Lab 1   Due   Sept 17

Hw 2   Due   Sept ~~12~~ 17

Chap 3   1, 3, 5, 7, 10-13, 16,
          18, 20, 21, 24, 25, 27, 28

Chap 4   1-14

Chap 4

von Neumann model

John von Neumann proposed
concept of a stored program.
consists of 5 major parts:
memory, processing unit, input,
output, and a control unit.
instruction: smallest piece of
work that is specified by a
program.

9-5-02   P1

A computer can't do part
of an instruction.
The program (consists of
a set of instructions) is
stored in computers memory.

address space: number of
uniquely identifiable locations
in a computer's memory.
addressability: size (in bits)
of each location.

typical computer has 512 MB
memory. 29 bits are needed
to uniquely identify these locations

$A_{28} A_{27} \cdots A_0$ D_7 D_6 $\cdots$ D_0

$\vdots$

D_7 D_6 $---$ D_0

Memory

MAR   MDR
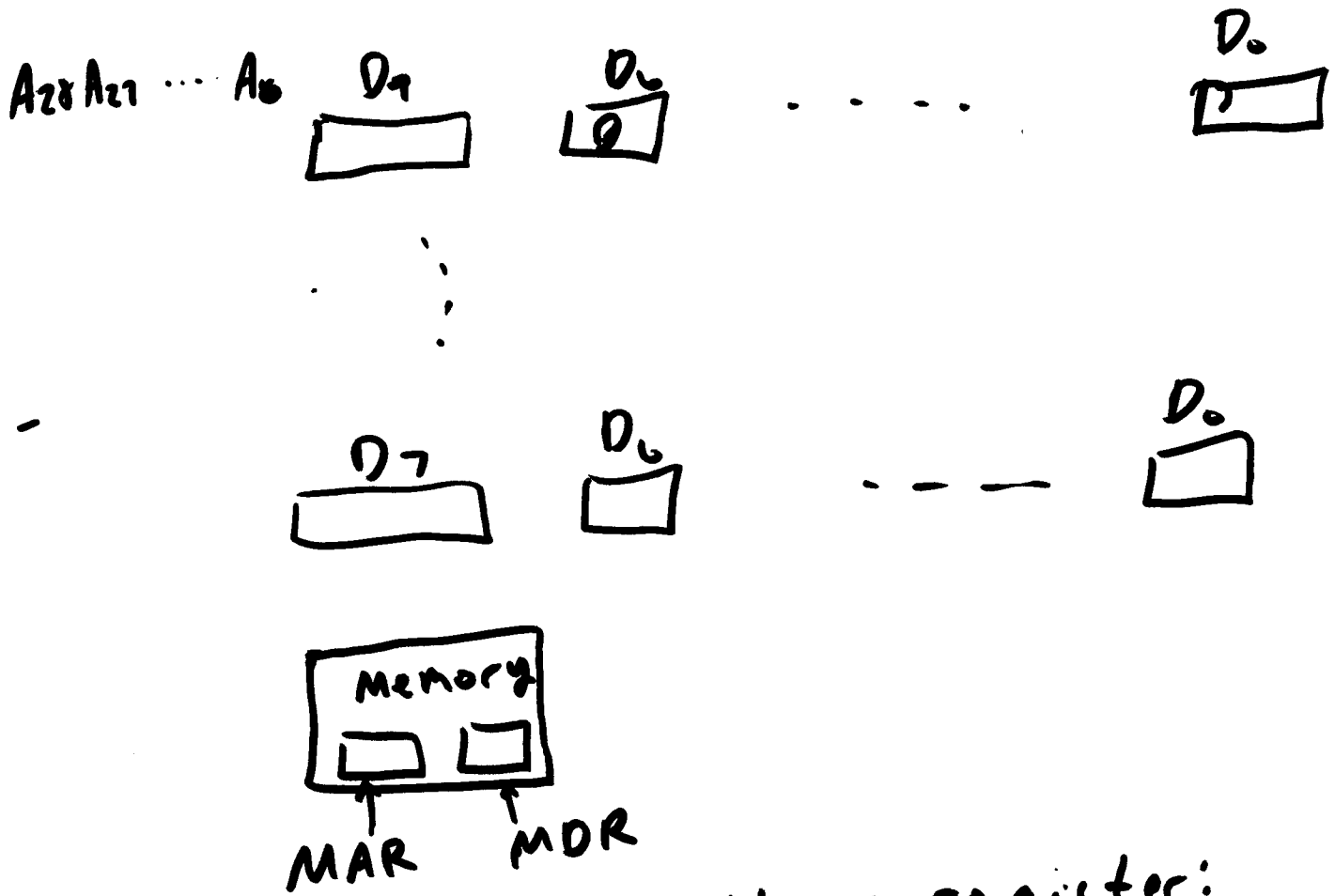
<u>MAR → Memory address register:</u> register that holds the address of the location we wish to access.

<u>MDR → memory data register:</u> place where data is stored, temporarily, when we write to or read from memory.

9-5-02   P3

- When we wish to read from memory, the processing unit places address in MAR. The memory then accesses the memory location, the data is placed in the MDR.

- When we wish to write to mem, we place addr. in MAR and Data in MDR. We then assert write enable signal

60ns typical access to time time between when we place an address on MAR and when data is available at MDR.

typical processor is running at 2 GHz

100 Mhz it 10ns access time

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typical processor must wait when there's an access to memory.

cache - small high-speed memory acts as a buffer between CPU and main memory.

Processing unit

where the actual processing of information takes place.
typical operations are: AND, OR, Not, addition, subtraction, mult., div, etc.
ALU: arithmetic logic unit
takes a set of operands for performing its processing on.
the size of operands, in bits, is the word length of computer.
Each element is a word.

LC-2 word length is 16 bits

when processing unit wants operands, they need to come from some storage location. in addition, the result must go to some storage location. most have a set of registers, known as a _register file_, for storing these values. these storage locations operate just as fast as the processor does.

<u>input/output:</u>

input: getting information into computer

output: getting info. from computer.

9-05 - P6

<u>Control unit</u>: responsible for ensuring that processing of instructions takes place correctly.

instruction <u>register</u>: holds the instruction that is to be executed.

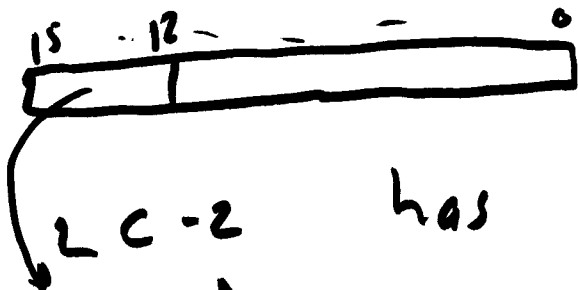<u>program counter</u>: keeps track of the ~~ins~~ address of the instruction.

Instruction processing

program ~~ad~~ and data are a sequence of bits in the computer's memory.

program is a set of instructions, executed one at a time by control unit.

<u>opcode</u>: what the instruction does

<u>operands</u>: elements the processing is performed on.

9-5-02   p7

```
15   12                    0
┌──┬──────────────────┐
│  │                  │
└──┴──────────────────┘
```

LC-2 has 16-bit instruction
opcode

4-bit opcode $\Rightarrow$ 2^4 or 16 possible distinct
instructions

Instruction cycle : sequence
of steps taken to process
an instruction. Each is referred
to as a phase.

Fetch cycle : control units goes
to memory to get instruction to
perform.

Decode phase : examine instruction to
determine what it does.

evaluate addr : determine memory loca-
tion needed to process instruction.