

24-02-24
Saturday

Day-4 Analytical problems

$$a + \frac{b \times c}{e^f} + b \times c$$

① Quadruple Representation:-

$$t_1 = b \times c$$

$$t_2 = e^f$$

$$t_3 = t_1 / t_2$$

$$t_4 = a + t_3$$

Triple Representation:-

$$t_1 = b \times c$$

$$t_2 = e^f$$

$$t_3 = t_1 / t_2$$

$$t_4 = t_3 + a$$

Indirect Triple Representation:-

$$t_1 = b \times c$$

$$t_2 = e^f$$

$$t_3 = t_1 / t_2$$

$$t_4 = a + t_3$$

②

Three address code for
while ($i < 10$)

{

$x = 0;$

$i = i + 1$

}

$L_1:$

$i < 10$

if false L_2

$x = 0$

$t_1 = i + 1$

$i = t_1$

goto L_1

$L_2:$

$x = 0$

$i = i + 1$

goto L_1

L_1, L_2 & L_3 are labels.

~~$x = 0$ goto L_2~~

$x = 0$ assigns 0 to variable x .

$i = i + 1$ increments the value of variable i by 1.

③ Three address code for the:
if $((a < b) \text{ and } (c < d) \text{ or } (a > d))$ then

$z = x + y * z$

else

$z = z + 1$

Codes for the given conditional statement:

if $a < b$ goto L_1

goto L_2

$L_1:$ if $c < d$ goto L_3

goto L_4

$L_3:$ goto L_5

$L_4:$ if $a > d$ goto L_5

goto L_6

$L_5:$ $t_1 = x + y$

$z = t_1 * z$

goto L_7

$L_6:$ $z = z + 1$

$L_1, L_2, L_3, L_4, L_5, L_6$ & L_7 are labels.

if $a < b$ goto L_1 ,
 $a < b$ is true.

if $c < d$ goto L_3 ,
 $c < d$ is true.

goto L_5 is unconditional jump if $(c < d)$ is false.

if $a > d$ goto L_5 , $a > d$ is true.

$z = t_1 * z$ stores in z .

$z = z + 1$ is executed if

conditions are not met.

goto L_7 is unconditional

jump that skip 'else' part

(4) Switch (ch)

```
{
Case 1: C=a+b;
break;
Case 2: C=a-b;
break;
}
```

Switch ch

```
Case 1: goto L1
Case 2: goto L2
default: goto L3
L1: C=a+b
    goto L4
L2: C=a-b
    goto L4
```

>> 'goto L1' & 'goto L2' are conditional jumps,
Case is executed based on value of 'ch'.
>> 'C=a+b' is executed if 'ch' is 1 (Case 1).
>> 'C=a-b' is executed if 'ch' is 2 (Case 2).
>> 'goto L4' in both cases, control slips & goes to
the end of switch statement (L4).
>> 'goto L3' in the default case is placeholder
for the default action.

Ex: it is empty ('L3:'), but you
would replace it with the code if needed.

(5) int a[10], b[10], i, dp=0;

for (i=0; i<10; i++)

```
{
dp += a[i] * b[i];
}
```

i = 0

goto L1

L2: t1 = i * 4

t2 = &a[t1]

t3 = *t2

t4 = i * 4

t5 = &b[t4]

t6 = *t5

t7 = t3 * t6

dp = dp + t7

i = i + 1

L4: if i < 10 goto L2

>> 'i=0' the loop control variable 'i'.

>> 'goto L1' is a jump to the loop condition.

>> 'L2:' is the beginning of the loop

>> t1 = i * 4 calculates the offset
for array 'a'.

>> dp = dp + t7. result in variable 'dp'.

>> i = i + 1 increments the loop control
Variable.

⑥ Quadruples for the Expression
 $-(a*b) + (c+d) - [a+b+c+d]$.

$$t_1 = a * b$$

$$t_2 = -t_1 \text{ (negation of } t_1 \text{)}$$

$$t_3 = c + d$$

$$t_4 = t_2 + t_3 \text{ (adding } t_2 \text{ \& } t_3 \text{)}$$

$$t_5 = a + b$$

$$t_6 = c + d$$

$$t_7 = t_5 + t_6 \text{ (adding } t_5 \text{ \& } t_6 \text{)}$$

$$\text{result} = t_4 - t_7 \text{ (subtracting } t_7 \text{ from } t_4 \text{)}.$$

In these Quadruples:-

>> $t_1, t_2, t_3, t_4, t_5, t_6$ \& t_7 are temporary variables.

>> result is the final result of the Expression.

⑦ L₁: if $A \geq C$

goto L₂

if $B \leq D$ goto L₃

goto L₄

L₂: $A \neq 1$ goto L₆

$C = C + 1$

goto L₁

L₃: if $A > B$ goto L₅

$A = A + B$

goto L₃

L₄:

L₅:

⑧ $a > b$ then

$x = a + b$

else $x = a - b$

A) if $a > b$ goto L₄

$x = a + b$

goto L₂

L₄:

$x = a - b$

L₂:

⑨ Quadruple:

$$t_1 = A$$

$$t_2 = t_1 + B$$

$$t_3 = t_2 * C$$

$$t_4 = A$$

$$t_5 = t_4 + B$$

$$A = t_6$$

Triple:

$$t_1 = A + B$$

$$t_1 = t_1 * C$$

$$t_2 = t_2$$

Indirect triple:

$$t_1 = A + B$$

$$t_2 = t_1 * C$$

$$A = t_2$$

10) $a_2 = b = b * C + b * -C$
address code

$t_1 = -C$
 $t_2 = b * t_1$
 $t_3 = b * t_1$
 $t_4 = t_2 + t_3$
 $a = t_4$

Quadruples

$* b - C t_1$
 $* b - C t_2$
 $+ t_2 t_3$
 $= t_4 a$

11) if $a < b$ goto L_1 if $c < d$ goto L_2 if $c < d$ goto L_3 goto L_4

L_1 : Result true goto L_5

L_2 : Result: true goto L_5

L_4 : Result: false

L_5 :

12) Translation schema:

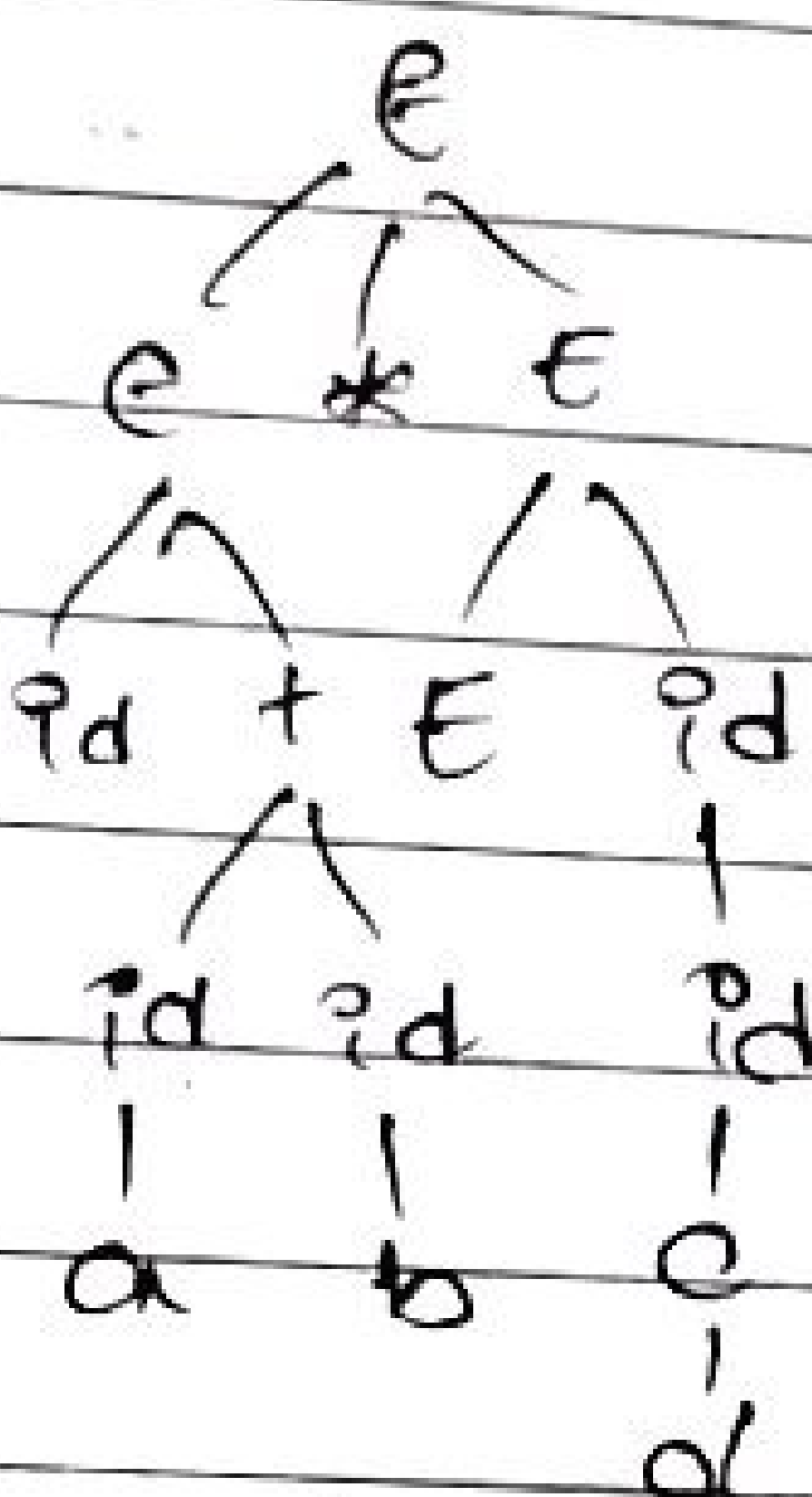
$S \rightarrow b$

$E \rightarrow E_1 * E_2$

$E \rightarrow E_1 + E_2$

$E \rightarrow (E)$

$E \rightarrow id$



13) Translation given boolean function.

for $(a < b)$

if $(a < b)$ goto L_1

goto L_2

L_1 : t_1 : true

goto L_3

L_1 : L_2 : false

L_3 :

for $(c < d)$:

for $(c < d)$

if $c < d$ goto L_4

goto L_5

L_4 : L_2 : true

if $c < d$ goto L_7

goto L_8

L_7 : L_8 : true

goto L_9

L_8 : L_3 : false

Final expression:

$t_1 | t_2 | t_3$