

Little Man Computer Practical

1 Introduction

This session introduces the Little Man Computer, a simple compute simulator used in both GCSE and A level syllabuses. There are several versions available. We are using:

<http://peterhigginson.co.uk/LMC/>

LMC Registers

- 1. Program counter:** this register holds the address of the next instruction to be executed.
- 2. Accumulator (or calculator):** this is the computer working memory. Arithmetic operations and load/store use it as one of the operands.
- 3. Memory address register (MAR):** this register holds the address at which the memory is accessed. In the fetch part of the cycle, it has the address of the instruction; in the execute stage it has the address of the data value.
- 4. Instruction register (IR):** this holds the opcode of the current instruction.
- 5. Memory data register (MDR):** this register holds the data passing to or from the memory. (Not visible in the version we are using.)

Only the accumulator is used directly by the programmer. The other registers help to show the fetch-execute cycle in action.

The memory has 100 locations, numbered 00 to 99. It holds values in denary (not binary), with three digits.

LMC Commands

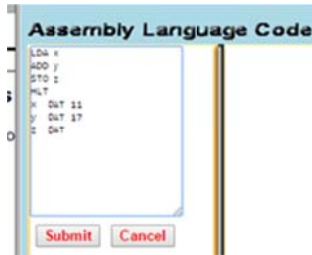
The following table shows the available instructions:

Name	Op Code	Operand (or n/a)	Description
ADD	1xx	xx = address of data	Calculate Acc + data
SUB	2xx		Calculate Acc - data
STO / STA	3xx		Store Acc at the address
LDA	5xx		Load data from the address to Acc
BR	6xx	xx = program address	Branch to new address
BRZ	7xx		Branch if Acc is zero
BRP	8xx		Branch if Acc is positive
INP	901	n/a	Input from user to Acc
OUT	902	n/a	Output from Acc to user
HLT	000	n/a	Halt or Stop
DAT	n/a	Initial value	Storage location

2. Exercises

2.1 Enter the following code into the left hand window within LMC and press the submit button.

```
LDA x
ADD y
STA z
HLT
x DAT 11
y DAT 17
z DAT
```



- What is the memory location for the variable 'x'?
- The first memory location has value '504'. Explain how this value represents the first instruction in the program
- Describe the program in words – use the table on page 1 to help

The program above has 4 instructions. Run the program, step by step and complete the following table to show the state of the system after each step:

Step	Program Counter	Memory Address Register	Instruction Register	Accumulator (Calculator)
0	00	---	---	000
1				
2				
3				

2.2 Enter the following code into the left hand window within LMC and press the submit button.

```
INP
STA 10
INP
STA 11
LDA 10
ADD 11
OUT
HLT
```

- Describe the program in words – use the table on page 1 to help
- Make modifications to the program so that...
 - Input three numbers and output the sum
 - The output value is stored to memory location 12
 - Input a number, double it twice and output (e.g. 7 input gives 28 out).
 - Input two numbers and calculate the difference. What happens if the answer is negative?