SER 502 – Team 16

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GITHUB REPO - HTTPS://GITHUB.COM/TARUNKOLLA/SER502-SPRING2018-TEAM16

FISH

- FISH is a simple programming language designed using JAVA, inspired by Python and Standard ML
- Parse tree and Intermediate byte code is generated using ANTLR
- Runtime written in JAVA
- Language Design:
  - Every program must lie between “startFISH” and “endFISH”
  - Input program should have .fish file extension
  - Intermediate code generated as <program_name.fish.ic>
  - This intermediate code is processed by runtime to generate program output

FISH Grammar

- grammar FishLanguage;

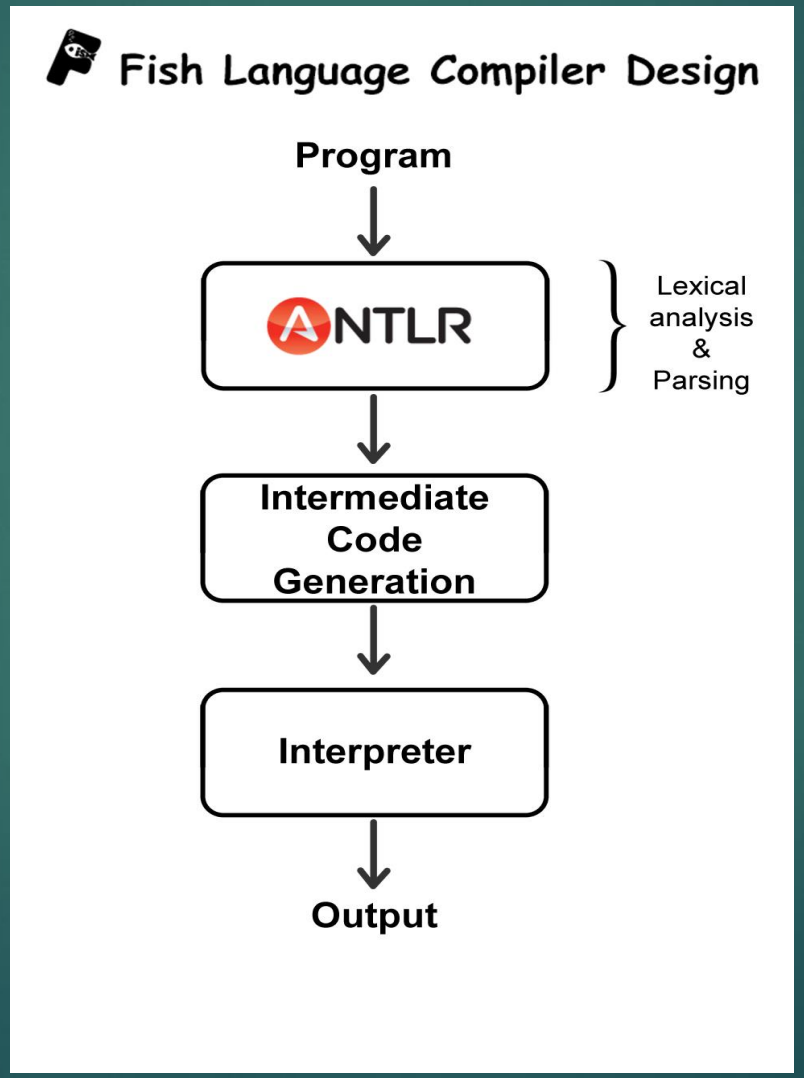
- program : mainBlock (functions)*;
- mainBlock : 'startFISH' statements+ 'endFISH';
- statements : (assignmentStatement
  | ifStatement
  | loopStatement
  | writeStatement
  | declarationStatement
  | readStatement
  | functionCallStatement
  | returnStatement);

- declarationStatement : DOLLAR IDENTIFIER;
- functions : 'fun' FUNCNAME LBRACE parameters RBRACE ':' statements+ 'endfun';
- parameters : (DOLLAR IDENTIFIER) (',' parameters)?;
- functionCallStatement : FUNCNAME LBRACE arguments RBRACE;
- arguments : (expression) (','arguments)?;
- returnStatement : 'return' expression;
- assignmentStatement : IDENTIFIER ASSIGNMENT expression;

- ifStatement : ifBlock (elseBlock)? 'endif';
- ifBlock : 'if' LBRACE booleanExpression RBRACE ':' statements+ ;
- elseBlock: 'else' ':' statements+;
- loopStatement : 'loop' LBRACE booleanExpression RBRACE ':' statements+ 'endloop';
- writeStatement : 'write' expression
  | 'write' STRING
  | 'write' booleanExpression;
- readStatement : 'read' IDENTIFIER;
- booleanExpression: expression EQUALS expression
  | expression GTE expression
  | expression LTE expression
  | expression NE expression
  | expression GT expression
  | expression LT expression
  | expression AND expression
  | expression OR expression
  | BOOLEAN;
- expression : expression (MULTIPLY | DIVIDE | MOD) expression
  | expression (ADD | SUBTRACT) expression
  | NUMBER
  | BOOLEAN
  | STRING
  | IDENTIFIER
  | REAL
  | functionCallStatement
  | LBRACE expression RBRACE;

```
BOOLEAN         : 'True'
                | 'False';
SUBTRACT        : '-';
NUMBER          :  [-]?[0-9]+;
REAL            : [-]?[0-9]+[.][0-9]+;
IDENTIFIER      :  [a-z]+;
DOLLAR          : '$';
ASSIGNMENT      : '=';
MULTIPLY : '*';
DIVIDE          : '/';
MOD             : '%';
ADD             : '+';
LBRACE          : '(';
RBRACE          : ')';
EQUALS          : '==';
GTE             : '>=';
LTE             : '<=';
NE              : '!=';
GT              : '>';
LT          : '<';
AND             : '&&';
STRING          : ['][ a-zA-Z:=><+*/%!\-]+['];
OR              : '| |';
FUNCNAME        : [A-Z]+;
NEWLINE         : [ \n\t\r] -> skip;
```

Language Design:



Tools:

- Compiler:
  - Based on JAVA Environment
  - ANTLR4 used to generate Lexer and Parser
- Run Time:
  - JAVA : Used to build the entire project JDK 1.8
  - Eclipse : Used as IDE

Features of FISH:

Datatypes:

- Integer Numbers
- Real Numbers
- BOOLEAN

Logical Operations:

- AND &&
- OR ||

Arithmetic Operations:

- Add +
- Subtract -
- Multiply *
- Divide /
- Mod %

Relational Operations:

- Equals ==
- NotEqualTo !=
- LessThan <
- LessThanEqualTo <=
- GreaterThan >
- GreaterThanEqualTo >=

Statements

General Statements

- Assignment Statement “=”
- Declaration Statement “$”
- Read “read f”
- Write “write “result = ””

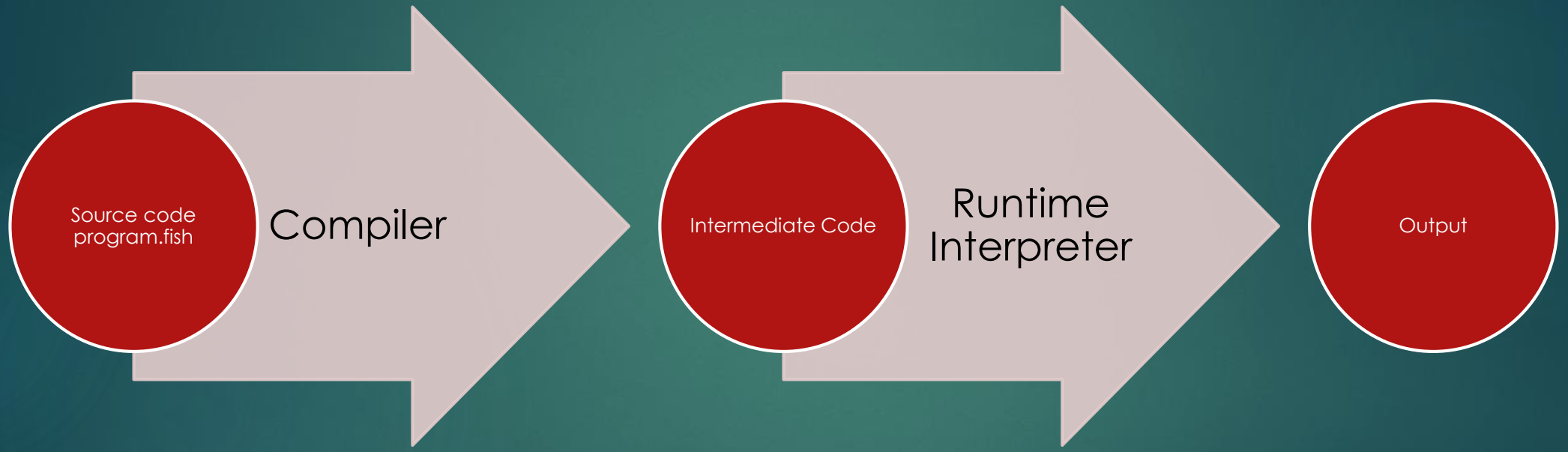
Conditional Statement

- If (condition):
  - <statements>
- <optional else>:
  - <statements>
- endif

Iterative Statement

- loop (condition):
  - <statements>
- endloop

Execution Flow:



Byte Code Instructions:

BASIC INSTRUCTIONS

- DECLARE
- PUSH
- ASSIGN
- PARAMASSIGN
- DISPLAY
- READ
- WRITE

ARITHMETIC OPERATIONS

- ADD
- SUBTRACT
- MULTIPLY
- DIVIDE
- MOD

CONTROL OPERATIONS

- GOTO
- FAILGOTO
- RETURNTO
- ENDIFGOTO

LOGICAL OPERATIONS

- AND
- OR

RELATIONAL OPERATIONS

- GREATERTHAN
- LESSTHAN
- GREATERTHANEQUAL
- LESSTHANEQUAL
- NOTEQUAL
- EQUALS

Sample Program:

Input Code

```
startFISH
$a
$b
$c
a=3
b=5
if (a % 2 == 0):
        c=10
    else:
        c=a+b
    endif
write c
endFISH
```

Intermediate Byte Code

1 START FISHING
2 DECLARE a
3 DECLARE b
4 DECLARE c
5 PUSH a
6 PUSH 3
7 ASSIGN
8 PUSH b
9 PUSH 5
10 ASSIGN
11 STARTIF
12 PUSH a
13 PUSH 2
14 MOD
15 PUSH 0
16 EQUALS
17 FAILGOTO 22
18 PUSH c
19 PUSH 10
20 ASSIGN
21 ENDIFGOTO 29
22 STARTELSE
23 PUSH c
24 PUSH a
25 PUSH b
26 ADD
27 ASSIGN
28 ENDELSE
29 PUSH c
30 DISPLAY
31 END FISHING

Run Time and Execution

- Instructions to install Fish Programming Language:

- -Download the install folder present in the reposority
- -The folder consistes of .jar file for compiler and runtime.
- -The 2 .bat files are used to execute the compiler and runtime
- Instructions to build and execute the program:

- -Write the Input program snippet with the file name <FileName>.fish within the same folder of the .jar files
- if not give the absolute path to the program file.
- Command to Execute the compiler and the runtime:

- For Windows:

- -Execute using the given .bat commands to run the .fish file.
- To Compile:

- fishCompile <FileName>.fish if in same folder
- fishCompile "absolute path" \<FileName>.fish for different folder
- Output: <FileName>.fish.ic
- To generate output:

- fish <FileName>.fish.ic if in same folder
- fish "absolute path" \<FileName>.fish.ic for different folder
- output: Generates the program output on to the command prompt

- For OSX:

- Navigate to the install folder or use absolute path and then

- To Compile:

- java -jar compile.jar <FileName>.fish
- Output: <FileName>.fish.ic
- To generate output:

- java -jar runtime.jar <FileName>.fish.ic
- Output: Generates the progrma output on to the command prompt

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