16.317: Microprocessor Systems Design I

Summer 2013

Lecture 3: Key Questions
July 16, 2013

1. Describe the x86 flags.

2. Describe the operation of the ADD, ADC, and INC instructions.

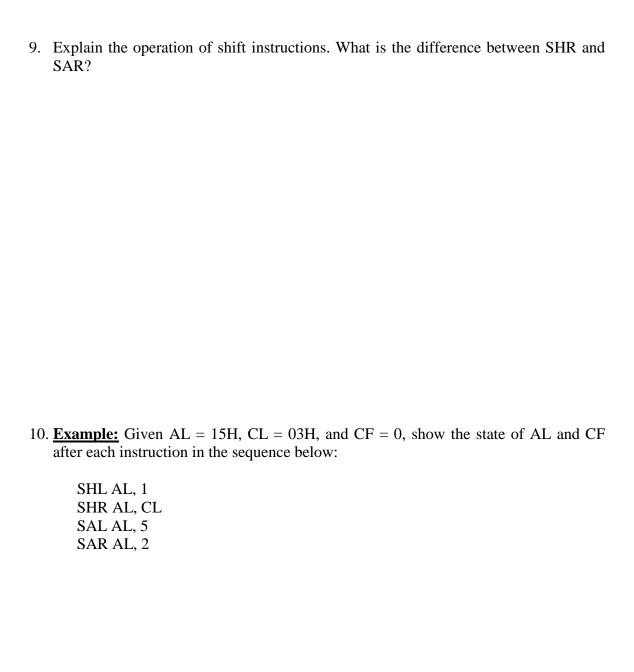3. Describe the operation of the SUB, SBB, DEC, and NEG instructions.

4. Given the following initial state:
   - AX = 1234H
   - BL = ABH
   - Memory location SUM = 00CDH

Show the results of each step of the following instruction sequence. Be sure to track the carry flag throughout the sequence:

ADD AX, [SUM]
ADC BL, 05H
NEG BL
SUB AX, 12H
INC WORD PTR [SUM]

5. Describe the operation of the MUL and IMUL operations.

6. Describe the operation of the DIV and IDIV operations.

7. Explain the general operation of the AND, OR, XOR, and NOT instructions.

8. **Example:** Show the state of AL after each instruction in the following sequence:

    MOV AL, 55H
    AND AL, 1FH
    OR AL, C0H
    XOR AL, 0FH
    NOT AL

9. Explain the operation of shift instructions. What is the difference between SHR and SAR?

10. **Example:** Given AL = 15H, CL = 03H, and CF = 0, show the state of AL and CF after each instruction in the sequence below:

    SHL AL, 1
    SHR AL, CL
    SAL AL, 5
    SAR AL, 2

11. Explain the operation of the rotate instructions (ROL, ROR, RCL, RCR).