Today’s Plan

Some action instructions and a decision instruction

Logical Operations

Boolean Logic

- Byte Level and Bit Level

Rotate

Swap

Boolean operators

Sensing and Machine control

Sense on/off of external switch

Decision based on Switch states

Boolean operators - Byte

Destination Operand

Register A

or

direct address in internal RAM

Boolean operators - Byte

Operations are performed using individual bit of the dest and source bytes

Entire Byte is affected

Boolean Logic - Syntax

ANL A, Rr

; AND each bit of A with the same bit of register Rr ; put the results ;in A

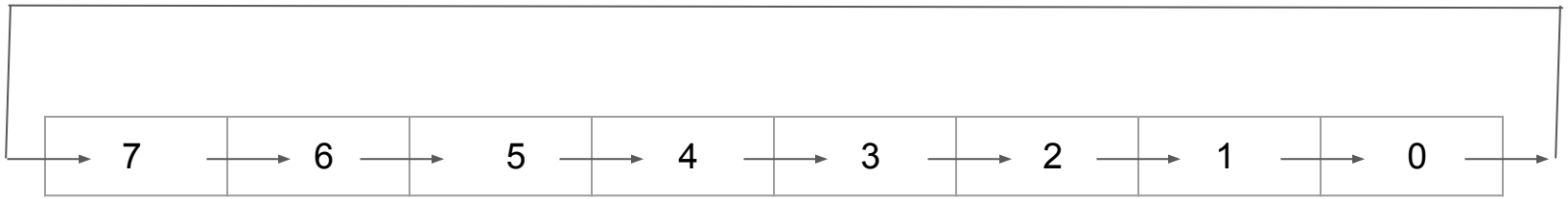
Boolean Logic - Example

```
MOV A, #0FFh      ; A = FFh

MOV R0, #77h      ; R0 = 77h

ANL A, R0         ; A = ?
```

Rotate - Syntax

```
RR A
; Rotate the A register one bit position
; to the right
```

RR A



Rotate - Example

```
MOV A, #0A5h    ; A = 10100101b = A5h

RR A            ; A = 11010010b = D2h

RR A            ; A = ?
```

Arithmetic Operations

Increment/Decrement

Addition/Subtraction

Multiplication/Division

Decimal Arithmetic

Addition - Syntax

ADD A, @Rp

; Add A and the address contents

; put the sum in A

Addition - Example

```
MOV A, #1Ch       ; A = 0001 1100 b

MOV R5, #0A1h     ; R0 = 1010 0001 b

ADD A, R5         ; A = 1011 1101 b
```

Multiplication - Syntax

MUL AB

; Multiply A by B put the low-order byte

;put the high-order byte in B

Multiplication - Example

```
MOV A, #7Bh      ; A = 123(10)
MOV B, #02h      ; B = 02(10)
MUL AB           ; A = 246(10); B = 0(10)
```

Jump and Call Operations

Jump

Call/Subroutines

Interrupts

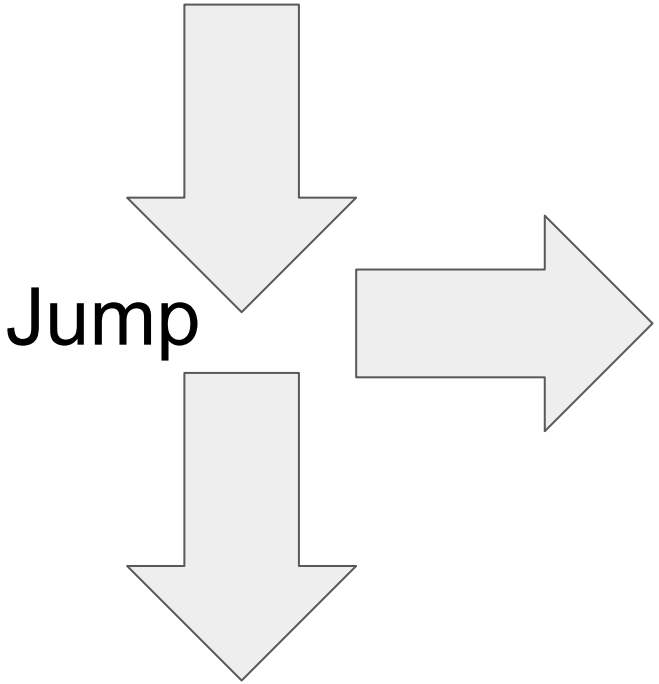
Returns

Jump

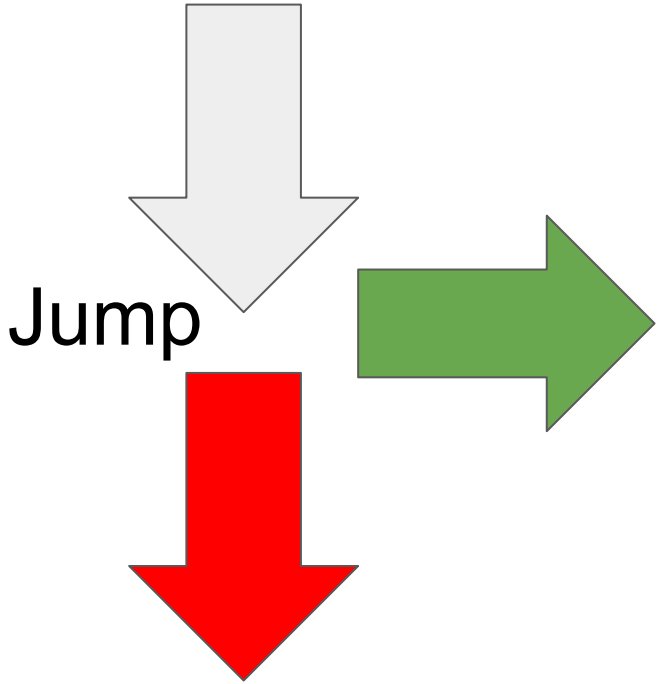
AND, RR, ADD, MUL *Action codes*

JUMP *Decision codes*

Jump - Program Flow



Jump - Program Counter



Bit Jump - Syntax

```
JNC radd
; Jump relative if the
; carry flag is reset to 0
```

Jump - Example

```
        MOV A, #10h   ; A = 0001 0000b
        MOV R0, A     ;R0 = 0001 0000b
ADDA:    ADD A, R0     ; add R0 to A
         JNC ADDA      ;until A is F0h
```

Summary

Logical: Byte-Level and Rotate

Arithmetic: Addition and Multiplication

Bit Jump