

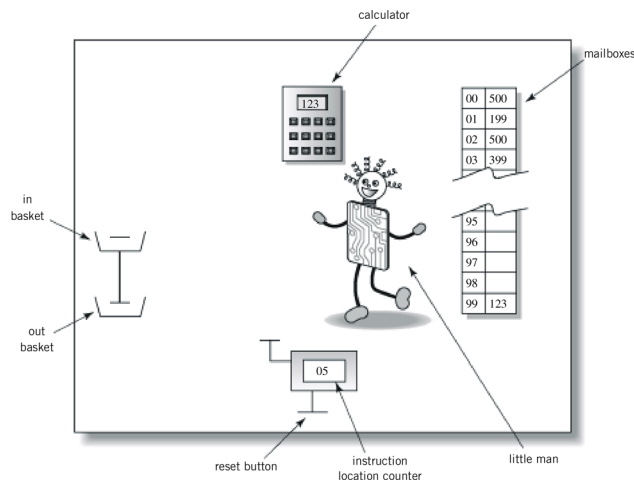


## G51CSA Lecture Notes # 3 - LMC

Reading: Chapter 6, Reference C

### The Little Man Computer

#### 1. Layout of the Little Man Computer



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

- The LMC consists of a walled mailroom, inside it are
  1. 100 mailboxes each numbered with address ranging from 00 to 99. The address is represented by two digit decimal number
  2. Each mailbox can hold a single slip of paper upon which is written a three digit decimal number. Note that the content of the mailbox is not the same as the address of the mailbox
  3. A calculator, which can be used to
    - Enter and temporarily hold numbers
    - Do addition and subtraction operations
    - Display 3 digit
  4. A two digit hand counter - instruction location counter. There is a reset button outside the mailbox
  5. The Little Man
  6. In/Out baskets used by the LMC to interact with the outside world.
- A user outside the mailroom can communicate with the Little Man inside the mailroom by putting a slip of paper with a three-digit number on it into the in basket, to be read by the Little Man at the appropriate time.
- The Little Man can write a three-digit number on a slip of paper and leave it in the out basket, where the user can receive it.
- All communication between the Little Man and the outside world is via three-digit numbers. Except for the reset button, no other form of communication is possible.
- Inside the mailroom, all instruction to the Little Man must be conveyed as three-digit numbers.



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### 2. Operation of the LMC

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

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

1. Load the instructions into the mailboxes, starting with mailbox 00. (See the LMC INSTRUCTIONS SET)
2. Place the data to be used by the program in the IN basket, in the order in which the program will use these data.
3. Press the reset button to set the Instruction Counter to 00 and to also wake up the Little Man.
4. Wait for the result to appear in the OUT basket.

### LMC INSTRUCTION SET

FORMAT	MNEMONIC	MEANING
000	HALT	Stops the Computer - the Little Man rests.
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.
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.
6xx	B xx	This instruction sets the instruction counter to the number xx, thus effectively branching to mailbox xx See the note for instruction BP
7xx	BZ xx	IF the calculator value is zero, THEN set the instruction counter to the number xx, thus effectively branching to mailbox xx. See the note for instruction BP
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. NOTE: Because of the three branching instructions, it is important for the LITTLE MAN to FIRST increment the instruction counter and THEN carry out the instruction. If he FIRST set the instruction counter to xx and THEN incremented the instruction counter the next instruction to be executed would be in mailbox xx+1, not in mailbox xx as was intended.
901	IN	Read a number from the IN basket and key it into the calculator.
902	OUT	Copy the number in the calculator onto a slip of paper and place it into the OUT basket.

### 3. Some simple programs

### 4. The Instruction Cycle

### 5. Key concepts of von Neumann machine