

Assignment Project Exam Help

CS 320 : Formal Grammars

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Announcements

- The third programming assignment is posted.
- Due Sunday October 25th 11:59pm.

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Plan for today

- Intro to Part 2
- Formal grammars

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PART II

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What is the area of Programming Languages?

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➤ Language Design

- Programming Constructs, Abstractions

➤ Formal mechanisms to reason about and specify programs / languages

- Type Systems, Verification

➤ Compiler Design

- Optimizations, Program Analysis, JIT

➤ Language Runtime Design

- Virtual Machines, Garbage Collection, JIT, Interpreters

What we have

focused on so far

will do for the rest of the class.

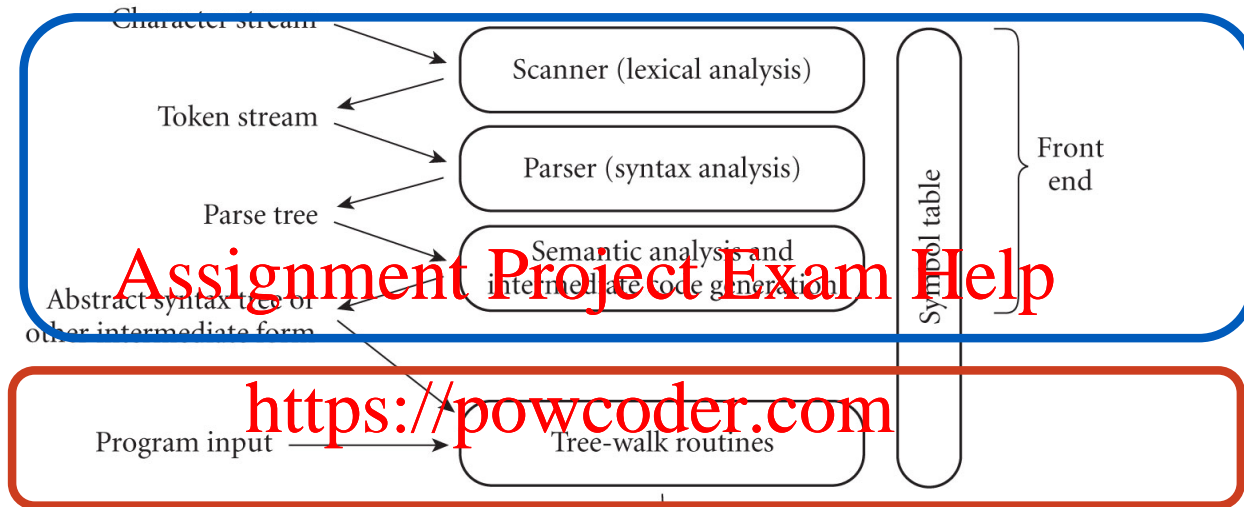
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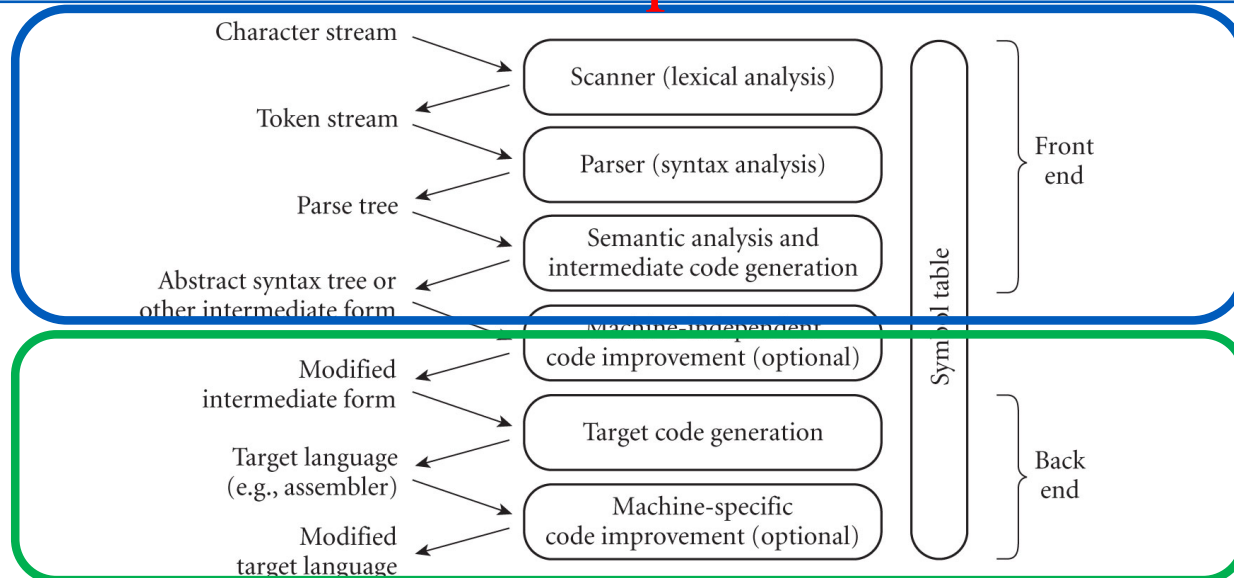
Commonalities and differences

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TopHat Q1-Q3

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Formal Grammars

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BNF - Backus Normal/Naur Form

- A grammar is defined by a set of terminals (tokens), a set of nonterminals, a designated nonterminal start symbol, and a finite nonempty set of rules

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```
<sentence> ::= <noun-phrase> <verb-phrase> .  
<noun-phrase> ::= <article> <noun>  
<article> ::= a | an | the  
<noun> ::= man | apple | worm | penguin  
<verb-phrase> ::= <verb> | <verb> <noun-phrase>  
<verb> ::= eats | throws | sees | is
```

Generator vs Recognizer

```
<program> ::= <stmts>
<stmts> ::= <stmt> | <stmt> ; <stmts>
<stmt> ::= <var> = <expr>
<var> ::= a | b
<expr> ::= <term> + <term> | <term> - <term>
<term> ::= <var> | const
```

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Recognize a sentence

```
a = b + const
<var> = b + const
<var> = <var> + const
<var> = <term> + const
<var> = <term> + <term>
<var> = <expr>
<stmt>
<stmts> ::= <program>
```

Generate a sentence

```
<program> ::= <stmts>
<stmt>
<var> = <expr>
a = <expr>
a = <term> + <term>
a = <var> + <term>
a = b + <term>
a = b + const
```

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TopHat Q4-Q8

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Some examples

```
<sentence> ::= <noun-phrase><verb-phrase>.  
<noun-phrase> ::= <article><noun>  
<article> ::= a | an | the  
<noun> ::= man | apple | worm | penguin  
<verb-phrase> ::= <verb> | <verb><noun-phrase>  
<verb> ::= eats | throws | sees | is
```

How do we generate the following sentence?

the penguin sees.

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Some examples

```
<sentence> ::= <noun-phrase><verb-phrase>.  
<noun-phrase> ::= <article><noun>  
<article> ::= a | an | the  
<noun> ::= man | apple | worm | penguin  
<verb-phrase> ::= <verb> | <verb><noun-phrase>  
<verb> ::= eats | throws | sees | is
```

How do we generate the following sentence?

a worm eats an apple.

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Some examples

```
<sentence>      ::= <noun-phrase><verb-phrase>.  
<noun-phrase>   ::= <article><noun>  
<article>       ::= a | an | the  
<noun>          ::= man | apple | worm | penguin  
<verb-phrase>   ::= <verb> | <verb><noun-phrase>  
<verb>          ::= eats | throws | sees | is
```

How do we recognize the following sentence?

a man throws a penguin.

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