CpE 213
Digital Systems Design
Address Decoding
Intro to Computer Organization

Lecture 5

Wednesday 8/31/2005

UNIVERSITY OF MISSOURI-ROLLA

The Name. The Degree. The Difference.

Overview

- Announcements
- Address decoding (continued)
- Introduction to computer organization

Announcements

- Homework 1 is due on Friday.
- Picture deadline is Friday.
- Group deadline is Friday.
- Learning Center
  - Wednesday and Thursday from 5:00 - 7:00
  - EECH 101
  - You are strongly encouraged to attend.

Introduction to Computer Organization

Some slides adapted from Dr. Shoukat Ali

Some definitions

- program: a set of instructions
- computer: a device that sequentially executes a stored program
- microprocessor: major functional blocks of a computer packaged in SINGLE chip
- microcontroller: a microprocessor PLUS a number of peripherals INTEGRATED into a SINGLE chip
- computer architecture: the arrangement and interconnection of its functional blocks
- instruction set of a computer: the set of operations the computer can be programmed to perform on data

von Neumann machine

- functional blocks of von Neumann machine
  - a memory, containing instructions and data
  - a processing unit, for performing arithmetic and logical operations
  - a control unit, for interpreting instructions
- basic sequence of operations
  1. get the first program instruction from the memory, **fetch**
  2. figure out what the instruction requires, **decode**
  3. execute the instruction, **execute**
  4. get the next program instruction, **fetch**
  5. go to step 2
- cycle through: ***fetch, decode, execute***

Micro operations

- each step in the sequence of operations consists of many micro-operations
- example
  - get the first program instruction from memory

1. find out the address where the instruction is located
2. send that address to the memory chip
3. enable the output of the memory chip
4. memory chip responds by placing the instruction on its “door”; get that instruction and bring it into a special register called the “instruction register”

- program counter register: a register that contains the address of the next instruction that the computer should execute
  - at start, it contains the address of the first instruction of the program

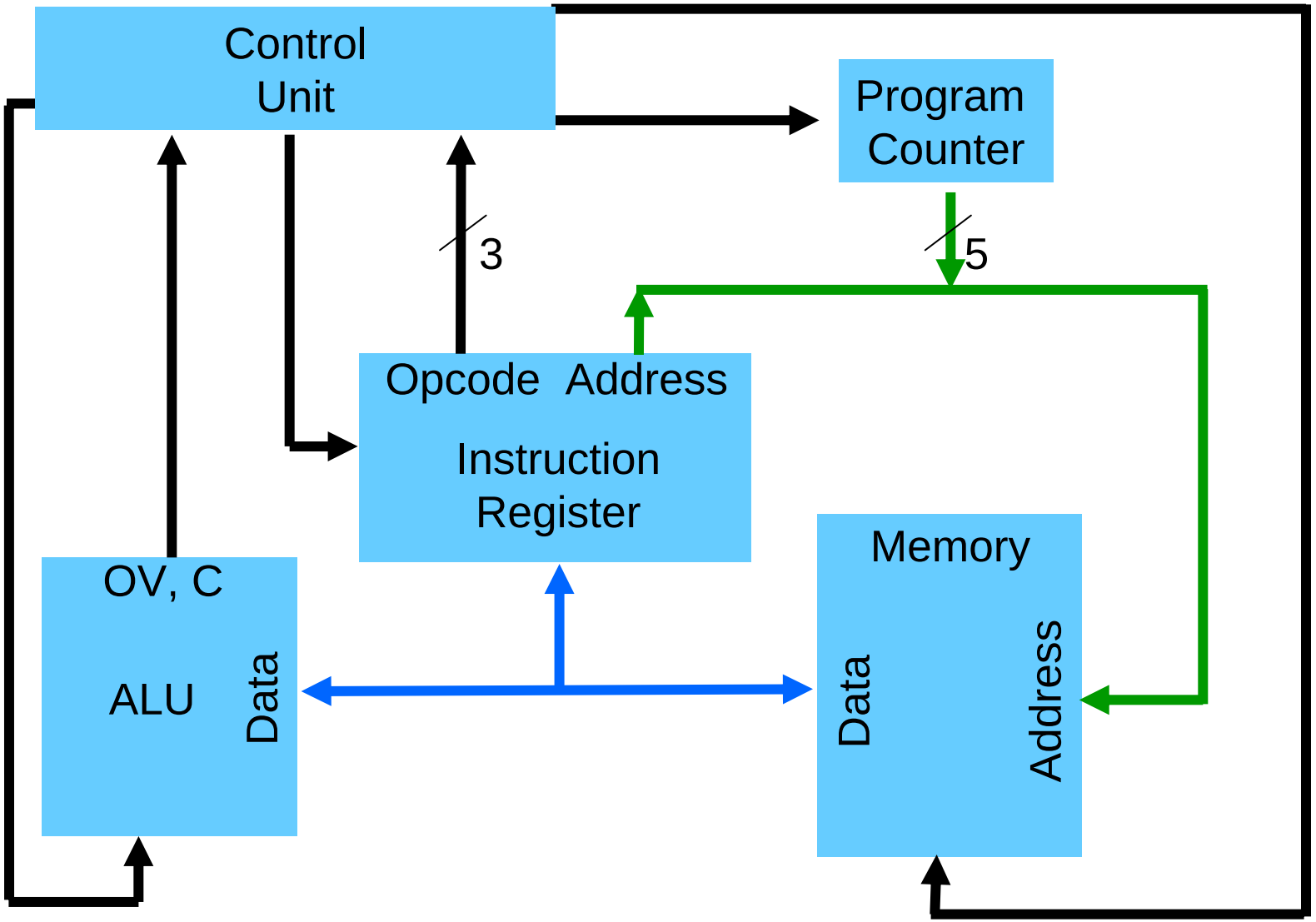
Diversion: programming model

- control unit uses two registers called the instruction register (IR) and the program counter (PC) to get the first (and subsequent) program instruction(s) from memory.
- the “user” or programmer cannot access instruction register.
- programming model of a computer: the set of registers available to a programmer
  - assume that for our simple computer, the user can access the PC, accumulator, and condition code register
    - condition code register: 2-bits, overflow and carry flags (simplistic)
- real life programming models
  - Alpha 21264 has 63 registers, each 64 bit wide
  - Intel Pentium 4 has 32 registers of width varying from 32 to 128 bits
  - Sun Sparc can have up to 520 registers!!!

Control unit

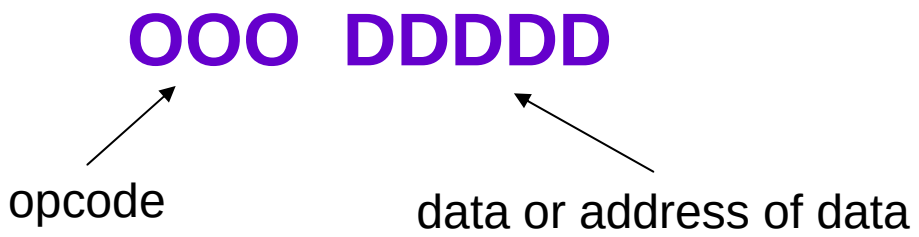
- orchestrates execution of the program
- consists of IR, PC, and sequential and combinational logic
- IR contains the current instruction
- PC contains the address of the next instruction to be executed
- control unit tasks
  - fetch: read an instruction from memory
    - the instruction's address is in the PC
  - decode: interpret the instruction, and then generate all those signals that tell the other components what to do to get the job done

Very simple view



Instruction format

- for a general purpose computer, instructions typically consist of many fields
  - opcode field: indicates the operation to be performed
  - data field: contains either the data on which the operation is to be performed or the address in memory where the data can be found
- assume a simple “8-bit” computer that has
  - a 3-bit opcode
    - therefore allowing at most eight instructions in its instruction set
  - a 5-bit address field
    - thus allowing access to 32 locations



For Friday

- Review today's lecture notes and textbook.
- Finish Assignment 1.
- Print lecture notes for Lecture 6.
- Come to my office and have your picture taken for bonus 5%.
- Email me names of your group members (one email per group).