

Tutorial- 6

1. Translate the expression $-(a+b)*(c+d)+(a+b+c)$ into

a) quadruple

b) triples

First of all this statement will be converted into three address code as-

$$t_1 = a+b$$

$$t_2 = -t_1$$

$$t_3 = c+d$$

$$t_4 = t_2 * t_3$$

$$t_5 = t_1 + c$$

$$t_6 = t_4 - t_5$$

Quadruple

Location	Operator	arg 1	arg 2	Result
(0)	+	a	b	t ₁
(1)	-	t ₁		t ₂
(2)	+	c	d	t ₃
(3)	*	t ₂	t ₃	t ₄
(4)	+	t ₁	c	t ₅
(5)	-	t ₄	t ₅	t ₆

Triple

Location	Operation	arg 1	arg 2
(0)	+	a	b
(1)	-	(0)	
(2)	+	c	d
(3)	*	(1)	(2)
(4)	+	(0)	c
(5)	-	(3)	(4)

2. Generate the three-address code for the following program segment.

```
main()
{
    int K:=1;
    int a[5];
    while (K <= 5) {
        a[K] := 0;
        K++;
    }
}
```

The three-address code :

1. $K := 1$
2. if $K \leq 5$ goto (4)
3. goto (8)
4. $t_1 := K * \text{width}$
5. $t_2 := \text{addr}(a) - \text{width}$
6. $t_2[t_1] := 0$
7. $t_3 := K + 1$
8. $K := t_3$
9. goto (2)
10. next

3. Generate the three-address code for the following program segment.

```
while (X < 2 and Y > 5)
do
    if X = 1 then
        Z := Z + 1
    else
        while X <= 5
        do X := X + 10;
```

The three-address code

1. if $X \geq 2$ goto (3)
2. goto (16)
3. if $Y > 5$ goto (5)
4. goto (16)
5. if $X = 1$ goto (7)
6. goto (10)

$$7, +1 := 2+1$$

8. $2:2+1$

9. goto (v)

10. If $x \leq 5$ goto (12)

11. goto ()

$$12. \quad t_2 = 2x + 10$$

13. $x := t_2$

14. goto (10)

15. goto(1)

16. Next

4. Apply the grammar and syntax-directed translation for desk calculator and show the annotated parse tree for expression $(3+4) * (5+6)$.

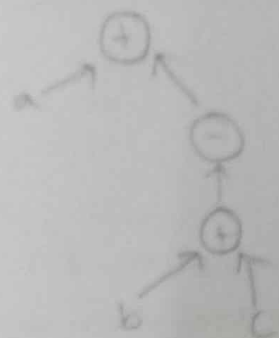
4) * (5+6).	
<p>Production</p> $L \rightarrow E n$ $E \rightarrow E_1 + T$ $E \rightarrow T$ $T \rightarrow T_1 * F$ $T \rightarrow F$ $F \rightarrow (E)$ $F \rightarrow \text{digit}$	<p>Semantic Rules</p> $L.val = E.val$ $E.val = E_1.val + T.val$ $E.val = T.val$ $T.val = T_1.val$ $T.val = F.val$ $F.val = E.val$ $F.val = \text{digit} / \text{ex.val}$

Parse Tree

Annotated parse Tree

5. Create the following for the arithmetic expression $a + -(b + c)$

- i) Syntax tree
- ii) Quadruples
- iii) Triples
- iv) Indirect Triples.



Syntax tree

Quadruples

	operator	Argument 1	Argument 2	result
0	+	b	c	t ₁
1	Unary minus	t ₁		t ₂
2	+	a	t ₂	t ₃

	operator	Argument 1	Argument 2
0	+	b	c
1	Unary minus	(0)	
2	+	a	(1)

Indirect Triples

0	(0)
1	(1)
2	(2)

Triples

6. Parse the input string int id, id ; using shift-reduce parser for the grammar

$S \rightarrow TL ;$

$T \rightarrow \text{int} \mid \text{float}$

$L \rightarrow L, \text{id} \mid \text{id}$

Stack	Input Buffer	Parsing Action
\$	int id, id ; \$	Shift
\$ int	id, id ; \$	Reduce $T \rightarrow \text{int}$
\$ T	id, id ; \$	Shift
\$ T id	, id ; \$	Reduce $L \rightarrow \text{id}$
\$ T L	, id ; \$	Shift
\$ T L,	id ; \$	Shift
\$ T L, id	, \$	Reduce $L \rightarrow L, \text{id}$
\$ T L	; \$	Shift
\$ T L ;	\$	Reduce $S \rightarrow TL ;$
\$ S	\$	Accept