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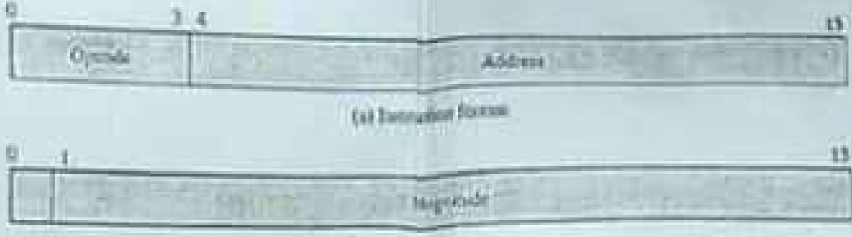
Midterm Exam (Fall 2017)
Time: 2 Hours

Paper: CSE-304 Computer Organization and Architecture
Marks: 25

Note: Attempt all questions on answer sheet.

Question No. 1 (Marks=8):

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.

0001
1010
1011

1101

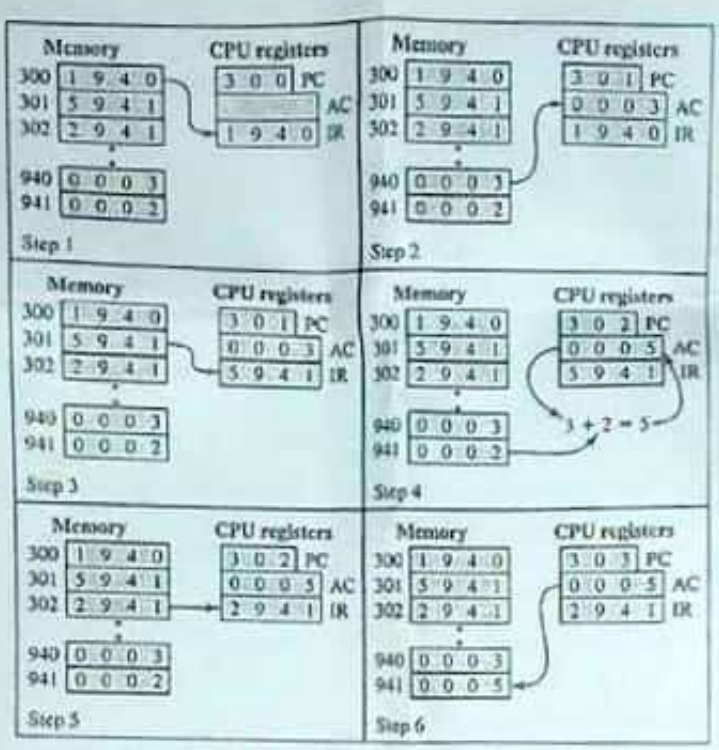


Figure 2: Example of program execution

4096 0000

Question No. 2 (Marks=6)

Consider a hypothetical microprocessor generating a 32-bit address and having a 32-bit data bus.

1. What is the maximum memory address space that the processor can access directly if it is connected to a "32-bit memory"?
2. What is the maximum memory address space that the processor can access directly if it is connected to an "16-bit memory"?

Question No. 3 (Marks=6)

Given x=0101 and y=1010 in twos complement notation (i.e. x=5, y=-6), compute the product $p=x \times y$ with Booth's algorithm.

Question No. 4 (Marks=5)

What is stack? How it works for the following program:

0011 1100

0101 1110

PUSH A
PUSH B
PUSH C
POP D

Status of registers:

SP=2100*H*; A=1234H; B=5678H; C=9A25H

Where;

SP(stack pointer), A, B, C, D are 16 bit-registers while each memory location is of 8-bit size.