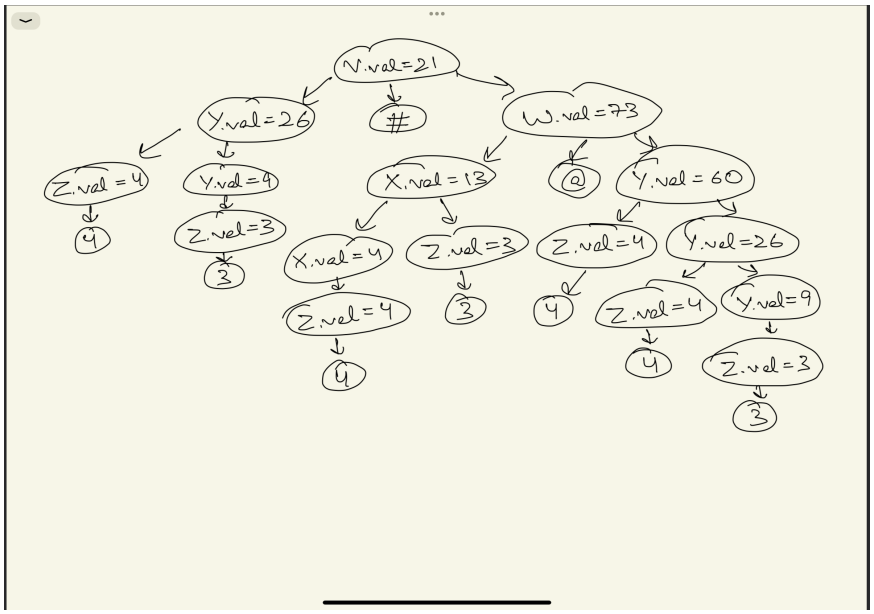

Figure 1: Problem 1: Part (i)

CS335: Compiler Design
Assignment 3

Yash Gupta (190997)

1 Problem 1

1.1 Part (i)

Figure 1

1.2 Part (ii)

The value at V computed by the translation scheme for the input string 43#43@443 is 21.

1.3 Part (iii)

The grammar is S-attributed as it uses only synthesized attributes.

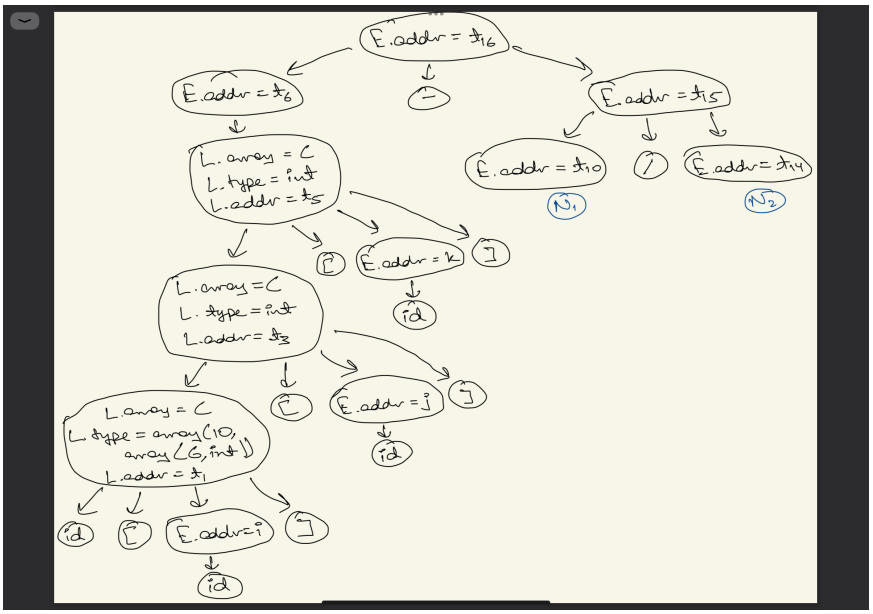

Figure 2: Problem 2: Annotated parse tree (part 1)

2 Problem 2

2.1 Annotated parse tree

Figures 2 and 3

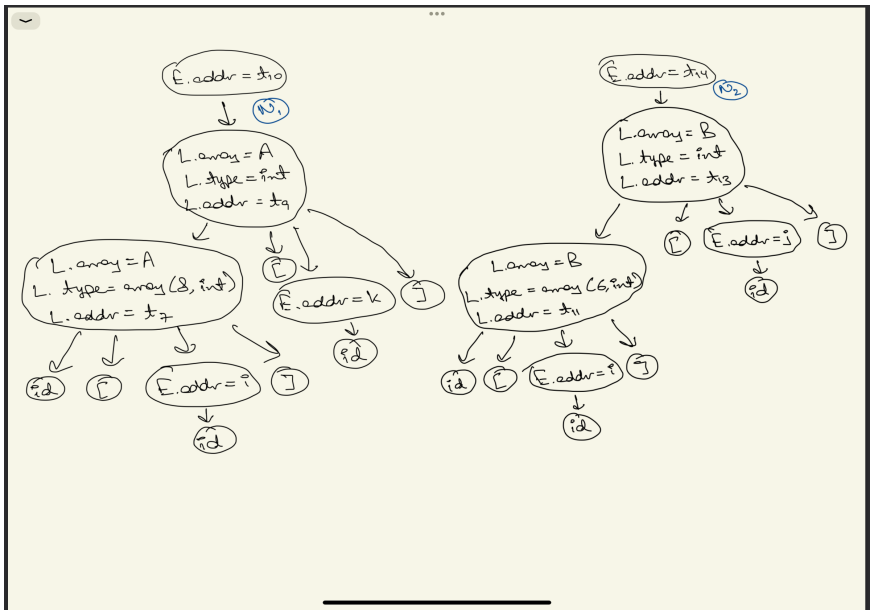

Figure 3: Problem 2: Annotated parse tree (part 2)

2.2 3AC code sequence

$$
\begin{aligned}
t_1 &= i * 240 \\
t_2 &= j * 24 \\
t_3 &= t_1 + t_2 \\
t_4 &= k * 4 \\
t_5 &= t_3 * t_4 \\
t_6 &= C[t_5] \\
t_7 &= i * 32 \\
t_8 &= k * 4 \\
t_9 &= t_7 + t_8 \\
t_{10} &= A[t_9] \\
t_{11} &= i * 24 \\
t_{12} &= j * 4 \\
t_{13} &= t_{11} + t_{12} \\
t_{14} &= B[t_{13}] \\
t_{15} &= t_{10}/t_{14} \\
t_{16} &= t_6 - t_{15}
\end{aligned}
$$

3 Problem 3

3.1 Part (i)

Production	**Semantic Actions**
$S \rightarrow \texttt{id} = E$	gen(symtop.get(id.lexeme) " = " E.addr)
$S \rightarrow L = E$	gen(L.array.base "[" L.addr "]" " = " E.addr)
$E \rightarrow E_1 + E_2$	E.addr = new Temp(); gen(E.addr " = " E_1.addr " + " E_2.addr)
$E \rightarrow L$	E.addr = L.addr
$L \rightarrow \texttt{id}$	L.addr = symtop.get(id.lexeme)
$L \rightarrow \texttt{id}[Elist$	L.array = symtop.get(id.lexeme) L.type = L.array.type.elem; L.addr = new Temp(); gen(L.addr " = " L.array.base "[" Elist.addr "]")
$Elist \rightarrow E]$	Elist.addr = new Temp() gen(Elist.addr = E.addr * Elist.type.width)
$Elist \rightarrow E, Elist_1$	t = new Temp() Elist.addr = new Temp() gen(t = E.addr * Elist.type.width) gen(Elist.addr = t + Elist1.addr)

3.2 Part (ii)

gen(): generates 3AC code
new Temp(): creates new temporary variable
addr: used for computing the offset for array reference
array: points to the symbol table entry for the array name. L.array.base gives the base address of the array
type: the type of the array generated by L. For an array of type t, t.width is the width of type t and t.elem gives the element type

3.3 Part (iii)

Figure 4

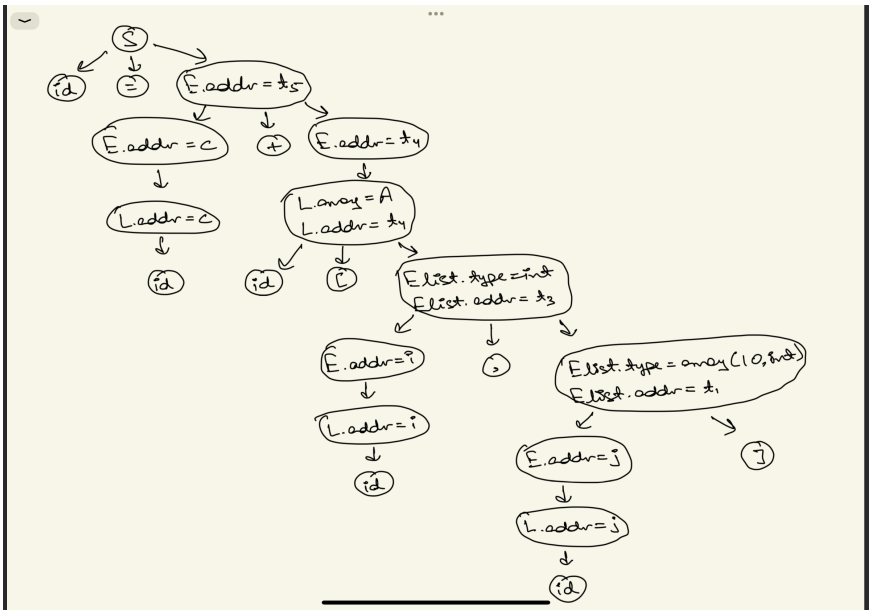

Figure 4: Problem 3: Part (iii)

3.4 Part (iv)

$$
\begin{aligned}
t_1 &= j * 40 \\
t_2 &= i * 4 \\
t_3 &= t_1 + t_2 \\
t_4 &= A[t_3] \\
t_5 &= c + t_4 \\
x &= t_5
\end{aligned}
$$