EXPERIMENT 9

Shift and Rotate Instructions

Objective

- Understand working of Shift and Rotate instruction
- Understand difference between Shift and Rotate instruction

The Shift and Rotate Instruction

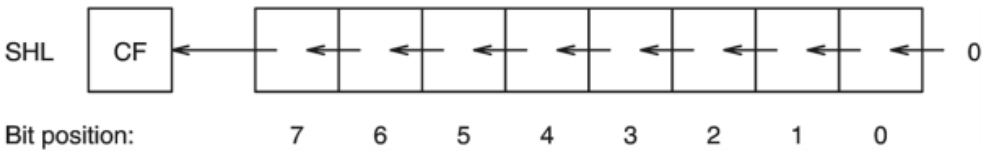
The Shift and Rotate instructions shift the destination operands by one or more then one position either to the left or right. Also out bit is placed in CF (Carry Flag). The difference between Shift and Rotate instruction is the Shift instructions lost bit or add zero (0) on the opposite side from where the bit is out, where the Rotate instruction place the same bit which is out to its the opposite side.

Shift Instruction

SAL/SHL Instruction

The SAL/SHL (Shift Arithmetic Left/Shift Logical Left) instruction shifts the content to the left that is from LSB to MSB. The MSB is out to Carry Flag and 0 is added on LSB position.
Instruction format

```
SAL/SHL     Destination, 1          ; Shift the content to left one time
or
SAL/SHL     Destination, CL         ; Shift the content to left by number in CL times
```

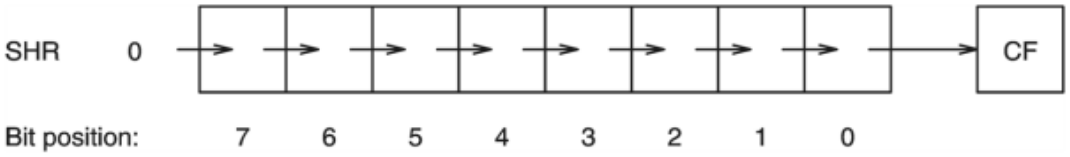


(*The MSB* **most significant bit** (**MSB**) *in an 8-bit binary* ***number*** *represents a value of 128 decimal.* ***The*** *LSB* **least significant bit** *represents a value of 1. In* ***computing****, the least significant bit (LSB) is the****bit*** *position in a* ***binary*** *integer giving the units value, that is, determining whether the* ***number*** *is even or odd.)*

SHR Instruction

The SHR (Shift Logical Right) instruction shifts the content to the right, that is from MSB to LSB. The LSB moves to Carry Flag and 0 is added to MSB position.
Instruction format

```
SHR    Destination, 1          ; Shift the content to right one time
or
SHR    Destination, CL         ; Shift the content to right by number in CL times
```

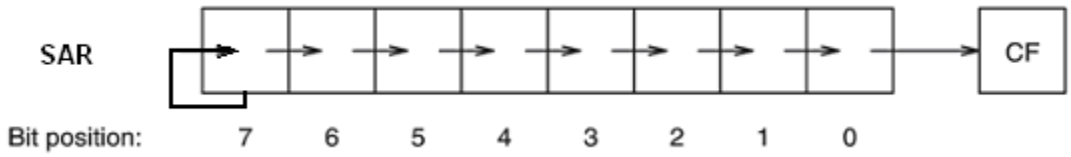


SAR Instruction

The SAR (Shift Arithmetic Right) instruction shifts the content to the right that is from MSB to LSB. The LSB is out to Carry Flag the MSB moves to LSB side and also repeated. (Mean sign return). This instruction is used in sign division by 2.

Instruction format

```
SAR    Destination, 1          ; Shift the content to right one time also repeat MSB
or
SAR    Destination, CL         ; Shift the content to right by CL times also repeat MSB
```



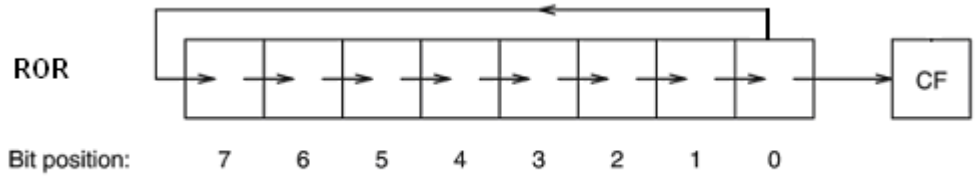
Rotate Instructions

ROR Instruction

The ROR (Rotate Right) instruction rotates the content to the right, that is from MSB to LSB. Also the bit which is out from LSB is come back to MSB and also copy to carry flag.

Instruction format:

```
ROR    Destination, 1          ; Rotate the content to right
or
ROR    Destination, CL         ; Rotate the content to right by number in CL times
```



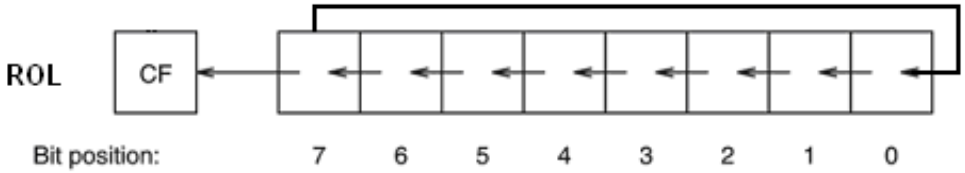
ROL Instruction

The ROL (Rotate Left) instruction rotates the content to left, which is from LSB to MSB. Also the bit which is out from MSB is come bask to LSB and also copy to carry flag.

Instruction format:

```
ROL    Destination, 1          ; Rotate the content to left
or
```

```
ROL    Destination, CL        ; Rotate the content to left by number in CL times
```

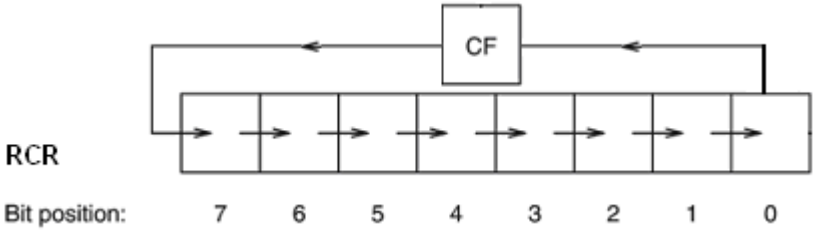


RCR Instruction

The RCR (Rotate Right Through Carry) instruction rotate the content to the right through carry flag, that is from MSB to LSB, and the bit which out from LSB store in carry flag and carry flag bit goes MSB.

Instruction format

```
RCR    Destination, 1         ; Rotate the content to right for one time
or
RCR    Destination, CL        ; Rotate the content to right by number in CL times
```

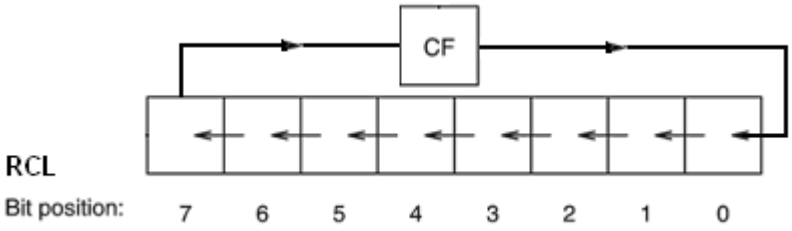


RCL Instruction

The RCL (Rotate Left Through Carry) instruction rotate the content to left through carry flag, that is from LSB to MSB side, and the bit which out from MSB store in carry flag and carry flag bit move to LSB.

Instruction format

```
RCL    Destination, 1         ; Rotate the content to right for one time
or
RCL    Destination, CL        ; Rotate the content to right by number in CL times
```



Exercise

1. Write a program which convert packed BCD into ASCII and display its output.