Lecture 13 :
Special Bit Instructions

Today's Goals

- Learn bit-set and bit-clear instructions
- Branch on bit instructions

Bit Manipulate Instructions

Set or clear bits in a memory byte

- BSET (M ← (M) + (mm))
  - Set to 1 bits in a memory location
- BCLR (M ← (M) · $\overline{(mm)}$)
  - Clear to 0 bits in a memory location
- Note that …
  - They can only be used on data in memory.
  - Use AND and OR instructions for setting/clearing bits on registers.
  - Therefore, two operands are needed.
    - 1st : the address
    - 2nd : immediate mask value
  - In the mask byte,
    - 1 means to affect the bit
    - 0 means preserve the bit
- Examples
  - `BSET 0,X, $81 ; $81 = %10000001`
  - `BCLR 0,Y, $33 ; $33 = %00110011`

Bit Test Instructions

Test bits

- BITA ((A) · (M))
  - Bit test A
  - Test bits without altering the value of the register.
- BITB ((B) · (M))
  - Bit test B
  - Test bits without altering the value of the register.
- Examples
  - `BITA #$44 ; $44 = %01000100`
    - Tests the bit 6 and 2 of register A.
    - Updates Z and N bits of CCR accordingly.
- Note that…
  - Like comparison instructions, the result is discarded. CCR bits are affected by the instructions.

Bit Condition Branch Instructions

- Make branch decisions based on the value of bits.
- BRCLR, BRSET
  - Perform bitwise logical AND on the contents of the specified memory location and the mask supplied with the instruction.
  - BRCLR: branch if (M) · (mm) = 0 [if selected bit(s) clear]
  - BRSET: branch if $\overline{(M)}$ · (mm) = 0 [if selected bit(s) set]
- Examples

```
here    brclr $66,$80,here
        ldd $70
;; ------------------------
loop    inc count
…
        brset $66,$e0,loop
…
```

Note: The first operand is an address.

Examples

Two door sport car

- Turn on the cabin light without affecting other bits

```
BSET   $00, %00000010       ; $02
```

	7	6	5	4	3	2	1	0
$0000	GBOXD	LEFTD	RGHTD	TRNKD	-	GBOXL	CBNL	TRNKL

Examples

Two door sport car

- Turn off the glove box light and trunk light without affecting other bits

```
BCLR   $00, %00000101       ; $05
```

	7	6	5	4	3	2	1	0
$0000	GBOXD	LEFTD	RGHTD	TRNKD	-	GBOXL	CBNL	TRNKL

Examples

Two door sport car

- Turn on the cabin light if either door is open (=the bit is set)

```
            LDAA   $00
            BITA   #%01100000          ; #$60
            BNE    CBNLON
            BRA    SKIP
CBNLON:     BSET   $00, %00000010      ; $02
SKIP:
```

	7	6	5	4	3	2	1	0
$0000	GBOXD	LEFTD	RGHTD	TRNKD	-	GBOXL	CBNL	TRNKL

Examples

Two door sport car

- Turn off the cabin light if both doors are closed

```
            BRCLR  $00, %01100000, CBNLOFF
            BRA    SKIP
CBNLOFF:    BCLR   $00, %00000010
SKIP:
```

	7	6	5	4	3	2	1	0
$0000	GBOXD	LEFTD	RGHTD	TRNKD	-	GBOXL	CBNL	TRNKL

Examples

Two door sport car

- Turn on the cabin light if both doors are open

```
            BRSET  #%01100000    CBNLON
            BRA    SKIP
CBNLON:     BSET   $00, %00000010       ; $02
SKIP:
```

	7	6	5	4	3	2	1	0
$0000	GBOXD	LEFTD	RGHTD	TRNKD	-	GBOXL	CBNL	TRNKL

Questions?

Wrap-up

What we've learned

What to Come