

1.2 SOFTWARE & SOFTWARE DEVELOPMENT · 1.2.4 · FULL A-LEVEL

Assembly language, the LMC & addressing modes

Original practice questions · 36 marks · about 50 minutes · spec 1.2.4(c)(d)

Instructions. Answer all questions. The number of marks is shown in brackets []. Quality of written communication is assessed in the extended-response question.

1**Total: 5 marks**

Complete the table of Little Man Computer mnemonics and their meanings.

[5]

Mnemonic	Meaning
	input a value into the accumulator
STA addr	
	branch if the accumulator is zero
ADD addr	
	halt the program

The LMC program below is run.

```
      INP
      STA first
      INP
      STA second
      SUB first
      BRP bigger
      LDA first
      OUT
      HLT
bigger LDA second
      OUT
      HLT
first  DAT
second DAT
```

- (a) State the output when the inputs are **9** then **5**. [1]
-
- (b) State the output when the inputs are **4** then **7**. [1]
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- (c) Describe the purpose of the program. [2]
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- (d) Give one instruction from the program that, when executed, changes the value in the accumulator. [1]
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- (e) Give one instruction from the program that, when executed, can change the value in the program counter to something other than the next address. [1]
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3

Total: 6 marks

- (a) Write an LMC program that inputs two numbers and outputs their **sum**, then halts. [4]

- (b) Explain what the line `total DAT 0` does in an LMC program. [2]

4

Total: 4 marks

- Describe **two** differences between assembly language and a high-level language. [4]

5

Total: 3 marks

- (a) Give **two** reasons why a programmer may choose to write code in assembly language. [2]

- (b) State the name of the translator that converts assembly language into machine code. [1]

Processor instructions contain an opcode and an operand. The operand can be interpreted in different ways, depending on the mode of addressing used.

Discuss the different modes of addressing memory (immediate, direct, indirect and indexed). **[12]**
In your answer you should explain how the value of the operand is interpreted in each mode and why having different modes is useful.

END OF QUESTIONS