

# 16.317: Microprocessor Systems Design I

Fall 2015

## Lecture 10: Key Questions

September 25, 2015

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

2. **Example:** Given AL = 43H, CL = 04H, and CF = 0, show the state of AL after each instruction in the sequence below:

```
ROR AL, 2  
ROL AL, CL  
RCR AL, 3  
RCL AL, 4
```

3. Explain the operation of the bit test instructions (BT, BTR, BTS, BTC)

4. Explain the operation of the bit scan instructions (BSF, BSR).

5. **Example:** Given the following initial state, list all changed registers and/or memory locations and their new values. Where appropriate, you should also list the state of the carry flag (CF).

Initial state:

EAX: 00000000H  
EBX: 0000000AH  
ECX: 00000000H  
EDX: 00000000H  
CF: 0  
ESI: 00000008H  
EDI: FFFF0000H  
EBP: 00000400H  
ESP: 00002000H

**Address**

21100H	04	00	10	10
21104H	89	01	20	40
21108H	02	00	00	16
2110CH	17	03	FF	00
21110H	1E	00	06	00
21114H	08	00	0A	00

Instructions:

BT      WORD PTR [21102H], 4  
BTC     WORD PTR [21110H], 1  
BTS     WORD PTR [21104H], 1  
BSF     CX, WORD PTR [2110EH]  
BSR     DX, WORD PTR [21109H]