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# Intermediate Code Generation Part-2

Complete Course on Compiler Design

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Ex

$E_1 \rightarrow E_2 + T \{ E_1.val = E_2.val + T.val \}$

$\quad | T \{ E_1.val = T.val \}$

$T_1 \rightarrow T_2 * F \{ T_1.val = T_2.val * F.val \}$

$F \rightarrow (E)\ G \{ F.val = 1;\ E.val = G.val \}$

$\quad | num \{ F.val = num \}$

$G \rightarrow num \{ G.val = num \}$

$T \rightarrow F \{ T.val = F.val \}$

S-attributed

L-attributed

None

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# Intermediate code Generation

ex

$x = a + b * c$

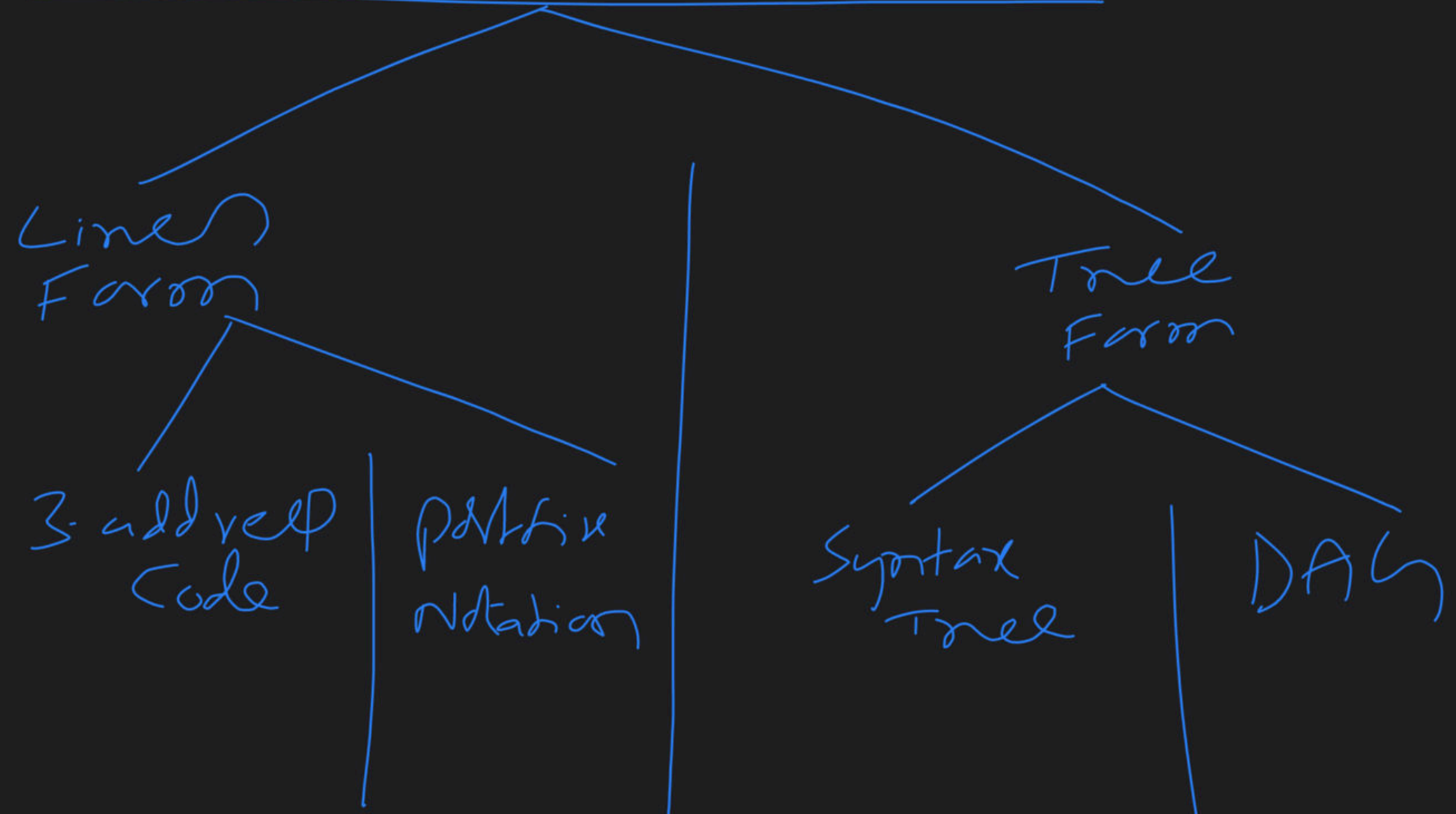
$\Downarrow$

$t_1 = b * c$

$t_2 = a + t_1$

$x = t_2$

# Representation of Intermediate Code



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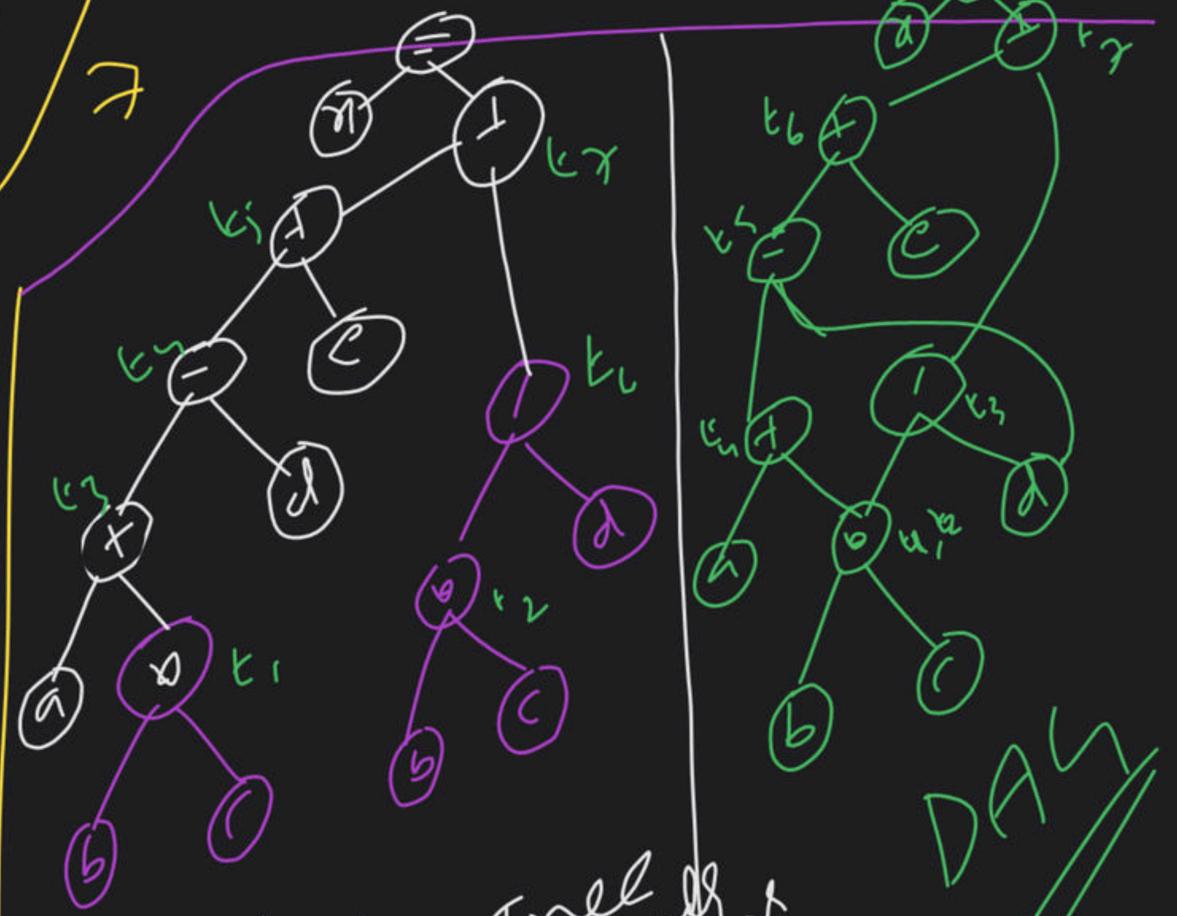
3-address code

$t_1 = b * c$
$t_2 = b * c$
$t_3 = t_2 / d$
$t_4 = a + t_1$
$t_5 = t_4 - d$
$t_6 = t_5 + e$
$t_7 = t_6 + t_3$
$x = t_7$

Postfix Notation

$x = a b c * + d - e + b c * / +$




Syntax Tree
LN - operands
IN - operators

DAG

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(1)

$x = \underbrace{\underbrace{((a+a)}_{1} * \underbrace{(a+a)}_{2})}_{3} + \underbrace{\underbrace{(\underbrace{(a+a)}_{4} * \underbrace{(a-a)}_{5})}_{6}}_{7}$

3 address code

$t_1 = a+a$

$t_2 = a+a$

$t_3 = t_1 * t_2$

$t_4 = a+a$

$t_5 = a-a$

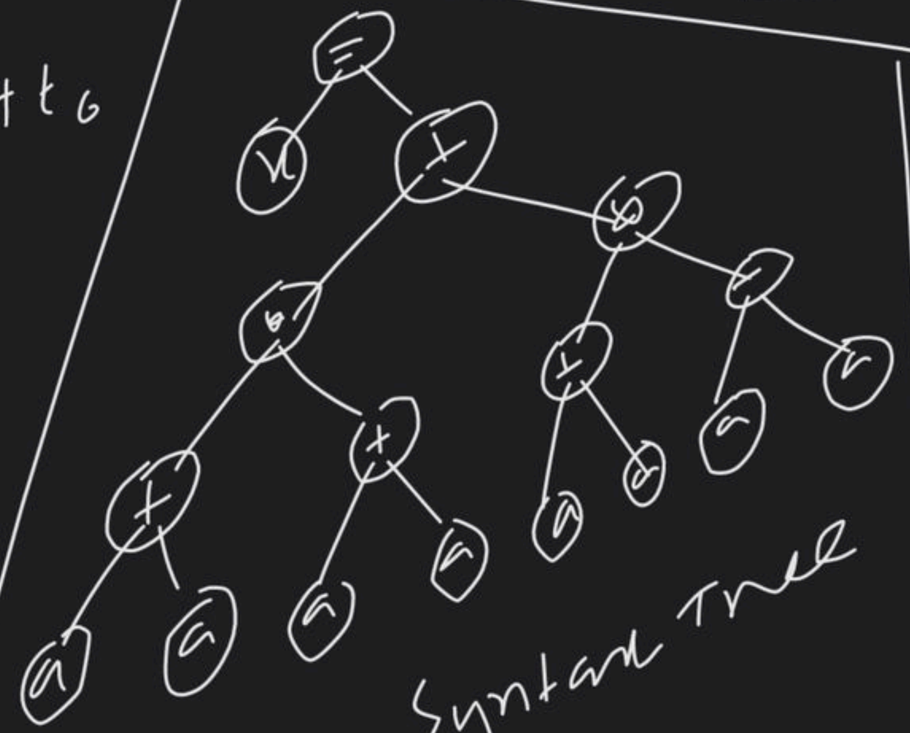
$t_6 = t_4 * t_5$

$t_7 = t_3 + t_6$

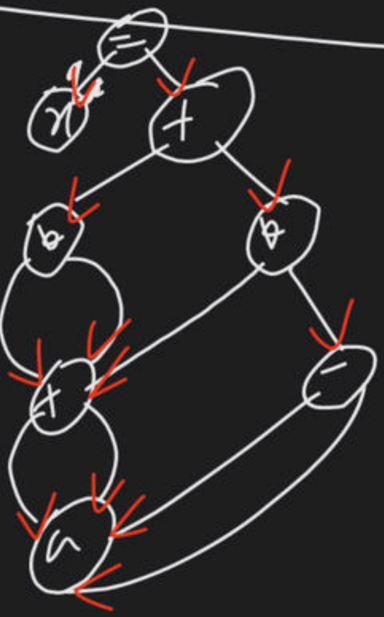
$x = t_7$

Postfix

$x \; \underbrace{aa+}_{1} \; \underbrace{aa+}_{2} * \underbrace{}_{3} \; \underbrace{aa+}_{4} \; \underbrace{aa-}_{5} * \underbrace{}_{6} +$



Syntax Tree



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# 3-address code (max 3-addresses)

1. $x = y + z$
2. $x = y$
3. $x = a[i]$
4. $a[i] = x$
5. $x = *a$
6. $*a = x$
7. ~~$x = a[i][j]$~~
8. ~~$x = f(a, b)$~~
9. $if(a < b)$ goto c
10. goto c

if((a==b) || (c==d)) then e=f else g=h

1000) if (a==b) goto 1003
1001) g=h
1002) goto 1006
1003) if (c==d) goto 1005
1004) goto 1001
1005) e=f
1006) ———

Backpatching

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Write 3-address code for the following program //

```
for(j=10; j<=1000; j++)
{
    x = y+2*a
}
```

⟹

```
q500) j = 10
q501) if(j<=1000) goto q503
q502) goto ----
q503) t1 = 2*a
q504) t2 = y + t1
q505) x = t2
q506) j = j+1
      goto q501
```

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ex

Write 3-address code for the following program

```
j = 25;
switch (j)
{
    case 3: x1 = a1 + b1 * c1
            break;
    case 10: x2 = a2 + b2 * c2
             break;
    default: x3 = a3 + b3 * c3
}
```

2011) $t_3 = t_2 * c_2$
12) $t_4 = a_2 + t_3$
13) $x_2 = t_4$
14) goto 2006

2007) $t_1 = b_1 * c_1$
08) $t_2 = a_1 + t_1$
09) $x_1 = t_2$
10) goto 2006

2006)

2000) j = 25
2001) if (j == 3) goto 2007
2002) if (j == 10) goto 2011
2003) $t_5 = b_3 * c_3$
2004) $t_6 = a_3 + t_5$
2005) $x_3 = t_6$
2006)

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Write 3-address code for the following

Size of 1 cell ⇒ 2B

Stmt: int a[10][25];

BA = 1000

No. of rows = (0-9) ⇒ 10

No. of cols = (0-24) ⇒ 25

$x = a[i][j]$

$t_1 = i * 25$

$t_2 = t_1 + j$

$t_3 = t_2 * 2$

$t_4 = 1000 + t_3$

$x = *t_4$