Maira Malhi (40128269)
Assignment 2 - COMP 442

Section 1. Transformed grammar into LL(1)

AMBIGUITIES:

The grammar is not LL(1) because:

- ARRAYSIZE has a first set conflict.
- EXPR has a first set conflict.
- FACTOR has a first set conflict.
- FUNCHEAD has a first set conflict.
- IDNEST has a first set conflict.
- LOCALVARDECL has a first set conflict.
- OPTFUNCHEAD1 is nullable with clashing first and follow sets.
- REPTFUNCTIONCALL0 is nullable with clashing first and follow sets.
- REPTVARIABLE0 is nullable with clashing first and follow sets. STATEMENT has a first set conflict.

GRAMMAR FIXED TO LL(1) :

START -> REPTSTART0 .

APARAMS -> EXPR REPTAPARAMS1 .

APARAMS -> .

APARAMSTAIL -> comma EXPR .

ADDOP -> plus .

ADDOP -> minus .

ADDOP -> or .

ARITHEXPR -> TERM RIGHTRECARITHEXPR .

ARRAYSIZE -> lsqbr ARRAYSIZE1 .

ARRAYSIZE1 -> intlit rsqbr .

ARRAYSIZE1 -> rsqbr .

ASSIGNOP -> equal .

CLASSDECL -> class id OPTCLASSDECL2 lcurbr REPTCLASSDECL4 rcurbr semi .

CLASSDECLORFUNCDEF -> CLASSDECL .

CLASSDECLORFUNCDEF -> FUNCDEF .

EXPR -> ARITHEXPR EXPR1 .

EXPR1 -> RELOP ARITHEXPR .

EXPR1 -> .

FPARAMS -> id colon TYPE REPTFPARAMS3 REPTFPARAMS4 .

FPARAMS -> .

FPARAMSTAIL -> comma id colon TYPE REPTFPARAMSTAIL4 .

FACTOR -> FUNCTIONCALLORVARIABLE .

FACTOR -> intlit .

FACTOR -> floatlit .

FACTOR -> lpar ARITHEXPR rpar .

FACTOR -> not FACTOR   .

FACTOR -> SIGN FACTOR   .

FUNCBODY -> lcurbr REPTFUNCBODY1 rcurbr   .

FUNCDEF -> FUNCHEAD FUNCBODY .

FUNCHEAD -> function id FUNCHEAD3 .

FUNCHEAD1 -> id lpar FPARAMS rpar arrow RETURNTYPE   .

FUNCHEAD1 -> constructor lpar FPARAMS rpar   .

FUNCHEAD3 -> sr FUNCHEAD1 .

FUNCHEAD3 -> lpar FPARAMS rpar arrow RETURNTYPE   .

ASSIGNSTAT -> VARIABLE ASSIGNOP EXPR   .

FUNCTIONCALL -> id FUNCALL3 .

FUNCALL3 -> lpar APARAMS rpar .

FUNCALL3 -> FUNCALL2 .

FUNCALL2 -> dot id FUNCALL4   .

FUNCALL4 -> INDICE FUNCALL2 .

FUNCALL4 -> lpar APARAMS rpar FUNCALL5 .

FUNCALL5 -> FUNCALL2 .

FUNCALL5 -> .

VARIABLE -> id VARIABLE3 .

VARIABLE3 -> INDICE .

VARIABLE3 -> VARIABLE2 .

VARIABLE3 -> .

VARIABLE2 -> dot id VARIABLE4 .

VARIABLE4 -> lpar APARAMS rpar VARIABLE2 .

VARIABLE4 -> INDICE VARIABLE5 .

VARIABLE5 -> VARIABLE2 .

VARIABLE5 -> .

FUNCTIONCALLORVARIABLE -> id FUNCTIONCALLORVARIABLE1 .

FUNCTIONCALLORVARIABLE1 -> INDICELOOP FUNCTIONCALLORVARIABLE2 .

FUNCTIONCALLORVARIABLE1 -> lpar APARAMS rpar FUNCTIONCALLORVARIABLE2 .

FUNCTIONCALLORVARIABLE2 -> dot id FUNCTIONCALLORVARIABLE3 .

FUNCTIONCALLORVARIABLE2 -> .

FUNCTIONCALLORVARIABLE3 -> INDICELOOP FUNCTIONCALLORVARIABLE2 .

FUNCTIONCALLORVARIABLE3 -> lpar APARAMS rpar FUNCTIONCALLORVARIABLE2 .

IDNEST1 -> dot id IDNEST2 .

IDNEST2 -> lsqbr ARITHEXPR rsqbr IDNEST2 .

IDNEST2 -> lpar APARAMS rpar .

IDNEST2 -> .

INDICE -> lsqbr ARITHEXPR rsqbr   .

LOCALVARDECL -> localvar id colon TYPE LOCALVARDECL2 .

LOCALVARDECL2 -> REPTLOCALVARDECL4 semi   .

LOCALVARDECL2 -> lpar APARAMS rpar semi   .

LOCALVARDECLORSTMT -> LOCALVARDECL   .

LOCALVARDECLORSTMT -> STATEMENT   .

MEMBERDECL -> MEMBERFUNCDECL   .

MEMBERDECL -> MEMBERVARDECL   .

MEMBERFUNCDECL -> function id colon lpar FPARAMS rpar arrow RETURNTYPE semi   .

MEMBERFUNCDECL -> constructor colon lpar FPARAMS rpar semi   .

MEMBERVARDECL -> attribute id colon TYPE REPTMEMBERVARDECL4 semi   .

MULTOP -> mult   .

MULTOP -> div   .

MULTOP -> and   .

OPTCLASSDECL2 -> isa id REPTOPTCLASSDECL22   .

OPTCLASSDECL2 -> .

RELEXPR -> ARITHEXPR RELOP ARITHEXPR   .

RELOP -> eq   .

RELOP -> neq   .

RELOP -> lt   .

RELOP -> gt   .

RELOP -> leq   .

RELOP -> geq   .

REPTSTART0 -> CLASSDECLORFUNCDEF REPTSTART0   .

REPTSTART0 -> .

REPTAPARAMS1 -> APARAMSTAIL REPTAPARAMS1   .

REPTAPARAMS1 -> .

REPTCLASSDECL4 -> VISIBILITY MEMBERDECL REPTCLASSDECL4   .

REPTCLASSDECL4 -> .

REPTFPARAMS3 -> ARRAYSIZE REPTFPARAMS3   .

REPTFPARAMS3 -> .

REPTFPARAMS4 -> FPARAMSTAIL REPTFPARAMS4   .

REPTFPARAMS4 -> .

REPTFPARAMSTAIL4 -> ARRAYSIZE REPTFPARAMSTAIL4   .

REPTFPARAMSTAIL4 -> .

REPTFUNCBODY1 -> LOCALVARDECLORSTMT REPTFUNCBODY1   .

REPTFUNCBODY1 -> .

REPTLOCALVARDECL4 -> ARRAYSIZE REPTLOCALVARDECL4   .

REPTLOCALVARDECL4 -> .

REPTMEMBERVARDECL4 -> ARRAYSIZE REPTMEMBERVARDECL4   .

REPTMEMBERVARDECL4 -> .

REPTOPTCLASSDECL22 -> comma id REPTOPTCLASSDECL22   .

REPTOPTCLASSDECL22 -> .

REPTSTATBLOCK1 -> STATEMENT REPTSTATBLOCK1   .

REPTSTATBLOCK1 -> .

RETURNTYPE -> TYPE   .

RETURNTYPE -> void   .

RIGHTRECARITHEXPR -> .

RIGHTRECARITHEXPR -> ADDOP TERM RIGHTRECARITHEXPR   .

RIGHTRECTERM -> .

RIGHTRECTERM -> MULTOP FACTOR RIGHTRECTERM   .

SIGN -> plus   .

SIGN -> minus   .

STATBLOCK -> lcurbr REPTSTATBLOCK1 rcurbr   .

STATBLOCK -> STATEMENT   .

STATBLOCK -> .

STATEMENT -> FUNCTIONCALLORASIGNSTAT semi   .

STATEMENT -> if lpar RELEXPR rpar then STATBLOCK else STATBLOCK semi   .

STATEMENT -> while lpar RELEXPR rpar STATBLOCK semi   .

STATEMENT -> read lpar VARIABLE rpar semi   .

STATEMENT -> write lpar EXPR rpar semi   .

STATEMENT -> return lpar EXPR rpar semi .

FUNCTIONCALLORASIGNSTAT -> id ISFUNCTIONCALLORVARIABLE .

ISFUNCTIONCALLORVARIABLE -> lpar APARAMS rpar AFTERFUNCTIONCALL .

ISFUNCTIONCALLORVARIABLE -> INDICELOOP AFTERVARIABLE .

AFTERFUNCTIONCALL -> dot id MIDDLESTATE .

AFTERVARIABLE -> dot id MIDDLESTATE .

MIDDLESTATE -> INDICELOOP AFTERVARIABLE .

MIDDLESTATE -> lpar APARAMS rpar AFTERFUNCTIONCALL .

AFTERVARIABLE -> ENDASSIGN .

AFTERFUNCTIONCALL -> .

INDICELOOP -> INDICE INDICELOOP .

INDICELOOP -> .

ENDASSIGN -> ASSIGNOP EXPR .

TERM -> FACTOR RIGHTRECTERM   .

TYPE -> integer   .

TYPE -> float   .

TYPE -> id   .

VISIBILITY -> public   .

VISIBILITY -> private   .

VISIBILITY -> .

Section 2.

PARSING TABLE GENERATED INTO CSV

```
,$,private,public,id,float,integer,rpar,lpar,dot,semi,return,write,read,while,
else,then,if,rcurbr,lcurbr,minus,plus,void,comma,geq,leq,gt,lt,neq,eq,isa,and,
div,mult,colon,attribute,constructor,arrow,function,localvar,rsqbr,lsqbr,sr,no
t,floatlit,intlit,class,equal,or
```

```
START,START → REPTSTART0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,START →
REPTSTART0,,,,,,,,START → REPTSTART0,,
```

```
APARAMS,,,,,APARAMS → EXPR REPTAPARAMS1,,,APARAMS → &epsilon,APARAMS → EXPR
REPTAPARAMS1,,,,,,,,,,,,,APARAMS → EXPR REPTAPARAMS1,APARAMS → EXPR
REPTAPARAMS1,,,,,,,,,,,,,,,,,,,,,,APARAMS → EXPR REPTAPARAMS1,APARAMS → EXPR
REPTAPARAMS1,APARAMS → EXPR REPTAPARAMS1,,,
```

```
APARAMSTAIL,,,,,,,,,,,,,,,,,,,,,APARAMSTAIL → comma
EXPR,,,,,,,,,,,,,,,,,,,,,,,,,
```

```
ADDOP,,,,,,,,,,,,,,,,,,,ADDOP → minus,ADDOP →
plus,,,,,,,,,,,,,,,,,,,,,,,,,ADDOP → or
```

```
ARITHEXPR,,,,,ARITHEXPR → TERM RIGHTRECARITHEXPR,,,,,ARITHEXPR → TERM
RIGHTRECARITHEXPR,,,,,,,,,,,,,ARITHEXPR → TERM RIGHTRECARITHEXPR,ARITHEXPR →
TERM RIGHTRECARITHEXPR,,,,,,,,,,,,,,,,,,,,,,ARITHEXPR → TERM
RIGHTRECARITHEXPR,ARITHEXPR → TERM RIGHTRECARITHEXPR,ARITHEXPR → TERM
RIGHTRECARITHEXPR,,,
```

```
ARRAYSIZE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,ARRAYSIZE → lsqbr
ARRAYSIZE1,,,,,,,
```

```
ARRAYSIZE1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,ARRAYSIZE1 →
rsqbr,,,,,,ARRAYSIZE1 → intlit rsqbr,,,
```

```
ASSIGNOP,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,ASSIGNOP → equal,
```

```
CLASSDECL,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,CLASSDECL → class id
OPTCLASSDECL2 lcurbr REPTCLASSDECL4 rcurbr semi,,
```

```
CLASSDECLORFUNCDEF,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,CLASSDECLORFUNCDEF →
FUNCDEF,,,,,,,,CLASSDECLORFUNCDEF → CLASSDECL,,
```

EXPR,,,,EXPR → ARITHEXPR EXPR1,,,,EXPR → ARITHEXPR EXPR1,,,,,,,,,,,,EXPR → ARITHEXPR EXPR1,EXPR → ARITHEXPR EXPR1,,,,,,,,,,,,,,,,,,,,,EXPR → ARITHEXPR EXPR1,EXPR → ARITHEXPR EXPR1,EXPR → ARITHEXPR EXPR1,,,

EXPR1,,,,,,,EXPR1 → &epsilon,,,EXPR1 → &epsilon,,,,,,,,,,,,EXPR1 → &epsilon,EXPR1 → RELOP ARITHEXPR,EXPR1 → RELOP ARITHEXPR,EXPR1 → RELOP ARITHEXPR,EXPR1 → RELOP ARITHEXPR,EXPR1 → RELOP ARITHEXPR,EXPR1 → RELOP ARITHEXPR,,,,,,,,,,,,,,,,,

FPARAMS,,,,FPARAMS → id colon TYPE REPTFPARAMS3 REPTFPARAMS4,,,FPARAMS → &epsilon,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

FPARAMSTAIL,,,,,,,,,,,,,,,,,,,,,,FPARAMSTAIL → comma id colon TYPE REPTFPARAMSTAIL4,,,,,,,,,,,,,,,,,,,,,,

FACTOR,,,,FACTOR → FUNCTIONCALLORVARIABLE,,,,FACTOR → lpar ARITHEXPR rpar,,,,,,,,,,,,FACTOR → SIGN FACTOR,FACTOR → SIGN FACTOR,,,,,,,,,,,,,,,,,,,,FACTOR → not FACTOR,FACTOR → floatlit,FACTOR → intlit,,,

FUNCBODY,,,,,,,,,,,,,,,,,,,,FUNCBODY → lcurbr REPTFUNCBODY1 rcurbr,,,,,,,,,,,,,,,,,,,,,,,,,,

FUNCDEF,,FUNCDEF → FUNCHEAD FUNCBODY,,,,,,,,,,,

FUNCHEAD,,FUNCHEAD → function id FUNCHEAD3,,,,,,,,,,,

FUNCHEAD1,,,,FUNCHEAD1 → id lpar FPARAMS rpar arrow RETURNTYPE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,FUNCHEAD1 → constructor lpar FPARAMS rpar,,,,,,,,,,,,

FUNCHEAD3,,,,,,,,FUNCHEAD3 → lpar FPARAMS rpar arrow RETURNTYPE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,FUNCHEAD3 → sr FUNCHEAD1,,,,,,,

ASSIGNSTAT,,,,ASSIGNSTAT → VARIABLE ASSIGNOP EXPR,,,

FUNCTIONCALL,,,,FUNCTIONCALL → id FUNCALL3,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

FUNCALL3,,,,,,,,FUNCALL3 → lpar APARAMS rpar,FUNCALL3 → FUNCALL2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

FUNCALL2,,,,,,,,,,FUNCALL2 → dot id FUNCALL4,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

FUNCALL4,,,,,,,,FUNCALL4 → lpar APARAMS rpar FUNCALL5,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,FUNCALL4 → INDICE FUNCALL2,,,,,,,

FUNCALL5,,,,,,,,,FUNCALL5 → FUNCALL2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

VARIABLE,,,,VARIABLE → id
VARIABLE3,,

VARIABLE3,,,,,,,VARIABLE3 → &epsilon,,VARIABLE3 →
VARIABLE2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,VARIABLE3 → INDICE,,,,,,VARIABLE3 →
&epsilon,

VARIABLE2,,,,,,,,,VARIABLE2 → dot id
VARIABLE4,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

VARIABLE4,,,,,,,,,VARIABLE4 → lpar APARAMS rpar
VARIABLE2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,VARIABLE4 → INDICE VARIABLE5,,,,,,,

VARIABLE5,,,,,,,VARIABLE5 → &epsilon,,VARIABLE5 →
VARIABLE2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,VARIABLE5 → &epsilon,

FUNCTIONCALLORVARIABLE,,,,FUNCTIONCALLORVARIABLE → id
FUNCTIONCALLORVARIABLE1,,

FUNCTIONCALLORVARIABLE1,,,,,,,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → lpar APARAMS rpar
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,,,,,,,,,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,,,,,,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,,,,,,FUNCTIONCALLORVARIABLE1 → INDICELOOP
FUNCTIONCALLORVARIABLE2

FUNCTIONCALLORVARIABLE2,,,,,,,FUNCTIONCALLORVARIABLE2 →
&epsilon,,FUNCTIONCALLORVARIABLE2 → dot id
FUNCTIONCALLORVARIABLE3,FUNCTIONCALLORVARIABLE2 →
&epsilon,,,,,,,,,FUNCTIONCALLORVARIABLE2 → &epsilon,FUNCTIONCALLORVARIABLE2 →
&epsilon,,FUNCTIONCALLORVARIABLE2 → &epsilon,FUNCTIONCALLORVARIABLE2 →
&epsilon,FUNCTIONCALLORVARIABLE2 → &epsilon,FUNCTIONCALLORVARIABLE2 →
&epsilon,FUNCTIONCALLORVARIABLE2 → &epsilon,FUNCTIONCALLORVARIABLE2 →
&epsilon,FUNCTIONCALLORVARIABLE2 → &epsilon,,FUNCTIONCALLORVARIABLE2 →

&epsilon,FUNCTIONCALLORVARIABLE2 → &epsilon,FUNCTIONCALLORVARIABLE2 →
&epsilon,,,,,,,FUNCTIONCALLORVARIABLE2 →
&epsilon,,,,,,,,FUNCTIONCALLORVARIABLE2 → &epsilon

FUNCTIONCALLORVARIABLE3,,,,,,,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → lpar APARAMS rpar
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,,,,,,,,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,,,,,,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2,,,,,,,FUNCTIONCALLORVARIABLE3 → INDICELOOP
FUNCTIONCALLORVARIABLE2

IDNEST1,,,,,,,,,IDNEST1 → dot id
IDNEST2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

IDNEST2,,,,,,,,IDNEST2 → lpar APARAMS
rpar,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,IDNEST2 → lsqbr ARITHEXPR rsqbr
IDNEST2,,,,,,,

INDICE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,INDICE → lsqbr ARITHEXPR
rsqbr,,,,,,,

LOCALVARDECL,,,LOCALVARDECL → localvar id
colon TYPE LOCALVARDECL2,,,,,,,,,

LOCALVARDECL2,,,,,,,,,LOCALVARDECL2 → lpar APARAMS rpar semi,,LOCALVARDECL2 →
REPTLOCALVARDECL4 semi,,,,,,,,,,,,,,,,,,,,,,,,,,,,,LOCALVARDECL2 →
REPTLOCALVARDECL4 semi,,,,,,,

LOCALVARDECLORSTMT,,,,LOCALVARDECLORSTMT → STATEMENT,,,,,,,LOCALVARDECLORSTMT
→ STATEMENT,LOCALVARDECLORSTMT → STATEMENT,LOCALVARDECLORSTMT →
STATEMENT,LOCALVARDECLORSTMT → STATEMENT,,,LOCALVARDECLORSTMT →
STATEMENT,,,,,,,,,,,,,,,,,,,,,LOCALVARDECLORSTMT → LOCALVARDECL,,,,,,,,,

MEMBERDECL,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,MEMBERDECL →
MEMBERVARDECL,MEMBERDECL → MEMBERFUNCDECL,,MEMBERDECL →
MEMBERFUNCDECL,,,,,,,,,,

MEMBERFUNCDECL,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,MEMBERFUNCDECL → constructor colon lpar FPARAMS rpar semi,,MEMBERFUNCDECL → function id colon lpar FPARAMS rpar arrow RETURNTYPE semi,,,,,,,,,,

MEMBERVARDECL,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,MEMBERVARDECL → attribute id colon TYPE REPTMEMBERVARDECL4 semi,,,,,,,,,,,,

MULTOP,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,MULTOP → and,MULTOP → div,MULTOP → mult,,,,,,,,,,,,,,

OPTCLASSDECL2,,,,,,,,,,,,,,,,,,,OPTCLASSDECL2 → &epsilon,,,,,,,,,,,OPTCLASSDECL2 → isa id REPTOPTCLASSDECL22,,,,,,,,,,,,,,,,,

RELEXPR,,,,RELEXPR → ARITHEXPR RELOP ARITHEXPR,,,,RELEXPR → ARITHEXPR RELOP ARITHEXPR,,,,,,,,,,,,,RELEXPR → ARITHEXPR RELOP ARITHEXPR,RELEXPR → ARITHEXPR RELOP ARITHEXPR,,,,,,,,,,,,,,,,,,,,,RELEXPR → ARITHEXPR RELOP ARITHEXPR,RELEXPR → ARITHEXPR RELOP ARITHEXPR,RELEXPR → ARITHEXPR RELOP ARITHEXPR,,,

RELOP,,,,,,,,,,,,,,,,,,,,,,,,,,RELOP → geq,RELOP → leq,RELOP → gt,RELOP → lt,RELOP → neq,RELOP → eq,,,,,,,,,,,,,,,,,,,

REPTSTART0,REPTSTART0 → &epsilon,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,REPTSTART0 → CLASSDECLORFUNCDEF REPTSTART0,,,,,,,,REPTSTART0 → CLASSDECLORFUNCDEF REPTSTART0,,

REPTAPARAMS1,,,,,,,REPTAPARAMS1 → &epsilon,,,,,,,,,,,,,,,REPTAPARAMS1 → APARAMSTAIL REPTAPARAMS1,,,,,,,,,,,,,,,,,,,,,,,

REPTCLASSDECL4,,REPTCLASSDECL4 → VISIBILITY MEMBERDECL REPTCLASSDECL4,REPTCLASSDECL4 → VISIBILITY MEMBERDECL REPTCLASSDECL4,,,,,,,,,,,,,,,REPTCLASSDECL4 → &epsilon,,,,,,,,,,,,,,,,,REPTCLASSDECL4 → VISIBILITY MEMBERDECL REPTCLASSDECL4,REPTCLASSDECL4 → VISIBILITY MEMBERDECL REPTCLASSDECL4,,REPTCLASSDECL4 → VISIBILITY MEMBERDECL REPTCLASSDECL4,,,,,,,,,,

REPTFPARAMS3,,,,,,,REPTFPARAMS3 → &epsilon,,,,,,,,,,,,,,,REPTFPARAMS3 → &epsilon,,,,,,,,,,,,,,,,,REPTFPARAMS3 → ARRAYSIZE REPTFPARAMS3,,,,,,,

REPTFPARAMS4,,,,,,,REPTFPARAMS4 → &epsilon,,,,,,,,,,,,,,,REPTFPARAMS4 → FPARAMSTAIL REPTFPARAMS4,,,,,,,,,,,,,,,,,,,,,,,,

REPTFPARAMSTAIL4,,,,,,,REPTFPARAMSTAIL4 → &epsilon,,,,,,,,,,,,,,,,REPTFPARAMSTAIL4 → &epsilon,,,,,,,,,,,,,,,,,,REPTFPARAMSTAIL4 → ARRAYSIZE REPTFPARAMSTAIL4,,,,,,,

REPTFUNCBODY1,,,,REPTFUNCBODY1 → LOCALVARDECLORSTMT REPTFUNCBODY1,,,,,,,REPTFUNCBODY1 → LOCALVARDECLORSTMT REPTFUNCBODY1,REPTFUNCBODY1 → LOCALVARDECLORSTMT REPTFUNCBODY1,REPTFUNCBODY1 →

LOCALVARDECLORSTMT REPTFUNCBODY1,REPTFUNCBODY1 → LOCALVARDECLORSTMT
REPTFUNCBODY1,,,REPTFUNCBODY1 → LOCALVARDECLORSTMT REPTFUNCBODY1,REPTFUNCBODY1
→ &epsilon,,,,,,,,,,,,,,,,,,,REPTFUNCBODY1 → LOCALVARDECLORSTMT
REPTFUNCBODY1,,,,,,,,,

REPTLOCALVARDECL4,,,,,,,,,,REPTLOCALVARDECL4 →
&epsilon,,,,,,,,,,,,,,,,,,,,,,,,,,,REPTLOCALVARDECL4 → ARRAYSIZE
REPTLOCALVARDECL4,,,,,,,

REPTMEMBERVARDECL4,,,,,,,,,,REPTMEMBERVARDECL4 →
&epsilon,,,,,,,,,,,,,,,,,,,,,,,,,,,REPTMEMBERVARDECL4 → ARRAYSIZE
REPTMEMBERVARDECL4,,,,,,,

REPTOPTCLASSDECL22,,,,,,,,,,,,,,,,,,REPTOPTCLASSDECL22 →
&epsilon,,,,REPTOPTCLASSDECL22 → comma id
REPTOPTCLASSDECL22,,,,,,,,,,,,,,,,,,,,,,

REPTSTATBLOCK1,,,,REPTSTATBLOCK1 → STATEMENT
REPTSTATBLOCK1,,,,,,,REPTSTATBLOCK1 → STATEMENT REPTSTATBLOCK1,REPTSTATBLOCK1
→ STATEMENT REPTSTATBLOCK1,REPTSTATBLOCK1 → STATEMENT
REPTSTATBLOCK1,REPTSTATBLOCK1 → STATEMENT REPTSTATBLOCK1,,,REPTSTATBLOCK1 →
STATEMENT REPTSTATBLOCK1,REPTSTATBLOCK1 →
&epsilon,,,,,,,,,,,,,,,,,,,,,,,,,,,,

RETURNTYPE,,,,RETURNTYPE → TYPE,RETURNTYPE → TYPE,RETURNTYPE →
TYPE,,,,,,,,,,,,,,,RETURNTYPE → void,,,,,,,,,,,,,,,,,,,,,,,,,

RIGHTRECARITHEXPR,,,,,,RIGHTRECARITHEXPR → &epsilon,,,RIGHTRECARITHEXPR →
&epsilon,,,,,,,,,,RIGHTRECARITHEXPR → ADDOP TERM
RIGHTRECARITHEXPR,RIGHTRECARITHEXPR → ADDOP TERM
RIGHTRECARITHEXPR,,RIGHTRECARITHEXPR → &epsilon,RIGHTRECARITHEXPR →
&epsilon,RIGHTRECARITHEXPR → &epsilon,RIGHTRECARITHEXPR →
&epsilon,RIGHTRECARITHEXPR → &epsilon,RIGHTRECARITHEXPR →
&epsilon,RIGHTRECARITHEXPR → &epsilon,,,,,,,,,,RIGHTRECARITHEXPR →
&epsilon,,,,,,,RIGHTRECARITHEXPR → ADDOP TERM RIGHTRECARITHEXPR

RIGHTRECTERM,,,,,,RIGHTRECTERM → &epsilon,,,RIGHTRECTERM →
&epsilon,,,,,,,,,,RIGHTRECTERM → &epsilon,RIGHTRECTERM →
&epsilon,,RIGHTRECTERM → &epsilon,RIGHTRECTERM → &epsilon,RIGHTRECTERM →
&epsilon,RIGHTRECTERM → &epsilon,RIGHTRECTERM → &epsilon,RIGHTRECTERM →
&epsilon,RIGHTRECTERM → &epsilon,,RIGHTRECTERM → MULTOP FACTOR
RIGHTRECTERM,RIGHTRECTERM → MULTOP FACTOR RIGHTRECTERM,RIGHTRECTERM → MULTOP
FACTOR RIGHTRECTERM,,,,,,RIGHTRECTERM → &epsilon,,,,,,,RIGHTRECTERM →
&epsilon

SIGN,,,,,,,,,,,,,,,,,,SIGN → minus,SIGN → plus,,,,,,,,,,,,,,,,,,,,,,,,,

STATBLOCK,,,,STATBLOCK → STATEMENT,,,,,,STATBLOCK → &epsilon,STATBLOCK →
STATEMENT,STATBLOCK → STATEMENT,STATBLOCK → STATEMENT,STATBLOCK →

STATEMENT,STATBLOCK → &epsilon,,STATBLOCK → STATEMENT,,STATBLOCK → lcurbr REPTSTATBLOCK1 rcurbr,,,,,,,,,,,,,,,,,,,,,,,,,,,,

STATEMENT,,,,STATEMENT → FUNCTIONCALLORASIGNSTAT semi,,,,,,,STATEMENT → return lpar EXPR rpar semi,STATEMENT → write lpar EXPR rpar semi,STATEMENT → read lpar VARIABLE rpar semi,STATEMENT → while lpar RELEXPR rpar STATBLOCK semi,,,STATEMENT → if lpar RELEXPR rpar then STATBLOCK else STATBLOCK semi,,,,,,,,,,,,,,,,,,,,,,,,,,,

FUNCTIONCALLORASIGNSTAT,,,,FUNCTIONCALLORASIGNSTAT → id ISFUNCTIONCALLORVARIABLE,,

ISFUNCTIONCALLORVARIABLE,,,,,,,,ISFUNCTIONCALLORVARIABLE → lpar APARAMS rpar AFTERFUNCTIONCALL,ISFUNCTIONCALLORVARIABLE → INDICELOOP AFTERVARIABLE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,ISFUNCTIONCALLORVARIABLE → INDICELOOP AFTERVARIABLE,,,,,,ISFUNCTIONCALLORVARIABLE → INDICELOOP AFTERVARIABLE,

AFTERFUNCTIONCALL,,,,,,,,,AFTERFUNCTIONCALL → dot id MIDDLESTATE,AFTERFUNCTIONCALL → &epsilon,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

AFTERVARIABLE,,,,,,,,,AFTERVARIABLE → dot id MIDDLESTATE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,AFTERVARIABLE → ENDASSIGN,

MIDDLESTATE,,,,,,,,MIDDLESTATE → lpar APARAMS rpar AFTERFUNCTIONCALL,MIDDLESTATE → INDICELOOP AFTERVARIABLE,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,MIDDLESTATE → INDICELOOP AFTERVARIABLE,,,,,,MIDDLESTATE → INDICELOOP AFTERVARIABLE,

INDICELOOP,,,,,,,INDICELOOP → &epsilon,,INDICELOOP → &epsilon,INDICELOOP → &epsilon,,,,,,,,,,,INDICELOOP → &epsilon,INDICELOOP → &epsilon,,INDICELOOP → &epsilon,INDICELOOP → &epsilon,INDICELOOP → &epsilon,INDICELOOP → &epsilon,INDICELOOP → &epsilon,INDICELOOP → &epsilon,INDICELOOP → &epsilon,,INDICELOOP → &epsilon,INDICELOOP → &epsilon,INDICELOOP → &epsilon,,,,,,,INDICELOOP → &epsilon,INDICELOOP → INDICE INDICELOOP,,,,,,INDICELOOP → &epsilon,INDICELOOP → &epsilon

ENDASSIGN,,,ENDASSIGN → ASSIGNOP EXPR,

TERM,,,,TERM → FACTOR RIGHTRECTERM,,,,TERM → FACTOR RIGHTRECTERM,,,,,,,,,,,,TERM → FACTOR RIGHTRECTERM,TERM → FACTOR RIGHTRECTERM,,,,,,,,,,,,,,,,,,,,TERM → FACTOR RIGHTRECTERM,TERM → FACTOR RIGHTRECTERM,TERM → FACTOR RIGHTRECTERM,,,

TYPE,,,,TYPE → id,TYPE → float,TYPE → integer,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

```
VISIBILITY,,VISIBILITY → private,VISIBILITY →
public,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,VISIBILITY → &epsilon,VISIBILITY →
&epsilon,,VISIBILITY → &epsilon,,,,,,,,,,
```

Section 3.

DESIGN

Using the concept of a table driven parser, I was able to generate the parsing table with the Univeristy of Calgary tool. This algorithm was encapsulated into the Parser class, in which a stack is used to determine matching elements where it would pop. If the match was not found, the parsing table was used to replace non terminals by its right side until another match was found. This parsing algorithm was the one found in the lecture slides of the top down parsing 1 slides.

Section 4.

For the tools, I used the University of Calgary tool to look and fix the ambiguities that were presented in the original grammar. The tool also allowed to generate the first and follow sets as well as the parsing table used. To get the tables into a CSV format to delimit, an online convertcsv tool was used where it then could be used in the Java language to work with its values.