

The Little Man Computer

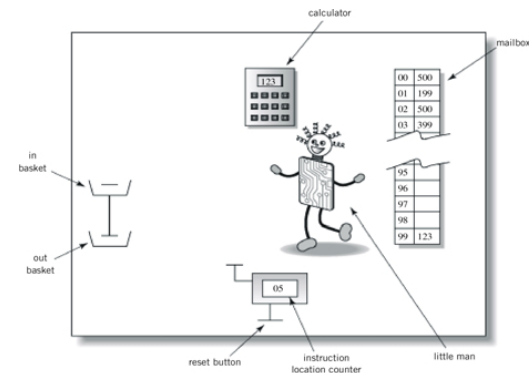
<http://www.cs.nott.ac.uk/~qiu/Teaching/CSA/20022003CoursePages/Slides/G51CSA-2002-2003-L2.pdf>



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The Little Man Computer: Components & Physical Layout



Englander: The Architecture of Computer Hardware and Systems Software, 2nd edition Chapter 6, Figure 06-01



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- ★ 100 mailboxes
 - ★ address 00 - 99
 - ★ Each holds 3-digit decimal number
- ★ Calculator
 - ★ Enter number
 - ★ Temporarily hold number
 - ★ Add and Subtraction
 - ★ Display 3 digits
- ★ Hand counter
 - ★ Reset button
 - ★ Instruction counter
- ★ Little Man
- ★ In/Out Basket

The Little Man Computer: Components & Physical Layout

★Start Button:

The operator of the LMC (not the Little Man) presses the START BUTTON to zero the Instruction Counter and ring a bell which wakes up the Little Man so he can start executing the program which has previously been stored in the mailboxes

★Instruction Counter:

This display contains the number of the mailbox in which the NEXT instruction is stored. The Little Man can change the number in the instruction counter (usually by incrementing but sometimes by replacement), and the user of the LMC can reset the Instruction Counter to 00 using the start button



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The Little Man Computer: Components & Physical Layout

★Calculator:

Performs simple arithmetic (addition and subtraction only)

Used for temporary storage of a single three digit number. The display is limited to three digits.

The calculator has ten numerical keys (0-9) and two operation keys (+ and -).

The calculator also has two lights which can be seen by the Little Man.

One of these lights turns on whenever the number being displayed is exactly zero.

The other light turns on whenever the number being displayed is positive (the number ZERO is considered a positive number). Thus when ZERO is displayed on the calculator, both lights will be on.

These lights are sometimes referred to as flags



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The Little Man Computer: Components & Physical Layout

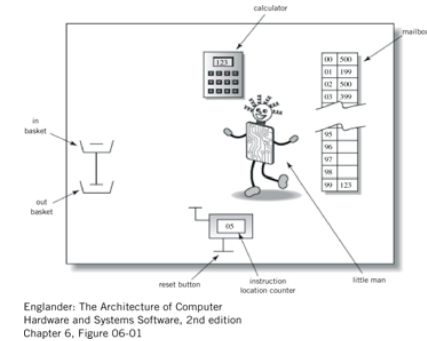
★ Mailboxes:

Mailboxes are identified using two-digit numbers (00 99) and each can hold a single slip of paper containing a single three digit number.



The Little Man Computer: Communication with outside World

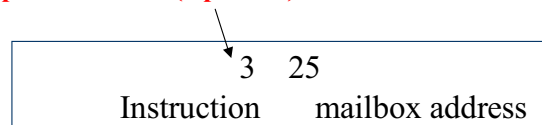
- ★ A user outside the mailroom communicate with the little man by
 - ★ Putting a 3-digit into the in basket
 - ★ Retrieving a 3-digit from the out basket
- ★ Apart from the reset button, all communication between the LMC and the outside world takes place using 3-digit numbers



The Little Man Computer: Operation

- ★ A small group of instructions, each consists of a single digit
- ★ The first digit of a 3-digit number is used to tell the Little Man which operation to perform.
- ★ In some cases, the Little Man is required to use a particular mailbox to store or retrieve data
- ★ The 3 digits can be used to give instructions to the Little Man according to

Operation Code (Op-Code)



The Little Man Computer: Instruction Set

FORMAT	MNEMONIC	MEANING
3xx	STO xx	Stores the calculator value into mailbox xx.
4xx	STA xx	Stores the address portion of the calculator value (last 2 digits) into the address portion of the instruction in mailbox xx.
5xx	LOAD xx	Loads the contents of mailbox xx into the calculator.



The Little Man Computer: Instruction Set

FORMAT	MNEMONIC	MEANING
1xx	ADD xx	Adds the contents of mailbox xx to the calculator display.
2xx	SUB xx	Subtracts the contents of mailbox xx from the calculator display.



The Little Man Computer: Instruction Set

FORMAT	MNEMONIC	MEANING
000	STOP	Stops the Computer - the Little Man rests.
6xx	B xx	This instruction sets the instruction counter to the number xx, thus effectively branching to mailbox xx
7xx	BZ xx	IF the calculator value is zero, THEN set the instruction counter to the number xx, thus effectively branching to mailbox xx.
8xx	BP xx	IF the calculator value is positive, THEN set the instruction counter to the number xx, thus effectively branching to mailbox xx. NOTE: zero is considered positive.



The Little Man Computer: Instruction Set

FORMAT	MNEMONIC	MEANING
901	INPUT	Read a number from the IN basket and key it into the calculator.
902	OUTPUT	Copy the number in the calculator onto a slip of paper and place it into the OUT basket.



The Little Man Computer: Execute Program

To actually run an LMC program we must carry out the following steps.

- ★ Load the instructions into the mailboxes, starting with mailbox 00.
- ★ Place the data to be used by the program in the IN basket, in the order in which the program will use these data.
- ★ Press the RESET BUTTON to set the Instruction Counter to 00 and to also wake up the Little Man. Then

1. The Little Man looks into the Instruction Counter
2. The Little Man find the mailbox whose address has the value in the Instruction Counter and fetches the 3-digit number from the mailbox.
3. The Little Man executes the instruction found in the mailbox
4. The Little Man go over to increase the instruction counter by 1
5. The Little Man repeat the by going to 1



The Little Man Computer: Program Example

Write a LMC program which adds two numbers together

Mailbox	Code	Instruction Description
00	901	INPUT
01	399	STORE DATA (to mailbox no 99)
02	901	INPUT
03	199	ADD the 1st number to 2nd number
04	902	OUTPUT RESULT
05	000	The Little Man rest

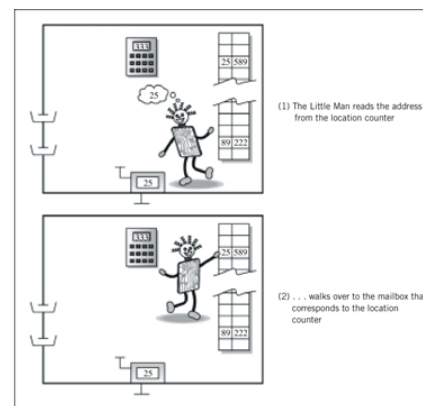
99 Data



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The Little Man Computer: The Instruction Cycle



(Figure continues on next slide)

Englander: The Architecture of Computer Hardware and Systems Software, 2nd edition Chapter 6, Figure 06-05a

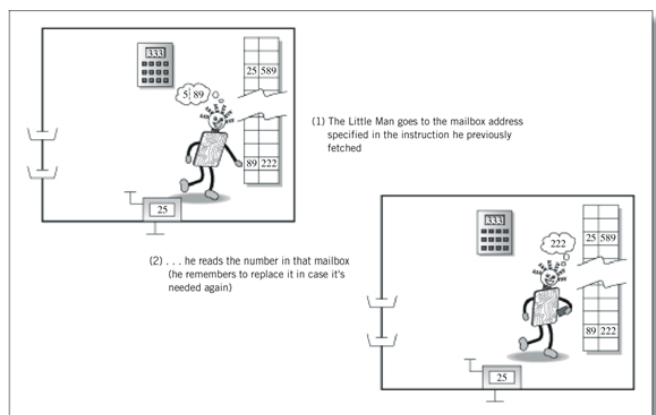


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The fetch portion of the instruction cycle (LOAD Instruction)

The Little Man Computer: The Instruction Cycle



(Figure continues on next slide)

Englander: The Architecture of Computer Hardware and Systems Software, 2nd edition Chapter 6, Figure 06-05b

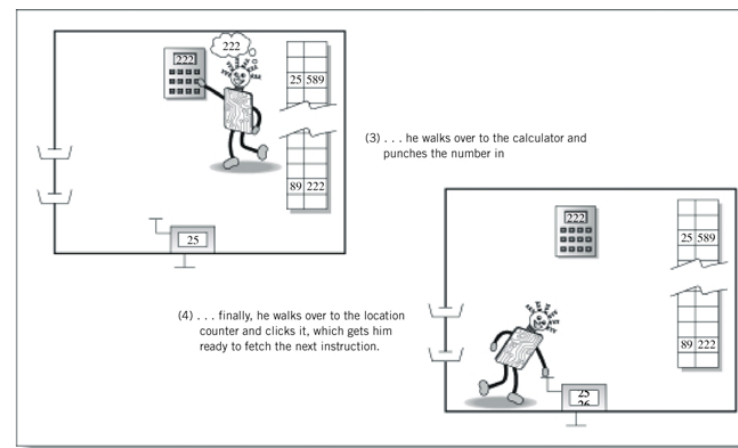
The execute portion of the instruction cycle (LOAD instruction)



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The Little Man Computer: The Instruction Cycle



Englander: The Architecture of Computer Hardware and Systems Software, 2nd edition Chapter 6, Figure 06-05b continued

The execute portion of the instruction cycle (LOAD instruction)



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