Assume that currently overflow flag, OF = 0,
carry flag, CF = 0, zero flag, ZF = 1, and sign flag, SF = 1.
Now consider the following code segment.

```
mov al, -110
add al, -140  ;OF=?,CF=?,SF=?,ZF=?
rol al, 4     ;OF=?,CF=?,SF=?,ZF=?
cmp al, 50    ;OF=?,CF=?,SF=?,ZF=?
```

Write the content of al register, after executing each instruction. Show the computation. (1 point for each instruction)
Write the value of the Carry Flag (CF), Overflow Flag (OF), Sign Flag (SF), and Zero Flag (ZF), after executing each
instruction. (0.5 points for each flag). No points if you don't provide any explanation.

Answer:

(1) Mov al, -110

110 in binary = 0110 1110

2's complement of 110

(1) Flip the bits : 1001 0001

(2) Add 1   +1

10010010

So, AL contains |1001 0010   or |92| Hex

mov doesn't Alter any flags.

(2) ADD AL, -140

140 in binary = 1000 1100
2's complement of 140:
(1) Flip the bits = 0111 0011
(2) Add 1   =   +1
                  0111 0100

ADD -110, -140:

        -110   1001 0010
        -140:   0111 0100   (+)
        _____
             (1) 0000 0110
        discard

AL contains |0000 0110| or |06| Hex
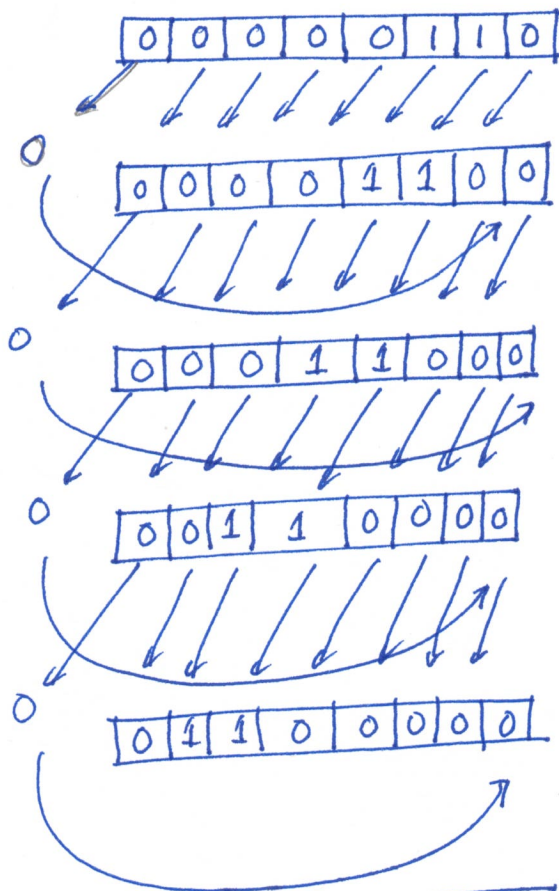   bin

Flags:

overflow, OF = 0,   result is inside
                    sign range.

carry, CF = 1,   system has a carry

sign, SF = 0,   MSB is 0

zero, ZF = 0,   result is non zero

③ rol dl, 4

| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | CF [1]

| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | one rotation. CF [0]

| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | two rotations   CF [0]

| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | three rotations CF [0]

| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | four rotations   CF [0]

AL contains | 0110 0000 | bin. or [60] Hex

Flags: carry flag , CF = 0
        overflow , OF = 0   unchanged.
        sign   , SF = 0   unchanged.
        zero   , ZF = 0   unchanged

CMP al, 50

al contain 60 in Hex

50 in Hex 32

60 - 32 = 28.

carry Flag, CF = 0, result is inside unsigned range.

overflow, OF = 0, result is inside signed range

sign, SF = 0, result is positive.

zero, ZF = 0, result is non zero

AL contains [0110 0000] or [60] Hex
             bin.