

6 A computer with a Von Neumann architecture has a central processing unit (CPU).

(a) Complete the statements about the operation of the CPU.

Use the terms from the list. **Not** all terms will need to be used. You should only use each term once.

accumulator	arithmetic logic unit	character set
control unit	current instruction register	cipher decoding set
instruction counter	instruction set	memory address register
memory data register	memory instruction register	next instruction register
program counter	program register	

The stores the address of the next instruction to be fetched. This address is then sent to the

This address is the location in RAM where the instruction can be found. The instruction is retrieved from RAM and immediately stored in the

The instruction is then sent to the where it is
 decoded by the The instruction is decoded using
 an

[6]

(b) Handling interrupts is one function of an operating system.

(i) An interrupt is sent to the CPU every time a key is pressed on the keyboard.

Give the name of this type of interrupt.

..... [1]

(ii) Give the name of the program that services the interrupt.

..... [1]

(iii) Give **one** other function of an operating system.

..... [1]

4 A computer with a Von Neumann architecture has a central processing unit (CPU) that performs the fetch–decode–execute (FDE) cycle.

(a) Complete and annotate the diagram to show how instructions are decoded and executed.



[5]

(b) The CPU is dual core and has a processor speed of 2.4 GHz.

Describe what is meant by a core.

..... [2]

[2]

(c) Explain **two** ways that the performance of the CPU could be increased.

[illegible]

5 A central processing unit (CPU) performs the fetch–decode–execute (FDE) cycle.

(a) Give the name of **two** registers that are used in the fetch stage of the cycle.

1

2

[2]

(b) Describe what happens at the decode stage of the cycle.

.....

.....

.....

.....

.....

..... [3]

(c) Give **one** register in the CPU that is used in the execute stage of the cycle.

..... [1]

(d) Buses are used in the CPU to transmit data through the FDE cycle.

Circle **three** buses that are used in the CPU.

fetch address register execute

data decode calculation

central value binary control

[3]

(e) A user changes their CPU from one with a dual core and a clock speed of 2.4 GHz to one with a dual core and a clock speed of 3.5 GHz.

Explain the effect this change will have on the performance of the CPU.

.....

.....

.....

..... [2]

6 A computer programmer uses assembly language to create a computer program for an embedded system in a washing machine.

(a) State what is meant by an embedded system.

.....

..... [1]

(b) Give the name of the translator that will be used for the program.

..... [1]

(c) The washing machine needs to display error codes on a small screen if there is a problem with the washing machine.

The error codes are stored as binary. The binary numbers are too long to be displayed on the washing machine.

State how the error codes could be reduced in length to be displayed on the screen.

..... [1]

(d) Give **one** benefit to the programmer of using assembly language to write the program.

.....

..... [1]

(e) The programmer uses an integrated development environment (IDE) to write the program.

A built-in translator to convert the program into machine code is one way that the IDE helps the computer programmer.

Describe **three** other ways the IDE can help the programmer.

[6]

6 The table contains names and descriptions of components in a central processing unit (CPU).

Complete the table by giving the missing component names and descriptions.

Component name	Description
.....	sends signals to manage the flow of data through the CPU
program counter	
.....	stores the address of the data that is about to be fetched from random access memory (RAM) into the CPU
.....	transmits data between the RAM and the CPU
accumulator	
.....	stores an instruction when it is being decoded

3 An instruction is fetched from random access memory (RAM) into the memory data register (MDR) to be decoded.

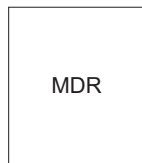
(a) Identify **two** other registers that are used in the fetch stage of the cycle.

1

2

[2]

(b) Complete and annotate the diagram to show how the data is decoded once it has been fetched into the MDR.



[4]

5 Instructions are processed by a central processing unit (CPU) in a computer.

(a) Complete the paragraph about fetching an instruction into the CPU to be processed.

Use the terms from the list.

Some of the terms in the list will **not** be used. You should only use a term once.

address	arithmetic logic unit (ALU)	binary	control unit (CU)
current instruction register (CIR)	data	denary	driver
fetch	interrupt	memory address register (MAR)	
memory data register (MDR)	random access memory (RAM)		
read only memory (ROM)	secondary storage	signal	

The program counter contains the

of the next instruction to be processed; this is then sent to the

..... using the address bus. The address is then

sent to the

Once the address is received, the instruction stored at the location is

sent to the, using the

..... bus. The instruction is then

sent to the that is built into the

.....

[7]

(b) The CPU uses an instruction set to decode the instruction.

State what is meant by an instruction set.

.....

..... [1]

8 A student has a computer that has a central processing unit (CPU).

(a) Describe the role of the CPU in the computer.

.....

.....

.....

..... [2]

(b) The CPU contains registers.

(i) State the purpose of a register.

.....

..... [1]

(ii) Give **three** registers that are built into the CPU.

1

2

3 [3]

(c) One component in the CPU is the arithmetic logic unit (ALU).

Describe the purpose of the ALU.

.....

.....

.....

.....

.....

..... [3]

(d) The student wants to replace the CPU to increase the performance of the computer.

Explain why a different CPU can increase the performance.

.....

.....

.....

.....

.....

.....

..... [4]

2 A computer has a central processing unit (CPU).

The CPU includes the registers:

- Program counter (PC)
- Memory address register (MAR)
- Memory data register (MDR)
- Accumulator (ACC)
- Current instruction register (CIR).

(a) The table contains **five** statements about the role of registers in the fetch–decode–execute cycle of a CPU.

Letter	Statement
A	PC stores the address of the next instruction to be accessed
B	MAR stores the instructions of the program that is running
C	MDR stores the data passed to it from the PC
D	ACC stores the result of each calculation
E	CIR stores the instruction currently being executed

Two of the statements are **not** correct.

Identify the letter of each incorrect statement.

Suggest a corrected statement for each.

Incorrect statement 1

Corrected statement

Incorrect statement 2

Corrected statement

[4]

(b) The computer has a single core 3.5GHz processor and an 8kB cache.

(i) State what is meant by a 3.5GHz processor.

.....
 [1]

(ii) The CPU is changed to a dual-core 3.5GHz processor.

Explain how the number of cores affects the performance of a CPU.

.....

 [2]

(iii) The amount of cache is increased to 64 kB.

Explain how the amount of cache affects the performance of a computer.

.....

 [2]

(c) The computer has both primary and secondary storage.

(i) Random access memory (RAM) is one example of primary storage.

Describe what is meant by RAM.

.....

 [2]

(ii) Read only memory (ROM) is another example of primary storage. ROM often stores the start-up instructions for a computer.

Identify **one** other item of data that is commonly stored in ROM.

.....
 [1]

(iii) Some computers make use of virtual memory.

State the purpose of virtual memory.

.....
 [1]

1 A student uses a computer and several hardware devices to complete his schoolwork.

The computer has a central processing unit (CPU).

(a) The student uses a keyboard to complete his schoolwork.

Tick (✓) **one** box to show which type of device the keyboard is.

- | | | |
|----------|---------|--------------------------|
| A | input | ☐ |
| B | memory | ☐ |
| C | output | ☐ |
| D | storage | ☐ |

[1]

(b) The student uses a printer to print his schoolwork.

Tick (✓) **one** box to show which type of device the printer is.

- | | | |
|----------|---------|--------------------------|
| A | input | ☐ |
| B | memory | ☐ |
| C | output | ☐ |
| D | storage | ☐ |

[1]

(c) A component in the CPU sends signals to manage the fetch-decode-execute cycle.

State the name of this component.

..... [1]

(d) The CPU has a clock speed of 2.4 Ghz.

Describe what is meant by a 2.4 Ghz clock speed.

.....

 [2]

(e) The CPU contains registers including the memory data register (MDR).

(i) Describe the role of the MDR in the fetch-decode-execute cycle.

.....

 [2]

(ii) Identify **three** other registers contained in the CPU.

1
 2
 3 [3]

3 A user's computer has a central processing unit (CPU) that has a clock speed of 2 GHz.

She wants to change it to a CPU that has a clock speed of 3 GHz.

(a) (i) State what is meant by clock speed.

.....
 [1]

(ii) Explain the effect this change will have on the performance of the CPU.

.....

 [2]

(b) The CPU contains a memory address register (MAR).

Describe the role of the MAR in the fetch–decode–execute cycle.

.....

 [2]

(c) The CPU has a list of all the machine code commands it can process.

State the name of this list of commands.

..... [1]

4 A washing machine is an example of an embedded system.

(a) Give **two** characteristics of an embedded system.

1

 2
 [2]

(b) Circle **three** other examples of an embedded system.

	freezer	laptop	
personal computer (PC)	security light system	smartphone	
vending machine	web server		

[3]