

Unit 1: Components of a Computer
(1a. Components and Performance of Processors, A Level Only Content)

Marks: /9

Answer all the questions.

1(a). 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
```

Explain, giving an example, how pipelining in a CPU could speed up the execution of this program.

[3]

(b). Describe **one** issue the line `BRP start` may cause for a CPU using pipelining.

[2]

(c). Pipelining is one factor that affects the performance of a CPU. Identify **one** other factor.

[1]

2. A Little Man Computer (LMC) assembly language program is stored in memory as shown in Fig. 3.1.

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

Fig. 3.1

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

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

[3]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		<ul style="list-style-type: none"> - An instruction can be fetched as the previous one is being decoded ... - ... and the one before that is being executed. - E.g. LDA zero can be fetched, while OUT is being decoded and start LDA one is being executed. (1 per -)	3	
	b		<ul style="list-style-type: none"> - BRP could be followed by one of two possible instructions, which one will only be determined at execution - Meaning the wrong one may be fetched / decoded (1 per -)	2	
	c		<ul style="list-style-type: none"> - Clock speed - Cache Size - Number of cores (1 per max 1) 	1	
			Total	6	
2			<p>Pipelining would allow one instruction to be fetched as the previous one is being decoded and the one before that is being executed.(1)</p> <p>For example OUT could be fetched (1). As there are no jump/branch instructions it pipelines well (as there is no need to flush the pipeline). (1)</p>	3	Accept any valid example from the given code.
			Total	3	