



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

**COURSE NAME :19IT301 COMPUTER ORGANIZATION AND
ARCHITECTURE
II YEAR /III SEMESTER**

Unit 1- BASIC STRUCTURE OF COMPUTERS

Topic 7 : Instruction and Instruction sequencing



Instruction and Instruction sequencing



A computer must have instructions capable of performing four types of operations:

1. Data transfers between the memory and the processor registers
2. Arithmetic and logic operations on data
3. Program sequencing and control
4. I/O transfers



Instruction and Instruction sequencing- Register Transfer Notation (RTN)



- ✓ Identify a location by a symbolic name standing for its hardware binary address (LOC, R0,...)
- ✓ Contents of a location are denoted by placing square brackets around the name of the location

$R1 \leftarrow [LOC]$

$R3 \leftarrow [R1] + [R2]$



Instruction and Instruction sequencing-Assembly language notation



Represent machine instructions and programs.

Move LOC, $R1 = R1 \leftarrow [LOC]$

Add R1, R2, $R3 = R3 \leftarrow [R1] + [R2]$



Instruction and Instruction sequencing-Basic

Instruction types



Three-Address Instructions

Add A,B,C $C \leftarrow [A]+[B]$

Two-Address Instructions

Add B,D $D \leftarrow [B]+[D]$

One-Address Instructions

Add B $AC \leftarrow [AC] + [B]$

Load A

Store C

Zero-Address Instructions

Add $TOS \leftarrow TOS + (TOS - 1)$



Instruction and Instruction sequencing-

Basic instruction types



Example: Evaluate $C = A + B$

Both the operands are in registers

Move A,R0

Move B,R1

Add R0,R1

Move R1,C

Example: One operand in the memory and another one in the register

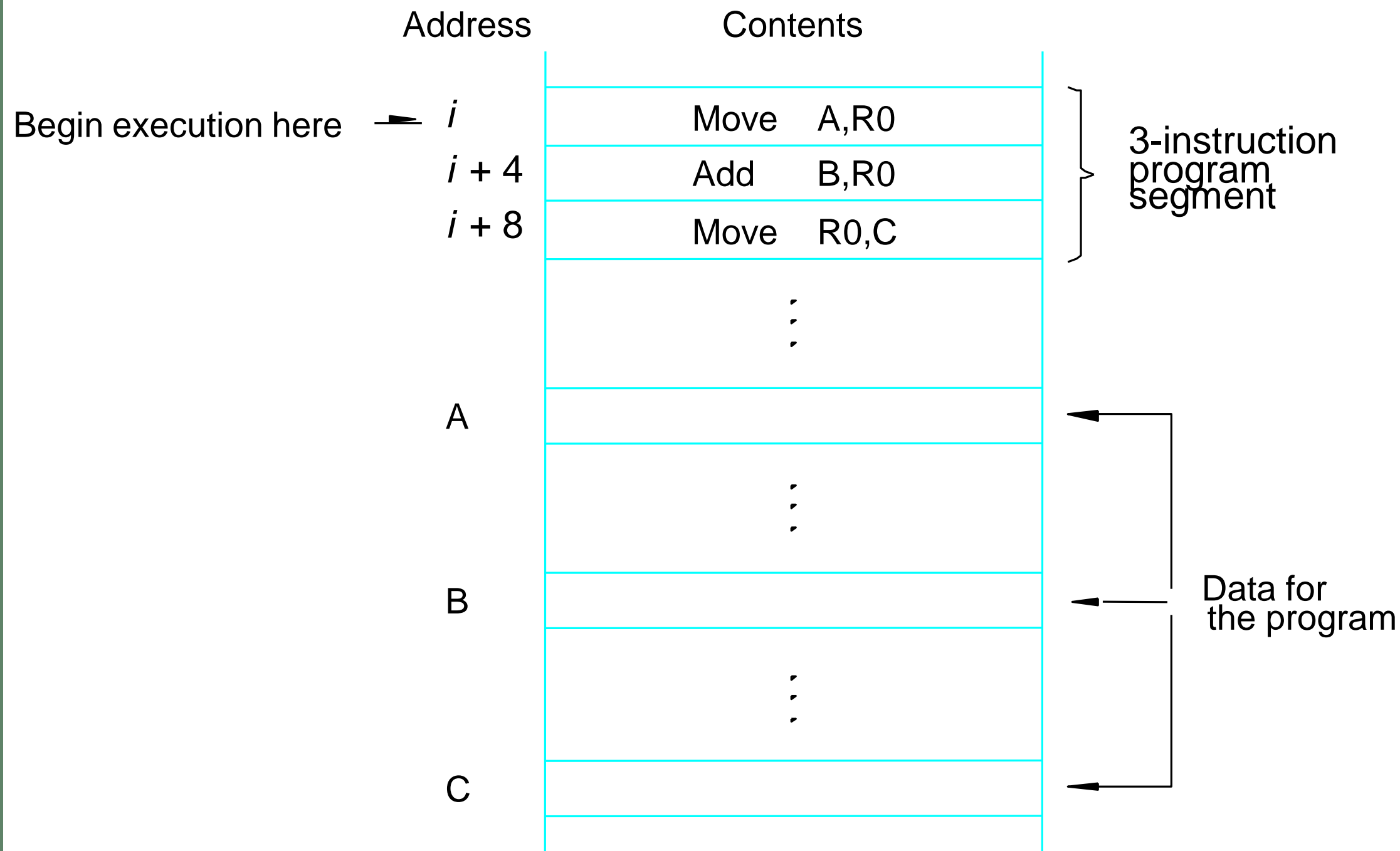
1. Move A,R1

2. Add B,R1

3. Move R1,C



Instruction Execution and Straight-Line Sequencing



Assumptions:

- One memory operand per instruction
- 32-bit word length
- Memory is byte addressable
- Full memory address can be directly specified in a single-word instruction

Two-phase procedure

- Instruction fetch
- Instruction execute

Figure 1. A program for $C \leftarrow [A] + [B]$.



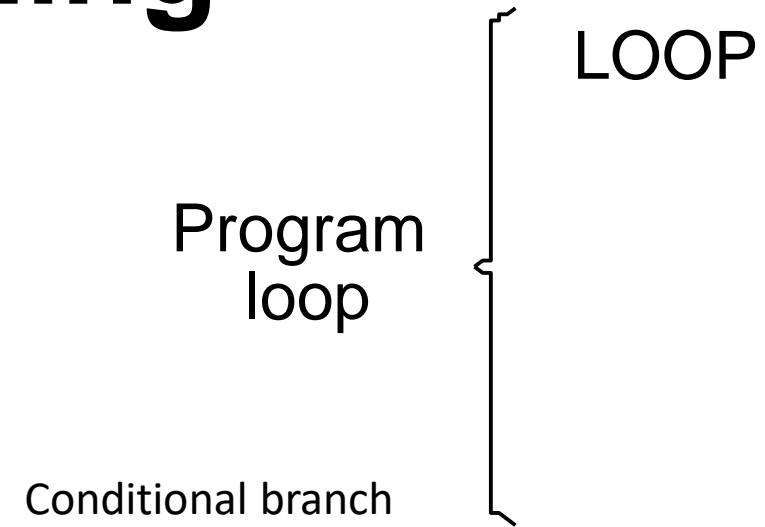
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i	Move	NUM1,R0
$i + 4$	Add	NUM2,R0
$i + 8$	Add	NUM3,R0
		•
		•
		•
$i + 4n - 4$	Add	NUM n ,R0
$i + 4n$	Move	R0,SUM
		•
		•
		•
SUM		
NUM1		
NUM2		
		•
		•
		•
NUM n		

Figure 2. A straight-line program for adding n numbers.



Branching



Move	N,R1
Clear	R0
Determine address of "Next" number and add "Next" number to R0	
Decrement	R1
R1>0	LOOP
Move	R0,SUM
	•
	•
	•
	<i>n</i>
	•
	•
	•

SUM
N
NUM1
NUM2

NUM *n*

Figure 3. Using a loop to add *n* numbers.



Instruction and Instruction sequencing



Condition code flags

Condition code register / status register

N (negative)

Z (zero)

V (overflow)

C (carry)

Different instructions affect different flags



Assessment



a). What are the 4 types of operations?

b) Give the purpose of the following:

1. Register transfer notation _____
2. Assembly language notation _____
3. Condition code flags _____





Reference



1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, McGraw-Hill, 6th Edition 2012.