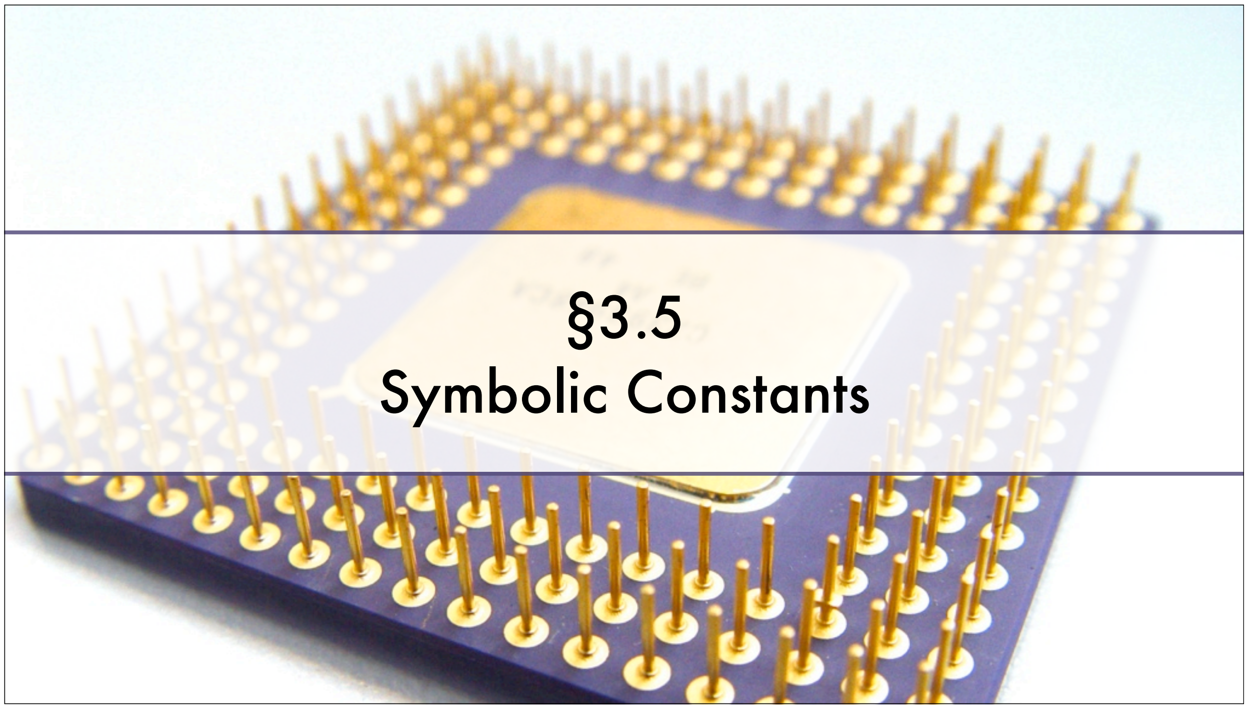


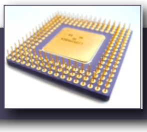
§3.5 Symbolic Constants

Homework

- **Quiz 1** on 9/22 – one week from Monday; **Exam 1** TBA
- **Homework 2** is due in one week – Friday, Sept 19, 11 a.m.
  - Submit electronically in Canvas
- For next class (Monday, September 15):
  - Read about the **Assemble-Link-Execute Cycle** on p. 71 (skip the rest of §3.3)
    - What is a **linker**? An **object file**? Your book's description is not very good, so Google these terms.
    - Note that the linker copies procedures from *statically* linked libraries into the executable. It does not copy procedures from *dynamically* linked libraries (DLLs); they are loaded at runtime.
  - Read **Sections 3.4–3.5** (omit §§3.4.7 and 3.4.8 on QWORD and TBYTE)
    - Covered Wednesday and today; more details in book

Makeup exams must be scheduled in advance. Makeup exams will not be given after the exam is given in class.

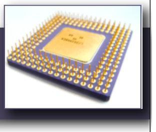
Last Time



- **§3.4 (Defining Data)**
  - BYTE, SBYTE, WORD, SWORD, DWORD, SDWORD, QWORD
  - DUP operator
  - ? initializer
  - Little vs. big endian
  - Difference between .DATA and .DATA? directives
  - Using **`mov`** for memory-register data movement

Finish Activity 6 (#6)

Symbolic Constants



Activity 7 #1–2

- Give a name to a constant value using =

```
CR   = 0Dh
LF   = 0Ah
NUL  = 00h

.data
input BYTE "Hi",CR,LF,NUL
```

becomes

```
.data
input BYTE "Hi",0Dh,0Ah,00h
```

- Syntax: *name* = *expression*   where *expression* is an integer constant or expression
- Read about EQU and TEXTEQU directives (§§3.5.3–3.5.4) – similar but different
- Symbolic constants are **not** stored in the resulting object file/executable
  - The assembler *replaces* them with their values *before* generating machine code
  - So the executable/machine code will be exactly the same as if you didn't use them

Current Location Counter ($)

- $ is a symbolic constant called the *current location counter*
- Its value is the memory address of the location at which it appears
- Note that the value of $ depends on where it is written!

```
; Suppose the first declaration
; will be at offset 00405000h
.data
start = $
value1 DWORD start
next = $
value2 DWORD next
```

becomes

```
.data
value1 DWORD 00405000h
value2 DWORD 00405004h
```

Calculating the Size of a Byte Array

- **$ is often used to determine the size of an array**
  - A label is just a name for a particular memory address
  - $ is also a name for a memory address
  - Subtract to compute the number of bytes between the two

```
.data
hello BYTE "Hello", 0
len = ($-hello)

.code
mov eax, len
call WriteDec ; Prints 6
```

Calculating the Size of a Byte Array

- **$ is often used to determine the size of an array**
- To be correct, **`len = ($-hello)`** must appear immediately after the definition of hello. Why?

```
.data
hello BYTE "Hello", 0
len = ($-hello)

.code
mov eax, len
call WriteDec ; Prints 6
```

```
.data
hello BYTE "Hello", 0
moreBytes BYTE 0,0,0,0
len = ($-hello)

.code
mov eax, len
call WriteDec ; Prints 10
```

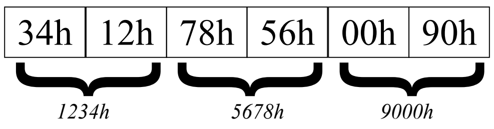
Calculating the Size of an Array

Activity 7 #3–5

- BYTE/SBYTE array: `($-start)`
- WORD/SWORD array: `($-start)/2`
  Equivalently, `($-start)/(SIZEOF WORD)`
- DWORD/SDWORD array: `($-start)/4`
  Equivalently, `($-start)/(SIZEOF DWORD)`

```
.data
nums SWORD 1234h, 5678h, 9000h
len = ($-nums)/(SIZEOF SWORD)

.code
mov eax, len
call WriteDec ; Prints 3
```


34h
12h
78h
56h
00h
90h
1234h
5678h
9000h