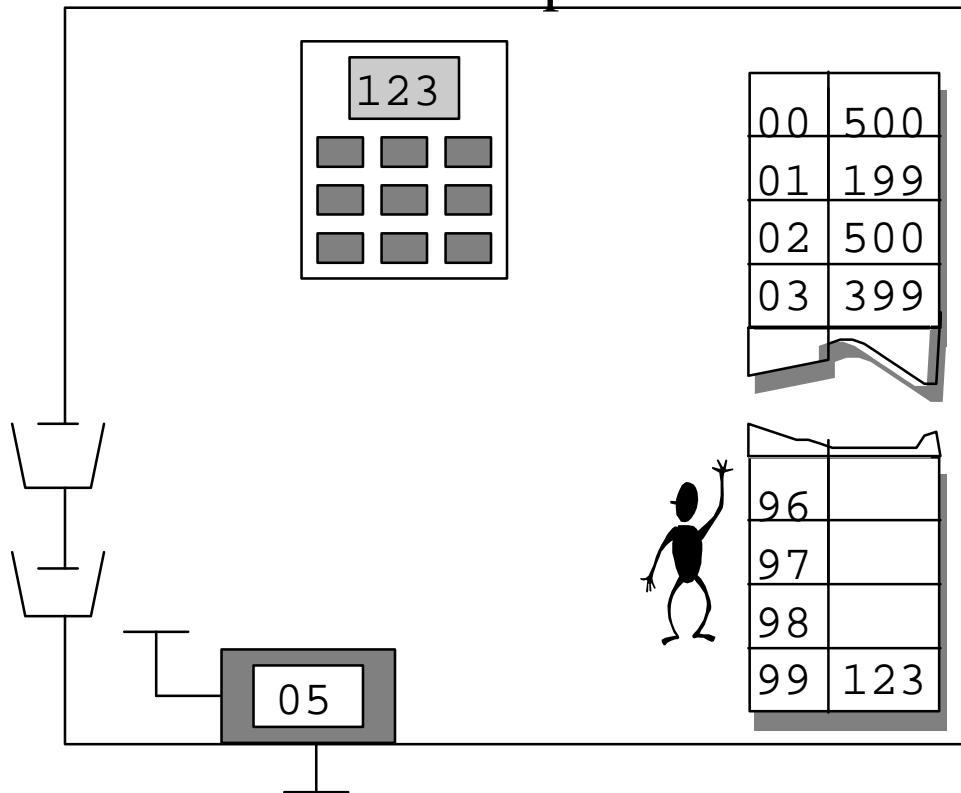


Central Processing Unit

Little Man Computer



In tray and Out tray for input and output

A series of 100 mailboxes, each has a two digit address and may have contents (3 digits)

A calculator

Counter

Try LMC:

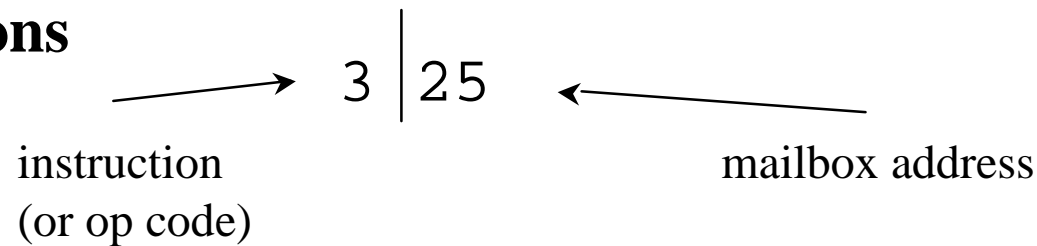
<http://www.herts.ac.uk/ltdu/projects/mm5/>

<http://www.acs.ilstu.edu/faculty/javila/lmc/>

Little Man computer

- Each mailbox may contain a 3 digit number
- This number may be data or an instruction

Instructions



There are 7 basic instructions

1	LOAD	2	STORE
3	ADD	4	SUBTRACT
5	INPUT (or READ)	6	OUTPUT (or PRINT)
7	HALT		

LMC instructions

LOAD 99 199

little man reads number in mailbox 99 and punches it into the calculator

STORE 98 298

(reverse of LOAD) little man reads the number on the calculator, writes it on a slip of paper and stores it in 98.

ADD 98 398

(similar to LOAD) little man reads the number in 98 and *adds* it to the number already in the calculator.

SUBTRACT 98 498

Guess

LMC instructions

INPUT 00 500

little man picks up slip of paper in In Box and keyes this number into the Calculator.(address portion not used)

OUTPUT 00 600

Guess again.

HALT 00 700

LMC Programs

These instructions can be stored in memory as a program.

```
00      500      INPUT
01      299      STORE DATA
02      500      INPUT 2ND NO
03      399      ADD 1ST NO TO IT
04      600      OUTPUT RESULT
05      700      HALT

99              DATA
```

- If numbers 15 and 13 are presented at the input, after the program runs 28 will be output.

What if instruction 03 were 299?

This is a simple machine code program.

More Instructions

We need instructions for branching and looping

SKIP

Skip next instruction if:

SKIP 00 800 if result in calculator is neg.

SKIP 01 801 if result in calculator is 0

SKIP 02 802 if result in calculator is 0 or pos.

JUMP 22 922

Jump to this instruction. In fact little man sets the program counter to this value.

Mnemonics

Sensible codes to describe instructions

LDA	Load
STA	Store
ADD	Add
SUB	Subtract
IN	Input
OUT	Output
HLT	Halt
SKN	Skip if neg (800)
SKZ	Skip if zero (801)
SKP	Skip if pos (802)
JMP	Jump
DAT	Data storage location

Mnemonics

Our program in Mnemonics

<u>Location</u>	<u>Mnemonic</u>	<u>Code</u>
01	STA 99	299
02	IN	500
03	ADD 99	399
04	OUT	600
05	HLT	700
99	DAT	

The Instruction Cycle

Two parts; **fetch** and **execute**

Fetch

1. Little man reads the address from the counter
2. Walks to the mailbox corresponding to the counter
3. Reads the number on the slip of paper and replaces the paper.

The Instruction Cycle

Two parts; **fetch** and **execute**

Execute (LOAD example)

1. Little man goes to the mailbox address specified in the instruction.
2. Reads the number in the mailbox
3. Walks over to the calculator and punches in the number.
5. Finally walks over to the program counter and clicks (increments) it.