Design Decisions and Evaluation of Parser

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1 Grammar

$Exp \rightarrow LtLevel$
$Exp \rightarrow Exp\,\text{"\&\&"}\ LtLevel$
$LtLevel \rightarrow PlusLevel$
$LtLevel \rightarrow LtLevel\ \text{"} < \text{"}\ PlusLevel$
$PlusLevel \rightarrow MultLevel$
$PlusLevel \rightarrow PlusLevel\ (\text{"} + \text{"}|\text{"} - \text{"})\ MultLevel$
$MultLevel \rightarrow DotLevel$
$MultLevel \rightarrow MultLevel\ \text{"} * \text{"}\ DotLevel$
$DotLevel \rightarrow PrimaryExp\ (\ \text{"["}\ Exp\ \text{"]"}\ |\ \text{"."}\ \text{"}length\text{"}\ |\ \text{"."}\ Id\ \text{"("}\ (\ Exp\ (\ \text{","}\ Exp\ )^*\ )?\ \text{")"}\ )^*$
$DotLevel \rightarrow \text{"!"}\ DotLevel$
$PrimaryExp \rightarrow \text{"}true\text{"}\ |\ \text{"}false\text{"}\ |\ \text{"}this\text{"}\ |\ \text{"}new\text{"}\ \text{"}int\text{"}\ \text{"["}\ Exp\ \text{"]"}\ |\ \text{"}new\text{"}\ Id\ \text{"("}\ \text{")"}\ |\ < NUM >\ |\ \text{"("}\ Exp\ \text{")"}$

1.1 Eliminate Left Recursion

$Goal \rightarrow MainClass\ (\ ClassDecl\ )^*\ < EOF >$
$MainClass \rightarrow \text{"}class\text{"}\ Id\ \text{"\{"}\ \text{"}public\text{"}\ \text{"}static\text{"}\ \text{"}void\text{"}\ \text{"}main\text{"}\ \text{"("}\ \text{"}String\text{"}\ \text{"["}\ \text{"]"}\ Id\ \text{")"}\ \text{"\{"}\ Stmt\ \text{"\}"}\ \text{"\}"}$
$ClassDecl \rightarrow \text{"}class\text{"}\ Id\ (\ \text{"}extends\text{"}\ Id\ )?\ \text{"\{"}\ (\ VarDecl\ )^*\ (\ MethodDecl\ )^*\ \text{"\}"}$
$VarDecl \rightarrow Type\ Id\ \text{";"}$
$MethodDecl \rightarrow \text{"}public\text{"}\ Type\ Id\ \text{"("}\ (\ Type\ Id\ (\ \text{","}\ Type\ Id\ )^*\ )?\ \text{")"}\ \text{"\{"}\ (\ VarDecl\ )^*\ (\ Stmt\ )^*\ \text{"}return\text{"}\ Exp\ \text{";"}\ \text{"\}"}$
$- -$
$Type \rightarrow \text{"}int\text{"}\ \text{"["}\ \text{"]"}\ |\ \text{"}boolean\text{"}\ |\ \text{"}int\text{"}\ |\ Id$
$- -$
$Stmt \rightarrow \text{"\{"}\ (\ Stmt\ )^*\ \text{"\}"}\ |$
$\text{"}if\text{"}\ \text{"("}\ Exp\ \text{")"}\ Stmt\ \text{"}else\text{"}\ Stmt\ |$
$\text{"}while\text{"}\ \text{"("}\ Exp\ \text{")"}\ Stmt\ |$
$\text{"}System.out.println\text{"}\ \text{"("}\ Exp\ \text{")"}\ \text{";"}\ |$
$Id\ \text{"} = \text{"}\ Exp\ \text{";"}\ |$
$Id\ \text{"["}\ Exp\ \text{"]"}\ \text{"} = \text{"}\ Exp\ \text{";"}\ |$
$- -$
$Exp \rightarrow LtLevel\ Exp'$
$Exp' \rightarrow \text{"\&\&"}\ LtLevel\ Exp'$
$Exp' \rightarrow$

$LtLevel \rightarrow PlusLevel\ LtLevel'$
$LtLevel' \rightarrow$ " $<$ " $PlusLevel\ LtLevel'$
$LtLevel' \rightarrow$
$PlusLevel \rightarrow MultLevel\ PlusLevel'$
$PlusLevel' \rightarrow$ (" $+$ "|" $-$ ") $MultLevel\ PlusLevel'$
$PlusLevel' \rightarrow$
$MultLevel \rightarrow DotLevel\ MultLevel'$
$MultLevel' \rightarrow$ " $*$ " $DotLevel\ MultLevel'$
$MultLevel' \rightarrow$
$DotLevel \rightarrow PrimaryExp$ ("[" Exp "]" | "." "$length$" | "." Id "(" (Exp ("," Exp)*)? ")")*
$DotLevel \rightarrow$ "!" $DotLevel$
$PrimaryExp \rightarrow$ "$true$" | "$false$" | "$this$" | "new" "int" "[" Exp "]" | "new" Id "(" ")" | $<$ NUM $>$ | "(" Exp ")"

1.2 Left Factoring

$Goal \rightarrow$ "$class$" $Id\ MainClass$ ("$class$" $Id\ RegClass$)* $<$ EOF $>$
$MainClass \rightarrow$ "{" "$public$" "$static$" "$void$" "$main$" "(" "$String$" "[" "]" Id ")" "{" $Stmt$ "}" "}"
$RegClass \rightarrow$ ("$extends$" Id)? "{" ($VarDecl$)* ($MethodDecl$)* "}"
$VarDecl \rightarrow Type\ Id$ ";"
$MethodDecl \rightarrow$ "$public$" $Type\ Id$ "(" ($Type\ Id$ ("," $Type\ Id$)*)? ")" "{" ($VarDecl$)* ($Stmt$)* "$return$" Exp ";" "}"
$Type \rightarrow$ "int" "[" "]" | "$boolean$" | "int" | Id
$Stmt \rightarrow$ "{" ($Stmt$)* "}" |
"if" "(" Exp ")" $Stmt$ "$else$" $Stmt$ |
"$while$" "(" Exp ")" $Stmt$ |
"$System.out.println$" "(" Exp ")" ";" |
$Id\ AssignStmt$
$AssignStmt \rightarrow$ " $=$ " Exp ";" |
"[" Exp "]" " $=$ " Exp ";"
$Exp \rightarrow LtLevel\ Exp'$
$Exp' \rightarrow$ "&&" $LtLevel\ Exp'$
$Exp' \rightarrow$
$LtLevel \rightarrow PlusLevel\ LtLevel'$
$LtLevel' \rightarrow$ " $<$ " $PlusLevel\ LtLevel'$
$LtLevel' \rightarrow$
$PlusLevel \rightarrow MultLevel\ PlusLevel'$
$PlusLevel' \rightarrow$ (" $+$ "|" $-$ ") $MultLevel\ PlusLevel'$
$PlusLevel' \rightarrow$
$MultLevel \rightarrow DotLevel\ MultLevel'$
$MultLevel' \rightarrow$ " $*$ " $DotLevel\ MultLevel'$
$MultLevel' \rightarrow$
$DotLevel \rightarrow PrimaryExp$ ("[" Exp "]" | "." "$length$" | "." Id "(" (Exp ("," Exp)*)? ")")*
$DotLevel \rightarrow$ "!" $DotLevel$

$PrimaryExp \rightarrow$ "$true$" | "$false$" | "$this$" | "new" $NewExp$ | $< NUM >$ | "(" Exp ")"
$NewExp \rightarrow$ "int" "[" Exp "]" | Id "(" ")"

2 Design Decisions