16.317: Microprocessor Systems Design I

Summer 2013

Lecture 5: Key Questions

July 25, 2013

1. Describe the two general classes of jump instruction.

2. Given the instructions below, what are the resulting register values if:
    - AX = 0010H, BX = 0010H
    - AX = 1234H, BX = 4321H

What type of high-level program structure does this sequence demonstrate?

```
        CMP   AX, BX
        JE    L1
        ADD   AX, 1
        JMP   L2
L1:     SUB   AX, 1
L2:     MOV   [100H], AX
```

3. **Example:** Given the instructions below, what are the resulting register values if, initially, AX = 0001H?

What type of high-level program structure does this sequence demonstrate?

```
        MOV   CX, 5
L:      SHL   AX, 1
        DEC   CX
        JNZ   L
```

4. **Example:** Given the instructions below, what are the resulting register values if, initially, AX = 0001H?

What type of high-level program structure does this sequence demonstrate?

```
        MOV   CX, 5
L:      JCXZ  END
        ADD   AX, AX
        DEC   CX
        JMP   L
END:    MOV   [10H], AX
```

5. Describe the 80386 loop instructions, as well as how these instructions can be used in a typical program.

6. Rewrite the post-tested loop example from earlier to use a loop instruction.

```
        MOV   CX, 5
L:      SHL   AX, 1
        DEC   CX
        JNZ   L
```

7. Describe the operation of the following program.
What is the final value of SI if the 15 bytes between 0A001 and 0A00F have the following values?

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E

```
                MOV   DL, 05
                MOV   AX, 0A00
                MOV   DS, AX
                MOV   SI, 0000
                MOV   CX, 000F
AGAIN:          INC   SI
                CMP   [SI], DL
                LOOPNE AGAIN
```

8. Describe the general structure and purpose of a subroutine.

9. Describe the basics of subroutines specific to the 80386.

10. Describe the operation of the CALL instruction.

11. Describe the operation of the RET instruction.

12. **Example:** Assuming AX = 2 and BX = 4, show the results of the following sequence. Assume the addresses of the first three instructions are CS:0005, CS:0008, and CS:0009, respectively:

```
        CALL  SUM
        RET                 ; End main function
SUM PROC NEAR
        MOV   DX, AX
        ADD   DX, BX
        RET
SUM ENDP
```

13. Explain the different instructions used to save state on the stack.

14. Explain the different instructions used to restore state from the stack.

15. **Example:** Assuming the initial state below, what is the resulting stack state of each of the following sequences?

EAX: 12345678H
EBX: 0000000AH
ECX: FF0000FFH
EDX: 00000000H
ESI: 00000008H
EDI: FFFF0000H
EBP: 00000400H
ESP: 00002000H
DS: 2110H
SS: 1000H

a. PUSH BX
PUSH AX

b. PUSH EBX
PUSH EAX

c. PUSHA