

1(a). The stored program concept uses the Fetch-Decode-Execute cycle to get the next instruction from memory and then execute it.

Describe what happens during the **fetch** stage of the Fetch-Decode-Execute cycle.

You should state the different registers and buses that are used in your answer.

-----[4]

(b). One of the instructions that may be fetched and executed as part of this cycle is a branch instruction.

State the name of the register that would be altered in the **execute** phase during a branch instruction.

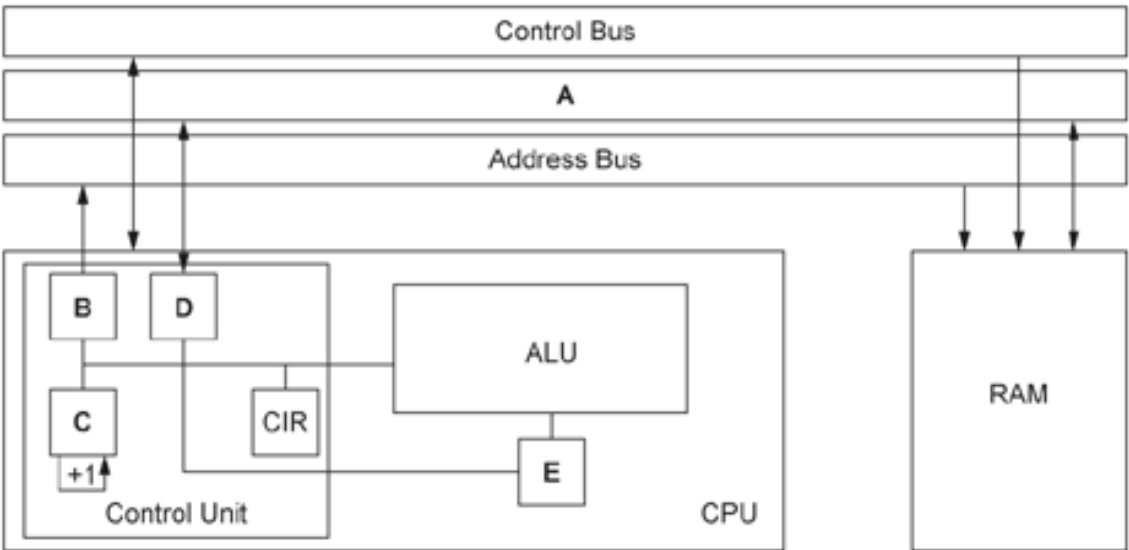
-----[1]

(c). Three ways of improving the performance of a CPU are increasing the clock speed, adding more cores and using pipelining.

Explain how pipelining improves the performance of a CPU.

-----[3]

2. Here is a diagram of a computer system.



Identify each of the labelled components in this computer system.

A	
B	
C	
D	
E	

[5]

3. Most modern computers are designed using Von Neumann Architecture. However, in some cases Harvard Architecture may be preferred.

Discuss the difference between Von Neumann Architecture and Harvard Architecture.

You should refer to the following in your answer:

- the different approaches each architecture takes to storing instructions and data
- the benefits of using a Von Neumann Architecture approach
- the benefits of using a Harvard Architecture approach.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Describe **two** factors that affect the performance of the CPU.

5(a). A charity is concerned that the performance of a computer is not sufficient and wishes to replace the processor.

Give **two** features of a replacement processor that would increase the typical performance of the computer.

1 _____

2 _____

[2]

(b). The processor contains registers including the accumulator and the program counter. The contents of these registers are modified during the Fetch-Decode-Execute cycle.

i. Describe how the accumulator is used during the Fetch-Decode-Execute cycle.

[2]

ii. Describe how the program counter is used during the Fetch-Decode-Execute cycle.

[2]

iii. State the name of **three** other registers that are used during the Fetch-Decode-Execute cycle.

1 _____

2 _____

3 _____

[3]

(c). A charity uses a desktop computer to record financial donations that it receives. The computer contains a single core, 2.4GHz processor with 2MB cache.

A processor uses the Von Neumann architecture.

- i. Describe what is meant by the term 'Von Neumann architecture'.

----- [2]

- ii. Give **one** way that the Harvard architecture differs from the Von Neumann architecture.

----- [1]

6. State why computer systems store data in binary.

----- [1]

7. Different computing devices in Arnold's home use different processor architectures.

One processor architecture is the Harvard architecture.

- i. Describe the Harvard architecture.

----- [2]

- ii. Arnold has a smart washing machine.

Explain why the Harvard architecture is suitable for a device like this.

----- [2]

8. A program written using the Little Man Computer instruction set is shown in **Fig. 1**.

```
      INP
      STA numone
      INP
      STA numtwo
main  LDA numone
      SUB numtwo
      BRP pos
notpos LDA count
      OUT
      LDA numone
      OUT
      HLT
pos   STA numone
      LDA count
      ADD one
      STA count
      BRA main
numone DAT
numtwo DAT
one    DAT 1
count  DAT 0
```

Fig. 1

In Von Neumann Architecture, various registers are used when a program is executed.

- i. State what is meant by the term 'register'.

[2]

- ii. Explain how the accumulator is used when the line `BRP pos` is executed.

[2]

9(a). The CPU uses pipelining to improve efficiency.

Explain what is meant by the term 'pipelining'.

[3]

(b). OCR Insurance uses a computer system to calculate the price that customers pay for car insurance.

The computer system contains a CPU, GPU, RAM and ROM.

i. State **two** factors that affect the performance of a CPU.

1

2

[2]

ii. Explain the difference between RAM and ROM, including how these are used by the computer system.

[4]

- iii. Describe **one** non-graphical use for a GPU.

[2]

10(a). Amy's processor makes use of pipelining during the fetch-decode-execute cycle.

The processor's pipeline consists of the following stages:

- Fetching the instruction from memory
- Decoding the instruction
- Executing the instruction.

Instructions A, B, C and D need to be processed.

Identify the stage(s) and instruction(s) run during each pipeline below.

Pipeline 1

Pipeline 2

Pipeline 3

Pipeline 4

[4]

[2]

[2]

Mnemonic	Instruction
ADD	Add
SUB	Subtract
STA	
LDA	Load
	Branch always
BRZ	
BRP	
INP	Input
OUT	Output
	End program

[5]

[illegible]

[6]

12(a). A company produces CPUs for desktop and laptop computers. Each CPU is designed around the Von Neumann Architecture.

Describe what is meant by the term 'Von Neumann Architecture'.

[2]

(b). A CPU will repeatedly run the Fetch-Decode-Execute-cycle shown in **Fig. 1**.

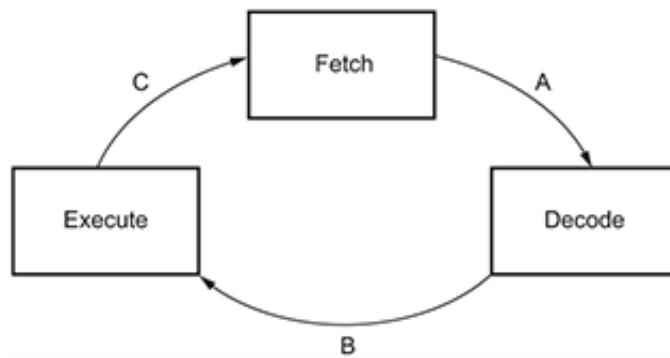


Fig. 1

- i. Describe what happens during the 'Fetch' stage shown in **Fig. 1**.

You should refer to the use of specific registers in your answer.

[4]

- ii. A CPU may need to stop running the Fetch-Decode-Execute-cycle in order to handle an interrupt.

Tick **one** box to indicate where in **Fig. 1** an interrupt would be handled.

A ☐

B ☐

C ☐

[1]

END OF QUESTION PAPER