

# Assignment 5

Due: Fri. Nov 17 at 11:59pm

Implement a CodeGenVisitor class to traverse the decorated AST and generate code. The abstract syntax has been annotated to indicate which part of the language is to be implemented in Assignment 5 and how it maps into JVM elements. The rest of the language will be implemented in Assignment 6.

Program ::= name (Declaration | Statement)\*

Generate code for a class called name.

statements are added to main method

Declaration ::= Declaration\_Image | Declaration\_SourceSink | Declaration\_Variable

Declaration\_Image ::= name ( xSize ySize | ε) Source

TODO Assignment 6

Declaration\_SourceSink ::= Type name Source

TODO Assignment 6

Declaration\_Variable ::= Type name (Expression | ε)

Add field, name, as static member of class.

If there is an expression, generate code to evaluate it and store the results in the field.

See comment about this below.

Statement ::= Statement\_Assign | Statement\_In | Statement\_Out

Statement\_Assign ::= LHS Expression

REQUIRE: LHS.Type == Expression.Type

StatementAssign.isCartesian <= LHS.isCartesian

Statement\_In ::= name Source

Generate code to get value from the source and store it in variable name.

For Assignment 5, the only source that needs to be handled is the command line.

Visit source to leave string representation of the value on top of stack

Convert to a value of correct type: If name.type == INTEGER generate code to invoke

Java.lang.Integer.parseInt. If BOOLEAN, invoke java/lang/Boolean.parseBoolean

TODO: Handling IMAGE type left for assignment 6.

Statement\_In.Declaration <= name.Declaration

REQUIRE: if (name.Declaration != null) & (name.type == Source.type)

Statement\_Out ::= name Sink

For INTEGERS and BOOLEANS, the only “sink” is the screen, so generate code to print to the console here. Use java.io.PrintStream .println. This is a virtual method, you can use the static field PrintStream “out” from class java.lang.System as the object.

TODO: handle images in Assignment 6

Expression ::= Expression\_Binary | Expression\_BooleanLit | Expression\_Conditional |  
Expression\_FunctionApp | Expression\_FunctionAppWithExprArg |  
Expression\_FunctionAppWithIndexArg | Expression\_Ident | Expression\_IntLit |  
Expression\_PixelSelector | Expression\_PredefinedName \_ Expression\_Unary

For each expression kind, generate code to leave the value of the expression on top of the stack.

Expression\_Binary ::= Expression<sub>0</sub> op Expression<sub>1</sub>

Generate code to evaluate the expression and leave the value on top of the stack.

Visiting the nodes for Expression<sub>0</sub> and Expression<sub>1</sub> will generate code to leave those values on the stack. Then just generate code to perform the op.

Expression\_BooleanLit ::= value

Generate code to leave the value of the literal on top of the stack

Expression\_Conditional ::= Expression<sub>condition</sub> Expression<sub>true</sub> Expression<sub>false</sub>

Generate code to evaluate the Expression<sub>condition</sub> and depending on its Value, to leave the value of either Expression<sub>true</sub> or Expression<sub>false</sub> on top of the stack.  
Hint: you will need to use labels, a conditional instruction, and goto.

Expression\_FunctionApp ::= Expression\_FunctionAppWithExprArg

| Expression\_FunctionAppWithIndexArg

TODO in assignment 6

Expression\_FunctionAppWithExprArg ::= function Expression

TODO in assignment 6

Expression\_FunctionAppWithIndexArg ::= function Index

TODO in assignment 6

Expression\_Ident ::= name

Generate code to get the value of the variable and leave it on top of the stack.

Expression\_IntLit ::= value

Generate code to leave constant on stack.

Expression\_PixelSelector ::= name Index

TODO Assignment 6

Expression\_PredefinedName ::= predefinedNameKind

~~Generate code to get the value of the variable and leave it on top of the stack.~~

TODO Assignment 6    ⇐ NEW

Expression\_Unary ::= op Expression

Generate code to evaluate the unary expression and leave its value on top of the stack.  
Which code is generated will depend on the operator. If the op is OP\_PLUS, the value that should be left on the stack is just the value of Expression

Index ::= Expression<sub>0</sub> Expression<sub>1</sub>

TODO Assignment 6

LHS ::= name Index

If LHS.Type is INTEGER or BOOLEAN, generate code to  
store the value on top of the stack in variable name.

TODO Assignment 6: handle case where LHS.Type is IMAGE

Sink ::= Sink\_Ident | Sink\_SCREEN

Sink\_Ident ::= name

TODO Assignment 6

Sink\_SCREEN ::= SCREEN

TODO Assignment 6

Source ::= Source\_CommandLineParam | Source\_Ident | Source\_StringLiteral

Source\_CommandLineParam ::= Expression<sub>paramNum</sub>

Generate code to evaluate the expression and use aload to read the element from the command line array using the expression value as the index. The command line array is the String[] args param passed to main.

Source\_Ident ::= name

TODO in Assignment 6

Source\_StringLiteral ::= fileOrURL

TODO in Assignment 6

### Corrections to previous assignment.

Change the type checking of

Statement\_In ::= name Source

Statement\_In.Declaration <= name.Declaration

~~REQUIRE: if (name.Declaration != null) & (name.type == Source.type)~~

Requirements:

For grading purpose, it is essential that you insert calls to `CodeGenUtils.genLog(..)` and `CodeGenUtils.genLogTOS(...)` at locations indicated in the comments of the provided class `CodeGenVisitor`.

The provided class `CodeGenVisitorTest` contains several test cases that should be useful to you. The empty program test should pass immediately. The others should pass in a completed assignment. These are not complete, you will need additional test cases.

**Turn in a jar file containing your source code for `CodeGenVisitor.java`, `CodeGenVisitorTest.java`, `TypeCheckVisitor.java`, `Parser.java`, `Scanner.java`, all of the AST classes, `TypeUtils.java`, `RuntimeLog.java`, `CodeGenUtils.java` and any classes that you have added.**

Your `CodeGenTest` will not be graded, but may be looked at in case of academic honesty issues. We will subject your parser to our set of unit tests and your grade will be determined solely by how many tests are passed.

**Name your jar file in the following format: *firstname\_lastname\_ufile\_hw5.jar***

## Comments and Suggestions

- **IMPORTANT:** Review the lectures on the JVM and the assignment before you begin.
- Remember that when you submit your assignment, you are attesting that have neither given nor received inappropriate help on the assignment. In this course, all assignments must be your own individual work, including the Scanner, Parser, and TypeChecker after they have been graded.

- Hint: be careful to keep the throw `UnsupportedOperationException` in place until a feature is implemented. This will save you a tremendous amount of time if you accidentally invoke a test program containing an unimplemented feature.