



Compilers

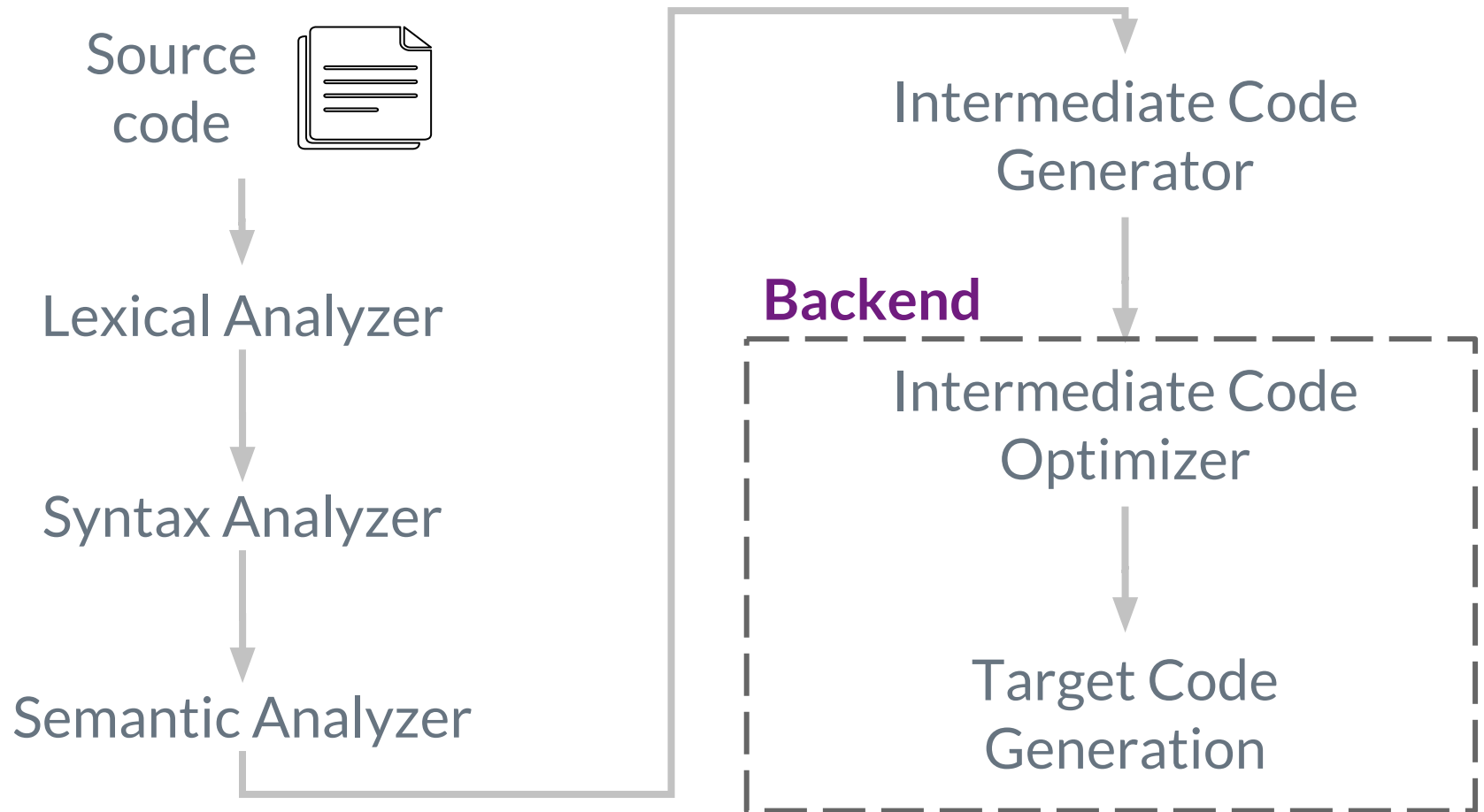
Lab II

Plan

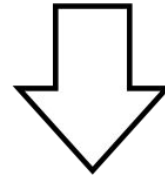
- ▷ Overview
- ▷ ϵ -NFA to DFA
- ▷ ANTLR

1. Overview

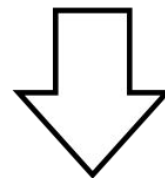
Compiler phases



i	f	(x		>		3	.	1	
---	---	---	--	---	--	---	--	---	---	---	--



Character Stream



Token Stream

KEYWORD
"if"

BRACKET
" ("

IDENTIFIER
"x"

OPERATOR
">"

NUMBER
"3.1"



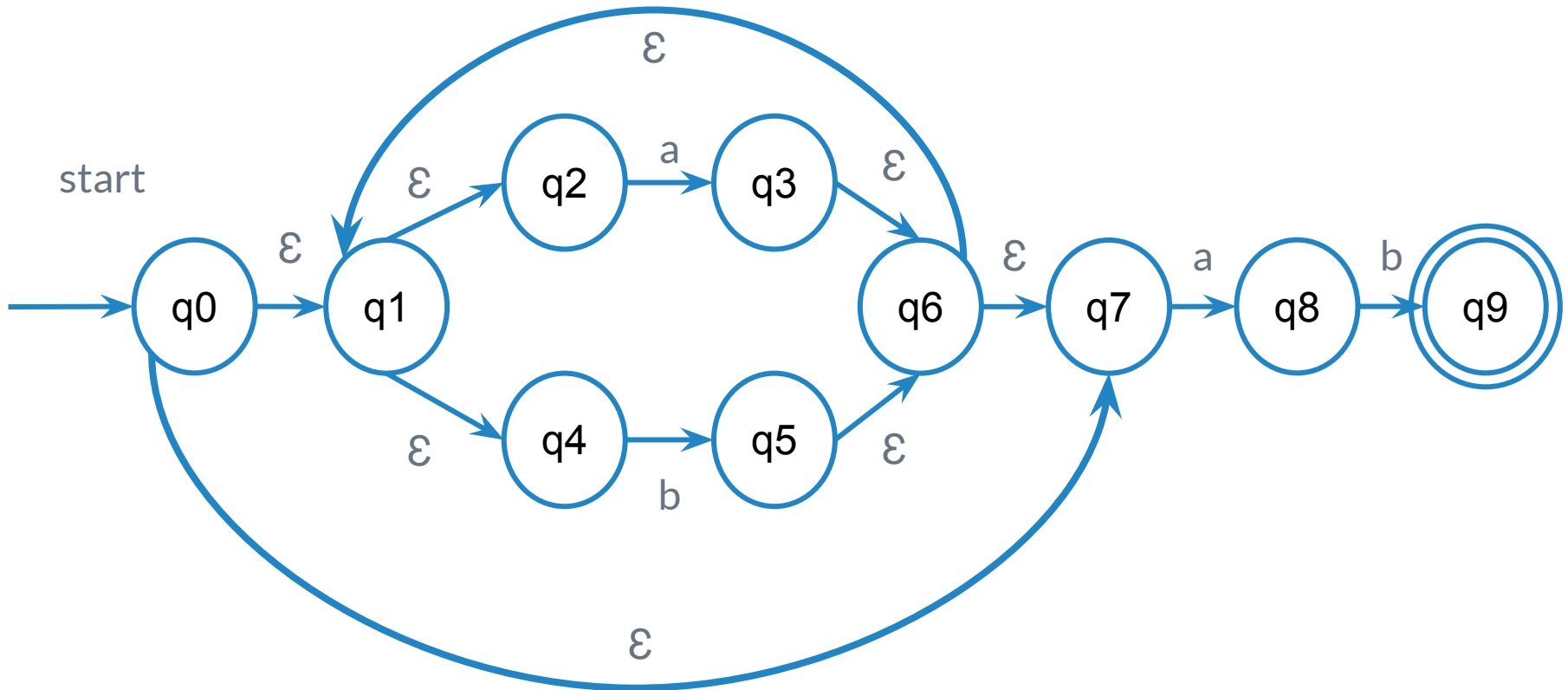
1. *Write regular definition*
2. *Compile corresponding regular expression*
3. *Convert expression to NFA*
4. *Convert NFA to DFA*

2.

ϵ -NFA to DFA

NFA Examples

$(a|b)^*ab$



NFA Examples

$(a|b)^*ab$

DFA state	NFA state	a	b
A	{q0, q1, q2, q4, q7}	B	C
B	{q1, q2, q3, q4, q6, q7, q8}	B	D
C	{q1, q2, q4, q5, q6, q7}	B	C
D	{q1, q2, q4, q5, q6, q7, q9}	B	C

3. ANTLR



ANother Tool for Language Recognition, is a powerful parser generator for reading, processing, executing, or translating structured text or binary files.



What Is ANTLR?

ANTLR (ANother Tool for Language Recognition) is a powerful parser generator for reading, processing, executing, or translating structured text or binary files. It's widely used to build languages, tools, and frameworks. From a grammar, ANTLR generates a parser that can build and walk parse trees.

Check out Terence's latest adventure explained.ai



Terence Parr is the maniac behind ANTLR and has been working on language tools since 1989. He is a professor of computer science at the University of San Francisco.

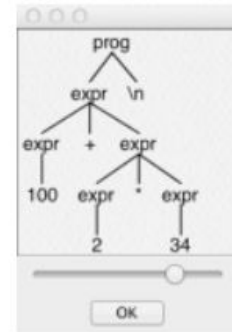
Quick Start

Samples

Samples

```
grammar Expr;
prog:  (expr NEWLINE)* ;
expr:  expr ('*' | '/')
      | expr ('+' | '-')
      | INT
      | '(' expr ')'
      ;
NEWLINE : [\r\n]+ ;
INT      : [0-9]+ ;
```

```
$ antlr4 Expr.g4
$ javac Expr*.java
$ grun Expr prog -gui
100+2*34
^D
```



ANTLR





ANTLR takes as input a grammar that specifies a language and generates as output source code for a recognizer of that language.

ANTLR can generate lexers, parsers, tree parsers, and combined lexer-parsers.

- ▷ Linear approximate lookahead
- ▷ Semantic and Syntactic predicates
- ▷ ANTLRWorks
- ▷ Tree parsing
- ▷ $LL(*)$
- ▷ Adaptive $LL(*)$ in ANTLR v4



ANTLR Setup

Name	Date modified	Type	Size
 antlr.bat	01-Feb-19 5:43 PM	Windows Batch File	1 KB
 antlr-4.7.2-complete.jar	01-Feb-19 2:42 PM	Executable Jar File	2,032 KB
 class.bat	01-Feb-19 5:56 PM	Windows Batch File	1 KB
 grun.bat	01-Feb-19 5:25 PM	Windows Batch File	1 KB

File	Code
antlr.bat	1 java org.antlr.v4.Tool %*
grun.bat	1 java org.antlr.v4.gui.TestRig %*
class.bat	1 SET CLASSPATH=.;%CLASSPATH%

ANTLR Setup

Edit User Variable

Variable name: CLASSPATH

Variable value: \Desktop\Compiler\ANTLR\antlr-4.7.2-complete.jar

Browse Directory... Browse File... OK

Edit environment variable

Desktop\Compiler\ANTLR

%CLASSPATH%

Edit System Variable

Variable name: Path

Variable value: C:\Program Files\Java\jdk-11.0.2\bin

Browse Directory... Browse File...

Environment Variables

User variables for xXMoXx

Variable	Value
CLASSPATH	
OneDrive	
OneDriveConsumer	
Path	
TEMP	
TMP	

New... Edit... Delete

System variables

Variable	Value
GTK_BASEPATH	
NUMBER_OF_PROCESSORS	
OS	
Path	
PATHEXT	
PROCESSOR_ARCHITECTURE	
PROCESSOR_IDENTIFIER	

New... Edit... Delete

OK Cancel

ANTLR Setup

Unix:

1. `sudo apt update`
2. `sudo apt install antlr4`
3. `sudo apt install default-jdk`
4. `sudo apt install python3-pip`
5. `pip3 install --user antlr4-python3-runtime`


```

1 grammar test;
2
3 start:  (expr NEWLINE)* ;
4
5 expr:  expr OPERATOR expr
6       | INT
7       | '(' expr ')'
8       ;
9
10 NEWLINE : [\r\n]+ ;
11 INT     : [0-9]+ ;
12 OPERATOR : ('*' | '/' | '+' | '-' );
13

```

```

1 100+2*24
2

```

```

1 import argparse
2 from antlr4 import *
3 from testLexer import testLexer
4 from testListener import testListener
5 from testParser import testParser
6 from antlr4.tree.Trees import Trees
7
8 def get_token_type(token):
9     if token.type == testLexer.INT:
10         return "INT"
11     elif token.type == testLexer.NEWLINE:
12         return "NEWLINE"
13     elif token.type == testLexer.OPERATOR:
14         return "OPERATOR"
15     else:
16         return "ERROR UNKNOWN TOKEN"
17
18 def main():
19
20     with open(args.file, "r") as file:
21         lines = file.read()
22         input_stream = InputStream(lines)
23         lexer = testLexer(input_stream)
24         token_stream = CommonTokenStream(lexer)
25         parser = testParser(token_stream)
26
27         # tree = parser.start()
28         # print(Trees.toStringTree(tree, None, parser))
29
30         token = lexer.nextToken()
31
32         while not token.type == Token.EOF:
33             print(get_token_type(token), token.text)
34             token = lexer.nextToken()
35

```

```

sample.txt
ANTLR runtime and generated code versions disagree: 4.7.2!=4.5.1
ANTLR runtime and generated code versions disagree: 4.7.2!=4.5.1
INT 100
OPERATOR +
INT 2
OPERATOR *
INT 24
NEWLINE

```

ANTLR Setup

To Run:

- ▷ `antlr test.g4`
- ▷ `antlr test.g4 -Dlanguage=Python3`
- ▷ `javac test*.java`
- ▷ `class`
- ▷ `grun test start sample.txt -gui`

Thanks!

Any questions?

You can find me at:

@piazza

mohammed.agamia@guc.edu.eg