Module 21:
"Interpreter"

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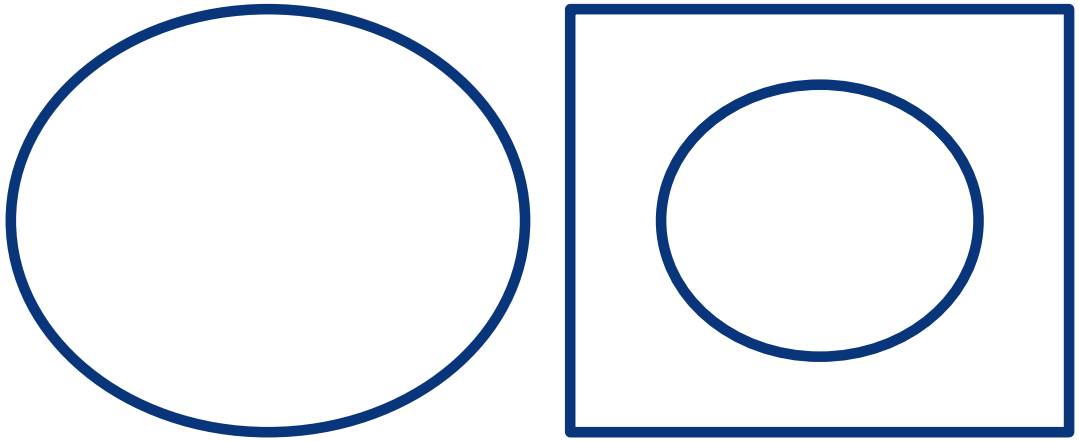
Agenda

- Introductory Example: A Graphical Language
- Challenges
- Background
- Implementing the Interpreter Pattern
- Pattern: Interpreter
- Overview of Interpreter Pattern
- .NET Framework Example: C# Expression Trees

Introductory Example: A Graphical Language



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Challenges

- How could we possibly write programs to interpret such graphical languages..??

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Background: BNF Grammars

<*drawing*> ::= <*drawing*> next to <*drawing*>
| <*drawing*> inside <shape>
| <*shape*>

<*shape*> ::= <*box*>
| <*ellipse*>

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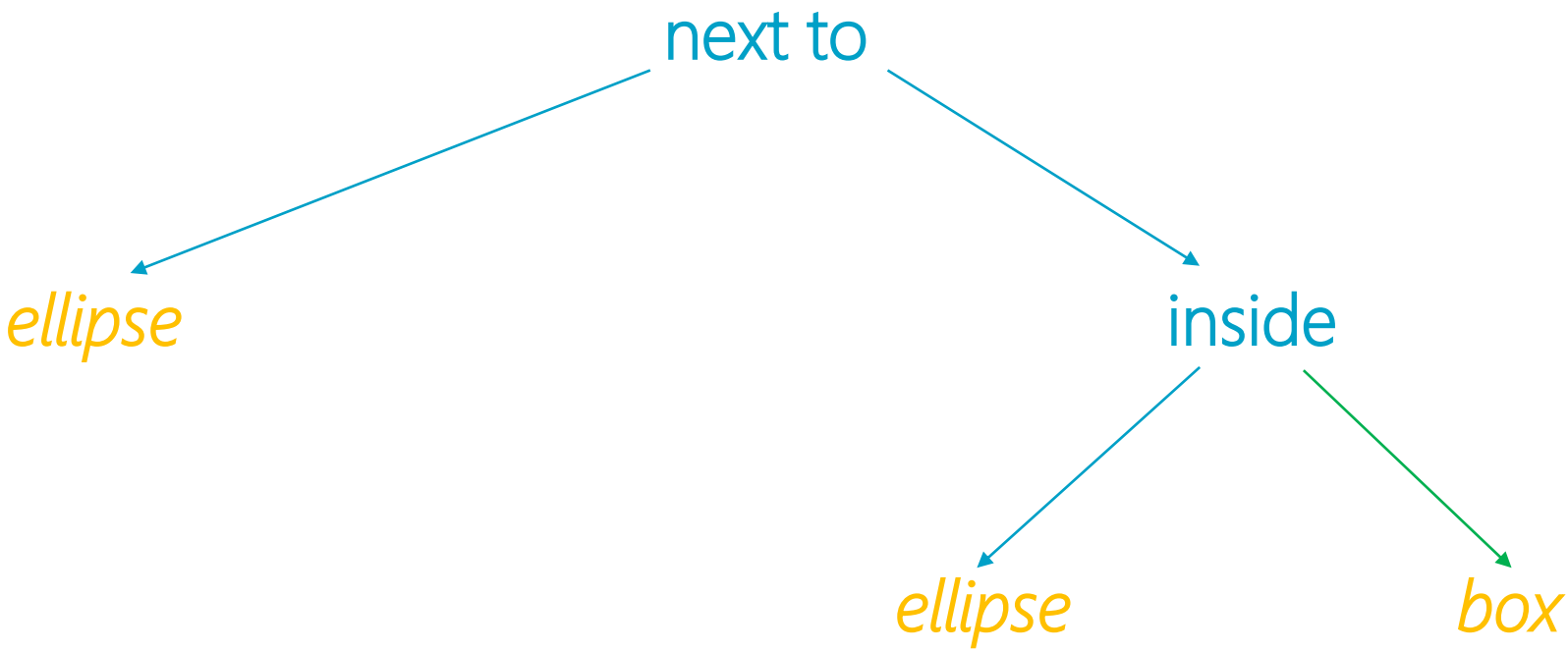
Abstract Syntax Tree (AST)



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Pattern: Interpreter

- *Given a language, define a representation for its grammar along with an interpreter that uses the representation to interpret sentences in the language.*

- Outline
  - Define a grammar as a Composite **`IExpression`** class hierarchy
  - Represent sentences as abstract syntax trees of **`IExpression`** objects
  - Interpret sentence by calling the **`Interpret()`** method of **`IExpression`** with a specified **`Context`**

- Origin: Gang of Four

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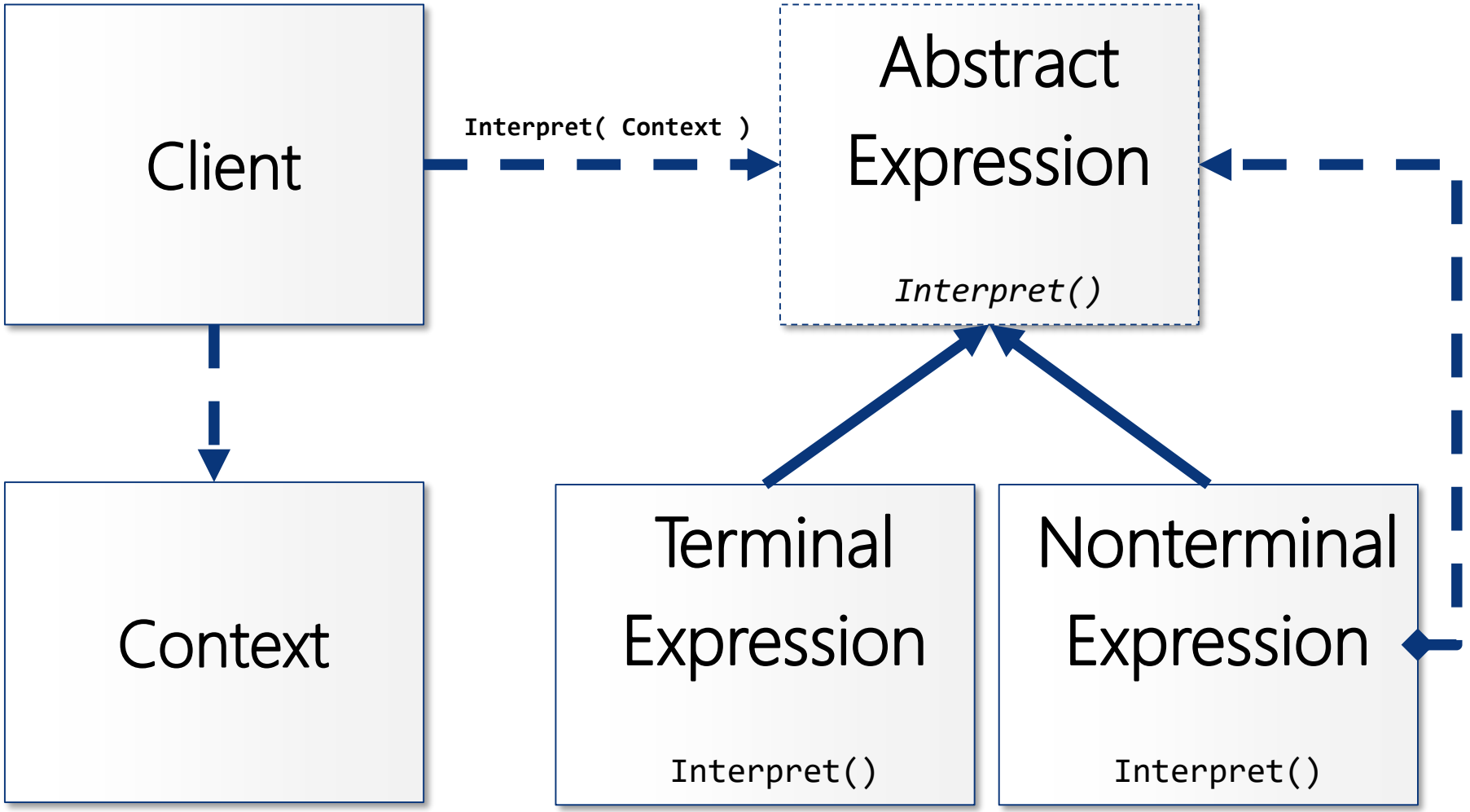
Overview of Interpreter Pattern



Overview of Interpreter Pattern

- Abstract Expression
  - Interface or abstract base class for elements of AST classes
- Terminal Expression
  - Concrete class capturing a Leaf (without subexpressions) of the AST
  - Provides concrete **`Interpret()`** method
- Nonterminal Expression
  - Concrete class capturing a Composite (with subexpressions) of the AST
  - Provides **`Interpret()`** method invoking **`Interpret()`** on subexpressions
- Context
  - Implements the infrastructure needed to interpret nodes of the AST
- Client
  - Invokes the **`Interpret()`** method on the root expression with some Context

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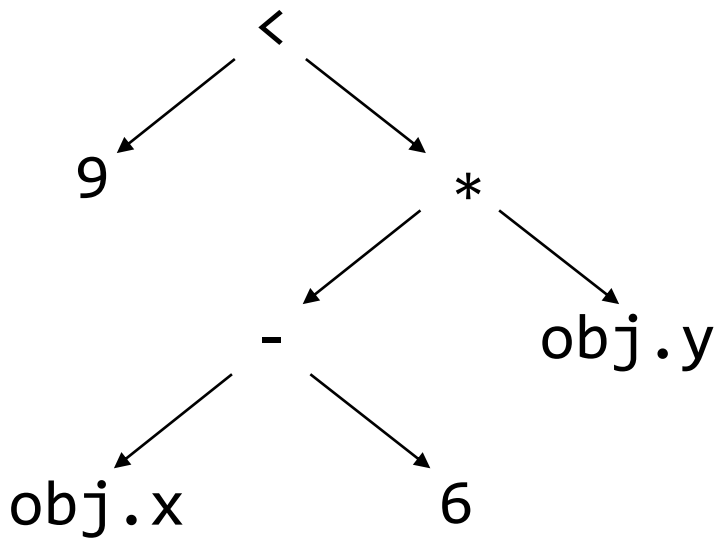
.NET Framework Example: C# Expression Trees

- The expression `9 < ( obj.x - 6 ) * obj.y` is



- **`Expression`** class captures abstract syntax trees for C# expressions

Compiling Lambda Expression Trees

- Expression trees can be compiled to the underlying delegate type at runtime!

```
Expression<Func<int, int, int>> addTree = ( x, y ) => x + y;

Func<int, int, int> add = addTree.Compile();
Console.WriteLine(add(5, 7));
```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