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** \((M \leftarrow (M) + (mm))\)
  - Set to 1 bits in a memory location

• **BCLR** \((M \leftarrow (M) \cdot (mm))\)
  - 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** \((A) \cdot (M))\)
  - Bit test A
  - Test bits without altering the value of the register.

- **BITB** \((B) \cdot (M))\)
  - 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 \((M) \cdot (mm) = 0\) [if selected bit(s) clear]
  - **BRSET**: branch if \((M) \cdot (mm) = 0\) [if selected bit(s) set]

**Examples**

```assembly
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

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<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
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<td>RGHTD</td>
<td>TRNKD</td>
<td>–</td>
<td>GBOXL</td>
<td>CBNL</td>
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Examples

Two door sport car

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

\[
\text{BCLR $00, \%00000101 \quad ; \quad $05}
\]
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:
```

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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:

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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:
```

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Questions?
Wrap-up

What we’ve learned
What to Come