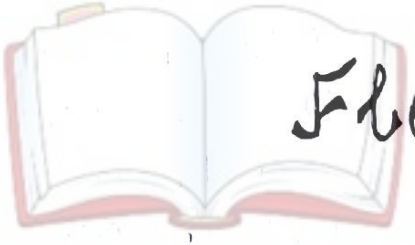
Basic Blocks

and

Flow Graph



Learn Vid Fun....

Introduction

- The basic block is a sequence of consecutive statements which are always executed in sequence without halt or possibility of branching.

- The basic blocks does not have any jump statements among them.

- When the first instruction is executed, all the instructions in the same basic block will be executed in their sequence of appearance without losing the flow control of the program.

Examples

→ $a = b + c + d$

Three address code-

$t_1 = b + c$
$t_2 = t_1 + d$
$a = t_2$ ✓

→ If A < B then 1 else 0

(1) if (A < B) goto (4)
(2) T1 = 0
(3) goto (5)
(4) T1 = 1
(5) ✗

Rules for partitioning into blocks

After an intermediate code is generated for the given code, we can use the following rules to partition into basic blocks -

Rule-1: Determine the leaders -

a) The first statement is a leader.

b) Any target statement of conditional or unconditional goto is a leader.

c) Any statement that immediately follow a goto is a leader.

Rule-2: The basic block is formed starting at the leader statement and ending just before the next leader statement appearing.

Problem 2: Consider the following three address code statements -

(1) PROD = 0

(2) I = 1

(3) T2 = addr(A) - 4

(4) T4 = addr(B) - 4

(5) T1 = 4 * I

(6) T3 = T2[T1]

(7) T5 = T4[T1]

(8) T6 = T3 * T5

(9) PROD = PROD + T6

(10) I = I + 1

(11) IF I <= 20 GOTO (5)

Compute the Basic Blocks.

Solution:

- Because first statement is a leader, so -

  PROD = 0 is a leader

- Because the target statement of conditional or unconditional goto is a leader, so -

  T1 = 4 * I is also a leader

So, the given code can be partitioned into 2 blocks as -

```
PROD = 0
I = 1
T2 = addr(A) - 4
T4 = addr(B) - 4
```

B_1

```
T1 = 4 * I
T3 = T2[T1]
T5 = T4[T1]
T6 = T3 * T5
PROD = PROD + T6
I = I + 1
IF I <= 20 GOTO B2
```

B_2

Flow Graph

Definition:-

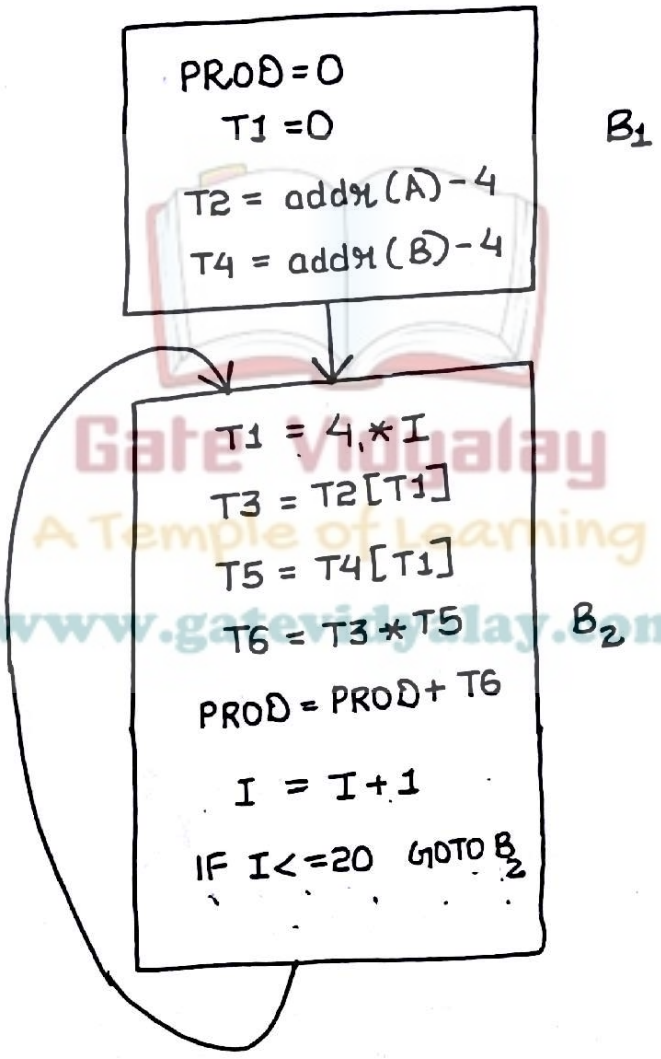
A flow graph is a directed graph in which the flow control information is added to the basic blocks.

Rules:-

- The basic blocks are the nodes to the flow graph.
- The block whose leader is the first statement is called initial block.
- There is a directed edge from block B_1 to block B_2 if B_2 immediately follows B_1 in the given sequence, we can say that B1 is a predecessor of B_2.

Problem 2: Draw the flow graph for the three address code given in the last question.

Soln 2:



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