Three

Address

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In three address code, at most three addresses are used to represent any statement.

**General form:**

The general form of three address code is-

\[ a = b \text{ op } c \]

where-
- \(a, b, c\) are the operands that can be names, constants or compiler generated temporaries
- \(\text{op}\) represents the operator

**Example:**

1. \(i\) \(\rightarrow a = b + c\)
2. \(ii\) \(\rightarrow c = a \times b\)
Common Three Address Instruction Forms

1. Assignment statements:
   - \( x = y \) or \( z \)
   - \( x = y \)

2. Copy statement:
   \( x = y \)

3. Conditional jump:
   \( \text{if } x \text{ relop } y \text{ goto } l \)
   \( \text{goto label;} \)
   \( \text{Label: } \)

4. Unconditional jump:
   \( \text{goto } l \)

5. Procedure call:
   \( \text{param } x \text{ call } f \)
   \( \text{return } y \)
   \( f(x) \)
   \( \{ \)
   \( \vdots \)
   \( \text{return } y; \)
   \( \} \)
Generation of 3 address code

Illustration-1: Generate 3 address code for:

\[ a = b + c + d \]

Soln.:

- '+', operator has higher precedence over '=' operator.
- '+', operator is left associative.

Three address code will be:

\[ T_1 = b + c \]
\[ T_2 = T_1 + d \]
\[ a = T_2 \]
Illustration-2: Generate 3 address code for:

\[-(a \times b) + (c+d) - (a+b+c+d)\]

**Sln:**
Three address code will be:

\[
\begin{align*}
t_1 &= a \times b \\
t_2 &= \text{uminus} \ t_1 \\
t_3 &= c+d \\
t_4 &= t_1 + t_3 \\
t_5 &= a+b \\
t_6 &= t_3 + t_5 \\
t_7 &= t_4 - t_6
\end{align*}
\]

Many operators have higher precedence over binary operators.
Illustration-3: Generate 3 address code for-

if \( A < B \)

then 1

else 0

Solution:

1. if \( A < B \) goto (4)
2. \( T1 = 0 \)
3. goto (5)
4. \( T1 = 1 \)
5.
Illustration - 4: Generate 3 address code for

"If a < b and c < d then t=1 else t=0"

Soln:

1. If (a < b) goto (3)
2. goto (4)
3. if (c < d) goto (6)
4. t = 0
5. goto (+)
6. 
7. t = 1