



SAGAR INSTITUTE OF RESEARCH AND TECHNOLOGY BHOPAL
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Semester

VI

Subject Code

CS603 (C)

Subject Name

Compiler Design

Unit-5

Topic: Code Generation



As Per

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New Scheme Based on AICTE Flexible Curricula
Computer Science and Engineering



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CODE GENERATION - Code generation is the final activity of compiler. It is a process of creating assembly language/machine language statements which will perform the operation specified by the source program when they run.

→ In code generation phase following properties desired -

- Correctness - It should produce correct code.
- High Quality - It should produce a high quality object code.
- Efficient use of resources of the target machine.
- Quick code generation.

→ Some basic instructions are -

MOV - (Move)

ADD - (Addition)

SUB - (Subtraction)

MUL - (Multiplication)

DIV - (Division)



Example -

MOV a R₀ (a is stored in register R₀)

ADD b R₀ (b is added in R₀)

MUL R₁ R₀ (R₁ is multiply in R₀ & R₁ empty)

NOTE - Whenever any register come at LHS it will be empty.





Question- Generate the machine code for the given 3AC and also show optimization helps to reduce line of code and for better utilization of memory?

$t_1 := a + b$

$t_2 := c + d$

$t_3 := t_2 - e$

$t_4 := t_1 - t_3$

Solution: M/C Code for given 3AC is -

MOV a R₀ /* a is in R₀ */

ADD b R₀ /* b is added in R₀; t₁ is in R₀ */

MOV c R₁ /* c is in R₁ */

ADD d R₁ /* c is added to R₁; t₂ is in R₁ */

SUB e R₁ /* e subtract from R₁; t₃ is in R₁ */

SUB R₁ R₀ /* t₄ is in R₀ and R₁ is empty */

MOV R₀ t₄ /* R₀ is in t₄ and R₀ is empty */

After applying optimization technique of Interchange of Statement, the three address code sequence will be -

$t_2 = c + d$

$t_3 = t_2 - e$

$t_1 = a + b$

$t_4 = t_1 - t_3$



and m/c code for optimized 3AC -

MOV c R₀ /* c is in R₀ */

ADD d R₀ /* d is added in R₀, i.e. t₂ is in R₀ */

SUB e R₀ /* e subtract in R₀, i.e. t₃ is in R₀ */

MOV a R₁ /* a is in R₁ */

ADD b R₁ /* b added in R₁, i.e. t₁ is in R₁ */

SUB R₀ R₁ /* t₃ subtract from t₁; t₄ is in R₁; R₀ empty */

MOV R₁ t₄ /* R₁ is in t₄ and R₁ is empty */





Question: Generate the machine code for the given Three Address Code and also show optimization helps to reduce line of code and for better utilization of memory?

$t_1 := a + b$

$t_2 := c + d$

$t_3 := e - t_2$

$t_4 := t_1 - t_3$

Solution: MLC code for given 3AC:-

MOV a R₀ // a is in R₀

ADD b R₀ // t₁ is in R₀

MOV c R₁ // c is in R₁

ADD d R₁ // t₂ is in R₁

SUB

MOV e R₂ // e is in R₂

SUB R₁ R₂ // t₃ is in R₂ ∵ R₂ - R₁ = R₂ & R₁ empty

SUB R₂ R₀ // t₄ is in R₀ & R₂ is empty

MOV R₀ t₄ // R₀ is empty & R₀ is in t₄.



Now after optimization 3AC will be

$t_2 = c + d$

$t_3 = e - t_2$

$t_1 = a + b$

$t_4 = t_1 - t_3$

and the machine code is -

1. MOV c R₀

5. MOV a R₀

2. ADD d R₀

6. ADD b R₀

3. MOV e R₁

7. SUB R₁ R₀

4. SUB R₀ R₁

8. MOV R₀ t₄

