Assignment 4

Due date: 20-11-2023

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Which instruction shifts each bit in an operand to the left and copies the highest bit into both the Carry flag and the lowest bit position?

ROL

Which instruction shifts each bit to the right, copies the lowest bit into the Carry flag, and copies the Carry flag into the highest bit position?

RCR

Write a sequence of shift instructions that cause AX to be sign-extended into EAX.

First, shift EAX 16 bits to the left. Next, shift it arithmetically 16 bits to the right:

```
shl eax,16
sar eax,16
```

Suppose the instruction set contained no rotate instructions. Show how we might use SHR and a conditional jump instruction to rotate the contents of the AL register one position to the right.

```
shr al,1        ; shift AL into Carry flag
jnc next        ; is the Carry flag set?
or al,80h       ; yes: set highest bit
; no: do nothing ;
next:
```

What happens to the Carry flag when the SHR AX,1 instruction is executed?

The Carry flag receives the lowest bit of AX (before the shift).

Write a logical shift instruction that multiplies the contents of EAX by 16.

```
shl eax,4
```

Write a logical shift instruction that divides EBX by 4.

```
shr ebx, 2
```

Write a single rotate instruction that exchanges the high and low halves of the DL register

ror dl,4 (or: rol dl,4)

Show the value of AL after each shift or rotate instruction has executed in the provided code sequence.

```
a. mov al, 0D4h
shr al, 1          ;a = 6Ah
; b. mov al, 0D4h
sar al, 1          ;b = EAh
; c. mov al, 0D4h
sar al, 4          ;c = FDh
; d. mov al, 0D4h
rol al, 1          ;d = A9h
```

Show the value of AL after each shift or rotate instruction has executed in another code sequence.

```
; a. mov al, 0D4h
ror al, 3          ;a = 9Ah
; b. mov al, 0D4h
rol al, 7          ;b = 6Ah
; c. stc mov al, 0D4h
rcl al, 1          ;c = 0A9h
; d. stc mov al, 0D4h
rcr al, 3          ;d = 3Ah
```