 T4 T5 T6 T7
S
+
*
T1
T2
T3
T4
T5
T6
T7


Analyzers
Synthesizers
preprocessed
C code
Lexical Analysis
Syntax Analysis
Semantic Analysis
Intermediate Code Generator
Code optimi-zer
Code Generator
Code optimizer
Code Assembly
Front end
(m/c Independent)
Back end
(m/c dependent)


preprocessed
C code
C Code
Lexical Analysis
Syntax Analysis
Semantic Analysis
Intermediate Code Generator
Intermediate Code
Code optimizer
Code Generator
Assembly Code
Code optimizer
Code Assembly

C code

I code

} M/c Indendent codes

A code

M code

} M/c Dependent code

I am student

Topic

- Words ✓ (lexical)
- Definition ✓ (syntax)
- Examples ✓ (meaning)
- Problems ✓

Lexical: I ✓ am ✓ student

Syntax: S+V+O ✓

Semantic: meaning ✓

Q1) one compiler

one M/c

one High Level program

If 1 HLL required to compile on one M/c,

How many phases of compiler required?

= 7

(Q2) One compiler

Two M/Cs

One High Level program

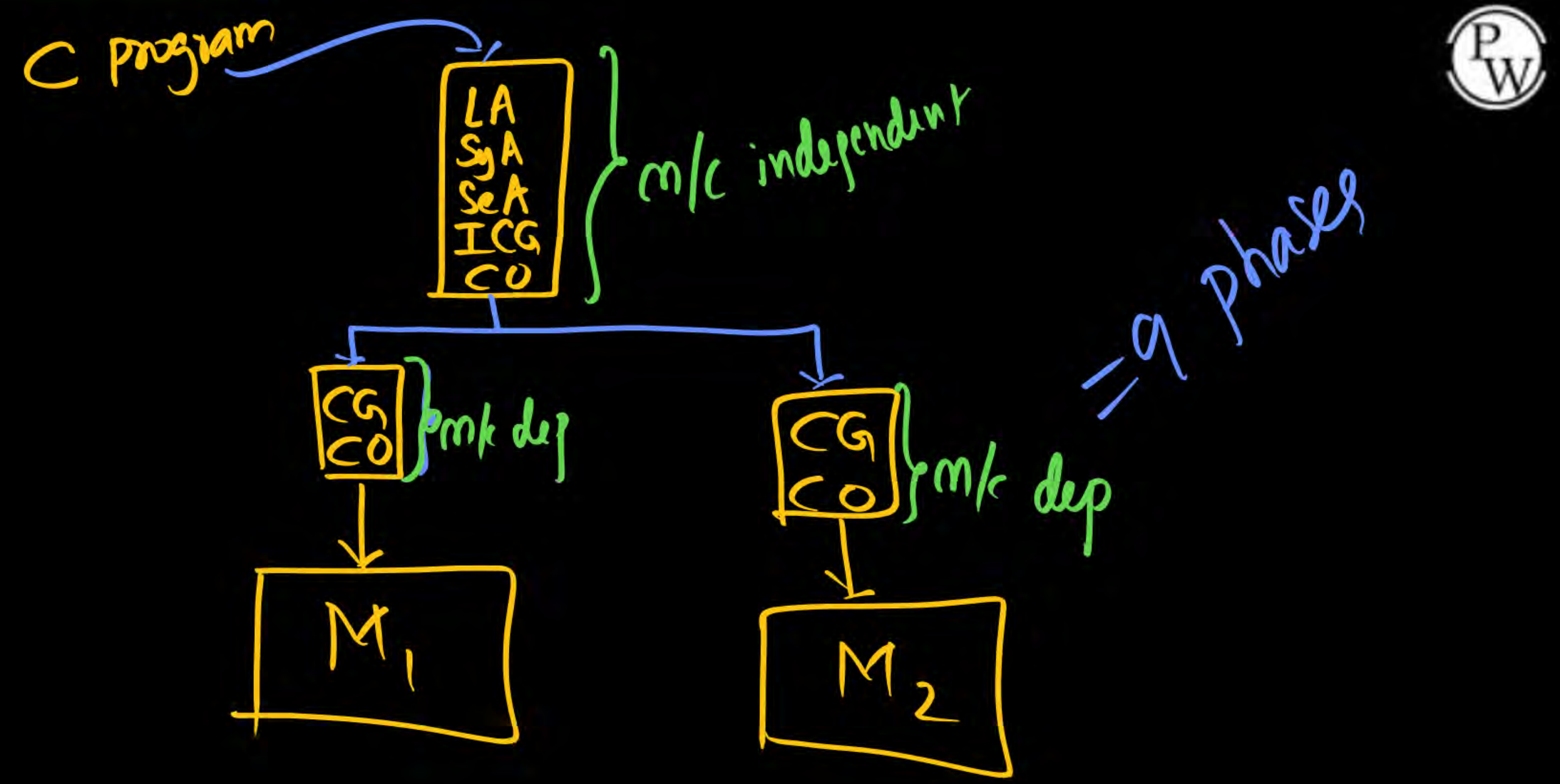
Best Answer

If 1 HLL required to compile on $2^{(n)}$ machines,

How many phases ?

$= 5 + 2 * 2^{(n)}$

$= 9$


C program
LA
Sy A
Se A
I CG
C O
m/c independent
CG
CO
m/c dep
CG
CO
m/c dep
M1
M2
=9 phases

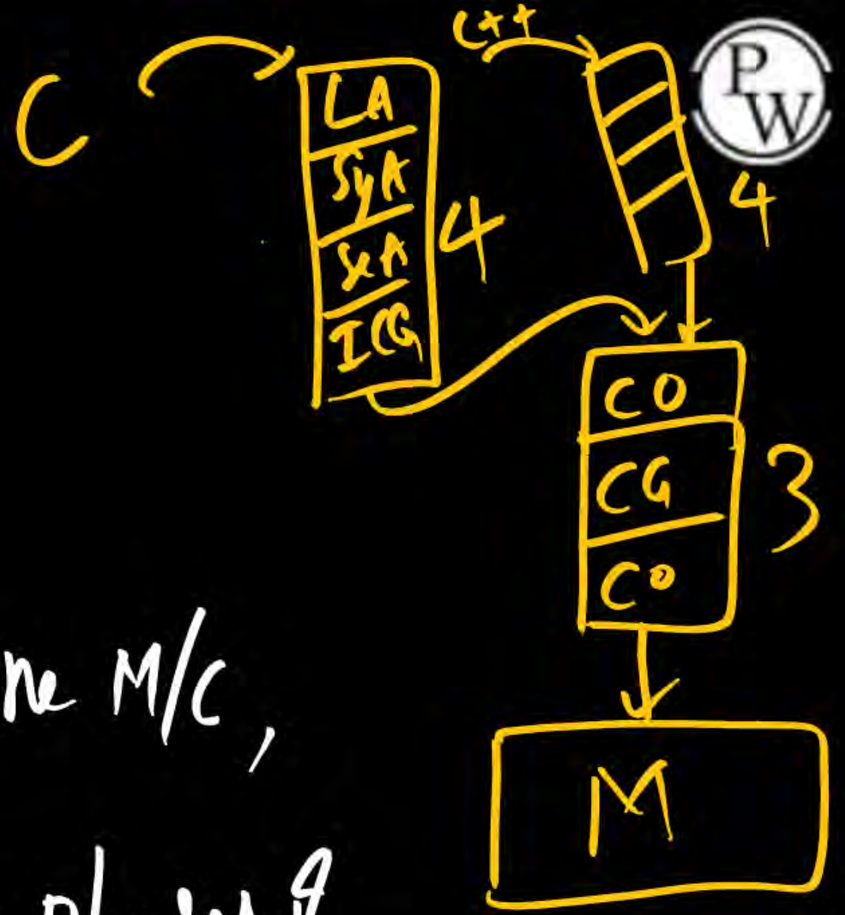
Q3)

one M/c

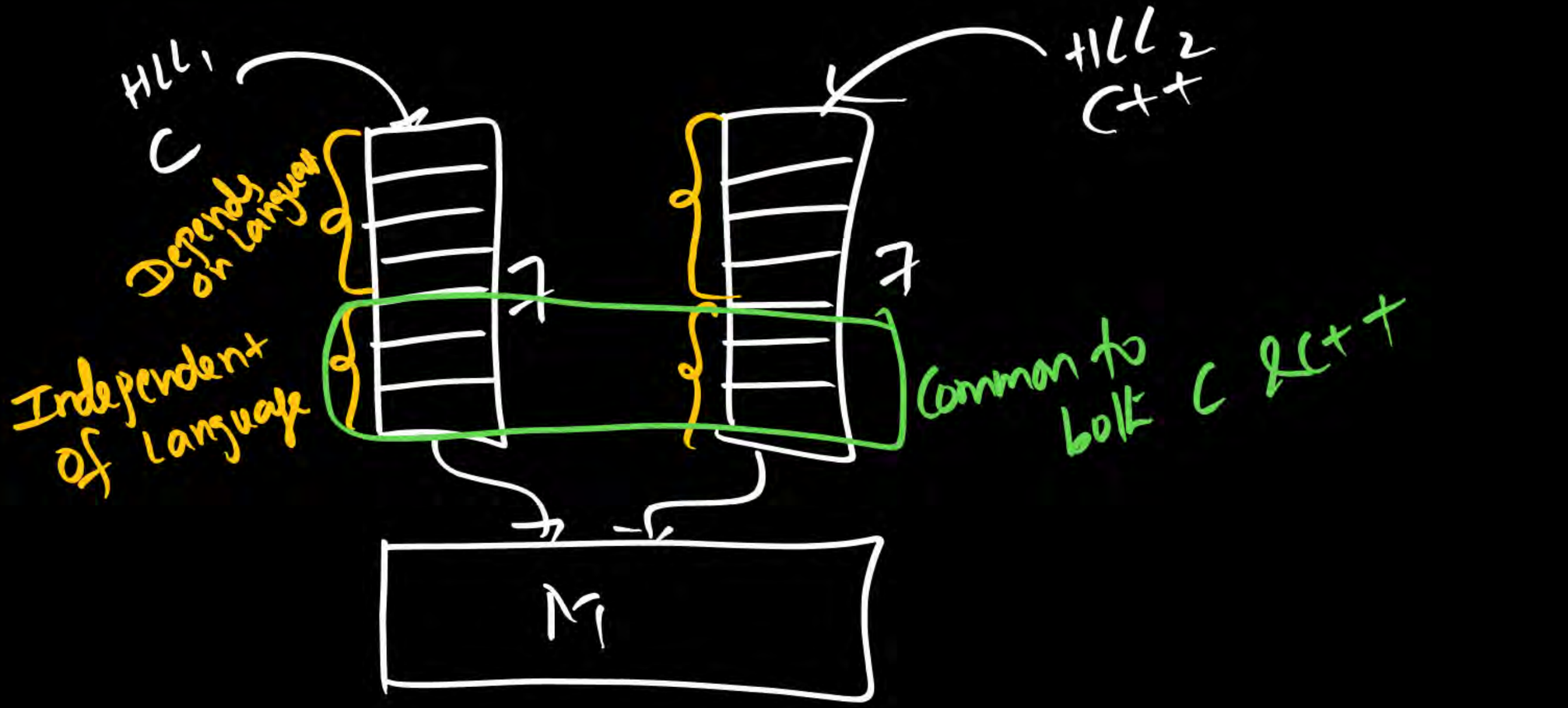
2 High Level programs

If 2 HLL required to compile on one M/c,

How many phases?



=11


HLL1
C
HLL2
C++
Depends on Language
Independent of Language
Common to both C & C++
M1

Compiler

⇓

Not portable

m/c Dependent

C

⇓

Portable

M/c Independent

Summary

- Introduction
- Next : Lexical Analysis


THANK YOU
GW
SOLDIERS !