Week 9
Chapter 7: Integer Arithmetic

Extended Addition and Subtraction

- ADC Instruction
- Extended Precision Addition
- SBB Instruction
- Extended Precision Subtraction

The instructions in this section do not apply to 64-bit mode programming.

Extended Precision Addition

- Adding two operands that are longer than the computer's word size (32 bits).
  - Virtually no limit to the size of the operands
- The arithmetic must be performed in steps
  - The Carry value from each step is passed on to the next step.

ADC Instruction

- ADC (add with carry) instruction adds both a source operand and the contents of the Carry flag to a destination operand.
- Operands are binary values
  - Same syntax as ADD, SUB, etc.
- Example
  - Add two 32-bit integers (FFFFFFFFh + FFFFFFFFh), producing a 64-bit sum in EDX:EAX:

```
mov edx,0
mov eax,0FFFFFFFFh
add eax,0FFFFFFFFh
adc edx,0              ;EDX:EAX = 00000001FFFFFFFEh
```

Extended Addition Example

- Task: Add 1 to EDX:EAX
  - Starting value of EDX:EAX: 00000000FFFFFFFFh
  - Add the lower 32 bits first, setting the Carry flag.
  - Add the upper 32 bits, and include the Carry flag.

```
mov edx,0            ; set upper half
mov eax,0FFFFFFFFh   ; set lower half
add eax,1            ; add lower half
adc edx,0            ; add upper half
```

```
EDX:EAX = 00000001 00000000
```

SBB Instruction

- The SBB (subtract with borrow) instruction subtracts both a source operand and the value of the Carry flag from a destination operand.
- Operand syntax:
  - Same as for the ADC instruction

Extended Subtraction Example

- Task: Subtract 1 from EDX:EAX
  - Starting value of EDX:EAX: 0000000100000000h
  - Subtract the lower 32 bits first, setting the Carry flag.
  - Subtract the upper 32 bits, and include the Carry flag.

```
mov edx,1              ; set upper half
mov eax,0              ; set lower half
sub eax,1              ; subtract lower half
sbb edx,0              ; subtract upper half

EDX:EAX = 00000000 FFFFFFFF
```