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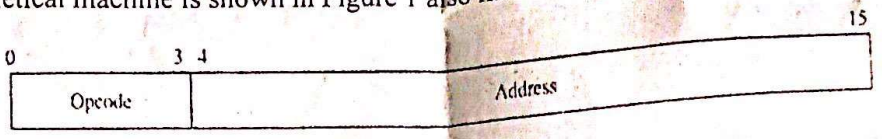
Midterm Exam (Fall 2019) **Paper:** CSE-304 Computer Organization and Architecture
Time: 2 Hours **Marks:** 20

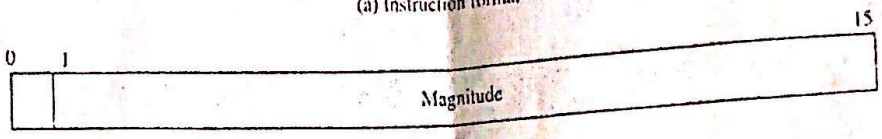
Note: Attempt all questions on answer sheet.

Question No. 1 (Marks=5) (CLO-1)

The hypothetical machine is shown in Figure 1 also has two I/O instructions:



(a) Instruction format



(b) Integer format

Program counter (PC) = Address of instruction
Instruction register (IR) = Instruction being executed
Accumulator (AC) = Temporary storage

(c) Internal CPU registers

0001 = Load AC from memory
0010 = Store AC to memory
0101 = Add to AC from memory

(d) Partial list of opcodes

Figure 1: Characteristics of hypothetical Machine

1. 0011 Load AC from I/O
2. 0111 Store AC to I/O

In these cases, the 12-bit address identifies a particular I/O device. Show the program execution (using the format of Figure 2) for the following program:

1. Load AC from device 5.
2. Add contents of memory location 940.
3. Store AC to memory location 941.
4. Store AC to device 6.

Assume that the next value retrieved from device 5 is 3 and that location 940 contains a value of 2.

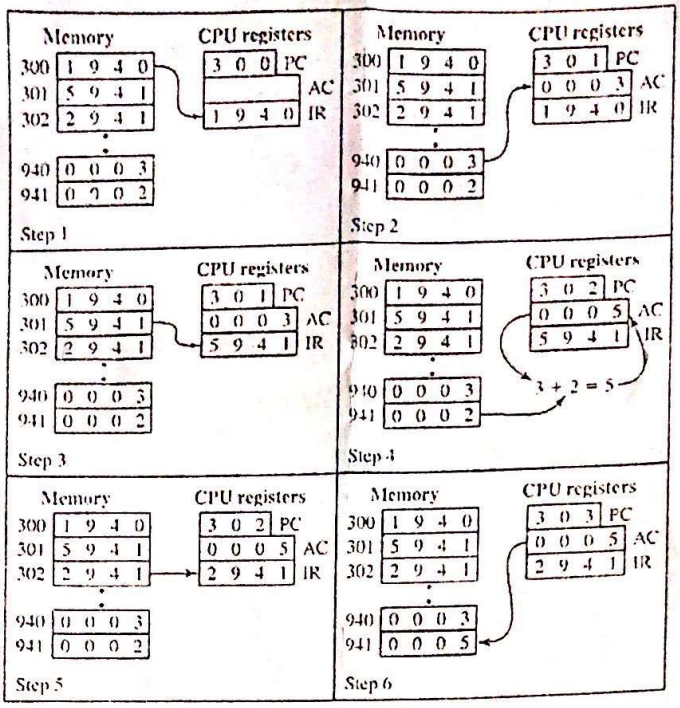


Figure 2: Example of program execution

Question No. 2 (Marks=5) (CLO-3)
Divide -5 by 3 (i.e. -5 is dividend and 3 is divisor) using signed division rules?

Question No. 3 (Marks=5)
Consider a hypothetical microprocessor generating a 16-bit address and having a 16-bit data bus.

1. What is the maximum memory address space that the processor can access directly if it is connected to a "16-bit memory"?
2. What is the maximum memory address space that the processor can access directly if it is connected to an "8-bit memory"?

Question No. 4 (Marks=5)

i. What are synchronous and asynchronous systems? Explain it with the help of timing diagram.

ii. How can we extend the 16-bit signed number to 32-bit signed number? Give examples. What is the range of signed numbers, if number of bits of a word is 32 bit.