



1.2.4 Assembly Languages & Addressing Modes

1. Below is part of a program written using the Little Man Computer instruction set. This section of code will exit to the code labelled pass or fail depending on the values in the accumulator.

```
test SUB ten
      BRZ pass
      BRP test
      BRA fail
ten   DAT 10
```

a)

- i. Explain what the line ten DAT 10 does.

[3 marks]

- ii. Complete the table below determining whether the program branches to pass or fail given the following values in the Accumulator when it is run.

Starting value in Accumulator	pass or fail
29	
30	
31	

[3 marks]





b) The complete program is shown below:

```
                INP
main  STA  entry
      BRA  test
fail  LDA  entry
      ADD  one
      BRA  main

test  SUB  ten
      BRZ  pass
      BRP  test
      BRA  fail

pass  LDA  entry
      OUT
      HLT

entry DAT
ten   DAT  10
one   DAT  1
```

- i. Give one instruction in the program that when executed, changes the value in the Accumulator.

[1 mark]

- ii. Give one instruction in the program that when executed, changes the value in the program counter.

[1 mark]

- iii. State the value the code outputs for the input 18.

[1 mark]

- iv. State the value the code outputs for the input 37.

[1 mark]

- v. Describe the purpose of the program.

[2 marks]





2. Write a program using the little man instruction set that will allow a user to input two numbers and then output the larger of the two numbers. The program should loop continuously.

[6 marks]

3. The following is a program written using the Little Man Computer instruction set.

```
start LDA one
      OUT
      LDA zero
      OUT
      LDA count
      SUB one
      STA count
      BRP start
      HLT
one   DAT 1
zero  DAT 0
count DAT 3
```

- a) Describe the difference between the STA and LDA instructions.

[2 marks]

- b) Describe what the instruction BRP does.

[2 marks]

- c) Identify the type of memory addressing the program uses.

[1 mark]

- d) State the output this program generates.

[3 marks]

- e) State what type of translator program would be needed to convert the code above into machine code.





4. A Little Man Computer (LMC) assembly language program is stored in memory as shown below.

0	LDA &7
1	ADD #4
2	OUT
3	HLT
4	6
5	2
6	10
7	15
8	16
9	17

In this variant of LMC the symbols & and # are used to denote different modes of addressing.

a) Given that the output is 17, state the addressing mode represented by each symbol.

i. &

[1 mark]

ii. #

b) Explain how pipelining would help a CPU execute the code in Fig. 3.1 more quickly.

[3 marks]

5. In assembly language, different modes of addressing memory can be used.

Discuss the different modes used. You should include:

- How the operand value is determined
- What an operand of 31 would refer to in that mode
- The reasons for requiring multiple modes of addressing

[12 marks]

