PRODUCTION	SEMANTIC RULES
$P \to L$	$L.next = newlabel()$ $P.code = L.code \,\|\|\, label(L.next)$
$L \to L_1 S$	$L_1.next = newlabel()$ $S.next = L.next$ $L.code = L_1.code \,\|\|\, label(L_1.next) \,\|\|\, S.code$
$L \to \varepsilon$	$L.code = \varepsilon$
$S \to \textbf{while}\ (\ B\ )\ S_1$	$begin = newlabel()$ $B.true = newlabel()$ $B.false = S.next$ $S_1.next = begin$ $loopStack.\textbf{push}(S.next, begin)$ around $S_1.code$ $S.code = label(begin) \,\|\|\, B.code$ $\|\| label(B.true) \,\|\| S_1.code$ $\|\| gen(\texttt{goto}\ begin)$
$S \to \textbf{if}\ (\ B\ )\ S_1$	$B.true = newlabel()$ $B.false = S_1.next = S.next$ $S.code = B.code \,\|\|\, label(B.true) \,\|\|\, S_1.code$
$S \to \textbf{if}\ (\ B\ )\ S_1\ \textbf{else}\ S_2$	$B.true = newlabel()$ $B.false = newlabel()$ $S_1.next = S_2.next = S.next$ $S.code = B.code$ $\|\| label(B.true) \,\|\| S_1.code$ $\|\| gen(\texttt{goto}\ S.next)$ $\|\| label(B.false) \,\|\| S_2.code$
$S \to \textbf{for}\ (\ A_1\ ;\ B\ ;\ A_2\ )\ S_1$	$begin = newlabel()$ $incr = newlabel()$ $B.true = newlabel()$ $B.false = S.next$ $S_1.next = incr$ $loopStack.\textbf{push}(S.next, incr)$ around $S_1.code$ $S.code = A_1.code \,\|\|\, label(begin) \,\|\|\, B.code$ $\|\| label(B.true) \,\|\| S_1.code$ $\|\| label(incr) \,\|\| A_2.code$ $\|\| gen(\texttt{goto}\ begin)$
$S \to \textbf{break}\ ;$	$S.code = gen(\texttt{goto}\ loopStack.top.break)$
$S \to \textbf{continue}\ ;$	$S.code = gen(\texttt{goto}\ loopStack.top.continue)$
$S \to \{\ L\ \}$	$L.next = S.next$ $S.code = L.code$
$S \to D\ ;$	$S.code = D.code$
$S \to A\ ;$	$S.code = A.code$
$A \to \textbf{id} = E$	$A.code = E.code \,\|\|\, gen(\textbf{id}.lexeme = E.addr)$
$A \to R = E$	$A.code = E.code \,\|\|\, R.code$ $\|\| gen(R.base\ [\ R.addr\ ] = E.addr)$
$D \to TV$	$V.type = T.type$ $D.code = \varepsilon$
$V \to V_1\ ,\ \textbf{id}$	$V_1.type = V.type$ $addtype(\textbf{id}.lexeme, V.type)$
$V \to \textbf{id}$	$addtype(\textbf{id}.lexeme, V.type)$
$E \to E_1\ \textbf{op}\ E_2$	$E.addr = newtemp()$ $E.code = E_1.code \,\|\|\, E_2.code$ $\|\| gen(E.addr = E_1.addr\ \textbf{op}.lexeme\ E_2.addr)$
$E \to (\ E_1\ )$	$E.addr = E_1.addr$ $E.code = E_1.code$
$E \to -\ E_1$	$E.addr = newtemp()$ $E.code = E_1.code \,\|\|\, gen(E.addr = \texttt{minus}\ E_1.addr)$
$E \to R$	$E.addr = newtemp()$ $E.code = R.code \,\|\|\, gen(E.addr = R.base\ [\ R.addr\ ])$
$E \to \textbf{id}$	$E.addr = \textbf{id}.lexeme$ $E.code = \varepsilon$
$E \to \textbf{num}$	$E.addr = \textbf{num}.lexeme$ $E.code = \varepsilon$
$R \to \textbf{id}\ [\ E\ ]$	$R.base = \textbf{id}.lexeme$ $R.type = lookup(\textbf{id}.lexeme).type.elem$ $R.addr = newtemp()$ $R.code = E.code \,\|\|\, gen(R.addr = E.addr \times R.type.width)$
$R \to R_1\ [\ E\ ]$	$R.base = R_1.base$ $R.type = R_1.type.elem$ $t = newtemp()$ $R.addr = newtemp()$ $R.code = R_1.code \,\|\|\, E.code$ $\|\| gen(t = E.addr \times R.type.width)$ $\|\| gen(R.addr = R_1.addr + t)$
$B \to B_1\ \|\|\ B_2$	$B_1.true = B.true$ $B_1.false = newlabel()$ $B_2.true = B.true$ $B_2.false = B.false$ $B.code = B_1.code \,\|\|\, label(B_1.false) \,\|\|\, B_2.code$
$B \to B_1\ \&\&\ B_2$	$B_1.true = newlabel()$ $B_1.false = B.false$ $B_2.true = B.true$ $B_2.false = B.false$ $B.code = B_1.code \,\|\|\, label(B_1.true) \,\|\|\, B_2.code$
$B \to !\ B_1$	$B_1.true = B.false$ $B_1.false = B.true$ $B.code = B_1.code$
$B \to (\ B_1\ )$	$B_1.true = B.true$ $B_1.false = B.false$ $B.code = B_1.code$
$B \to E_1\ \textbf{relop}\ E_2$	$B.code = E_1.code \,\|\|\, E_2.code$ $\|\| gen(\texttt{if}\ E_1.addr\ \textbf{relop}.lexeme\ E_2.addr\ \texttt{goto}\ B.true)$ $\|\| gen(\texttt{goto}\ B.false)$
$B \to \textbf{true}$	$B.code = gen(\texttt{goto}\ B.true)$
$B \to \textbf{false}$	$B.code = gen(\texttt{goto}\ B.false)$
$T \to WM$	$M.base = W.type$ $T.type = M.type$
$W \to \textbf{int}$	$W.type = int$
$W \to \textbf{float}$	$W.type = float$
$M \to [\ \textbf{num}\ ]\ M_1$	$M_1.base = M.base$ $M.type = array(\textbf{num}.val, M_1.type)$
$M \to \varepsilon$	$M.type = M.base$