Course Name: A Level (1st Sem) Subject: CO

Topic: Instruction Format Date: 28-05-20

Instruction Format: Instructions are classified not only on the basis of reference. Another way to classify instructions is to watch how many address fields are being used by the instruction at once. The instructions having more address fields are more complex to execute than those who have less number of address fields. Following is a list of all such instructions:

- Three-Address Instructions
- Two-Address Instructions
- One-Address Instructions
- Zero-Address Instructions

Three-Address Instructions: These instructions use three discrete but relevant addresses together. Two of these three are used for operands while the third one is used as destination of the result.

Expression: (A + B) * (C + D)

Operation	Addresses			Description
ADD	R1	A	B	R1 ← M [A] + M [B]
ADD	R2	A	B	R2 ← M [C] + M [D]
MUL	R3	R1	R2	R3 ← R1 * R2

Two-Address Instructions: These instructions use only two addresses at a time. MOV operation works well in these instructions. Results are stored in registers of CPU.

Expression: (A + B) * (C + D)

Operation	Addresses		Description
MOV	R1	A	R1 ← M [A]
ADD	R1	B	R1 ← R1 + M [B]
MOV	R2	C	R2 ← M [C]
ADD	R2	B	R2 ← R2 + M [D]
MUL	R1	R2	R1 ← R1 * R2
MOV	R3	R1	R3 ← R1

One-Address Instructions: These instructions use just one address and all operations are performed in Accumulator. LOAD and STORE operations are used frequently. LOAD operation loads an operand from memory to AC. Similarly STORE operation stores the result from AC to memory.

Expression: (A + B) * (C + D)

Operation	Addresses	Description
LOAD	A	AC ← M [A]
ADD	B	AC ← AC + M [B]
STORE	T	M [T] ← AC
LOAD	C	AC ← M [C]
ADD	D	AC ← AC + M [D]
MUL	T	AC ← AC * M [T]
STORE	T	M [T] ← AC

Zero-Address Instructions: These instructions are unique since the operations are performed by using a stack. Here AC is of no use. A stack of registers is used to execute instructions. In terms of mathematical expressions, Infix are first transformed into Postfix and then stacks perform the operations. PUSH and POP are the frequent operations here.

Expression: (A + B) * (C + D)

It's Postfix form is: A B + C D + *

Operation	Addresses	Description
PUSH	A	TOS ← M [A]
PUSH	B	TOS ← M [B]
ADD		TOS ← M [A] + M [B]
PUSH	C	TOS ← M [C]
PUSH	D	TOS ← M [D]
ADD		TOS ← M [C] + M [D]
MUL		TOS ← (M [A] + M [B]) * (M [C] + M [D])
POP	T	M [T] ← TOS

Assignment:

1. What are different instruction formats?.
2. Write three address and two address instruction codes for the following-
   ((A + B + C) * D) + E)