Von Neumann architecture 1

Practice 1

The term **Von Neumann architecture** is used to refer to any computer system where an operation to fetch an instruction and an operation to fetch data cannot occur at the same time because they share a common bus.

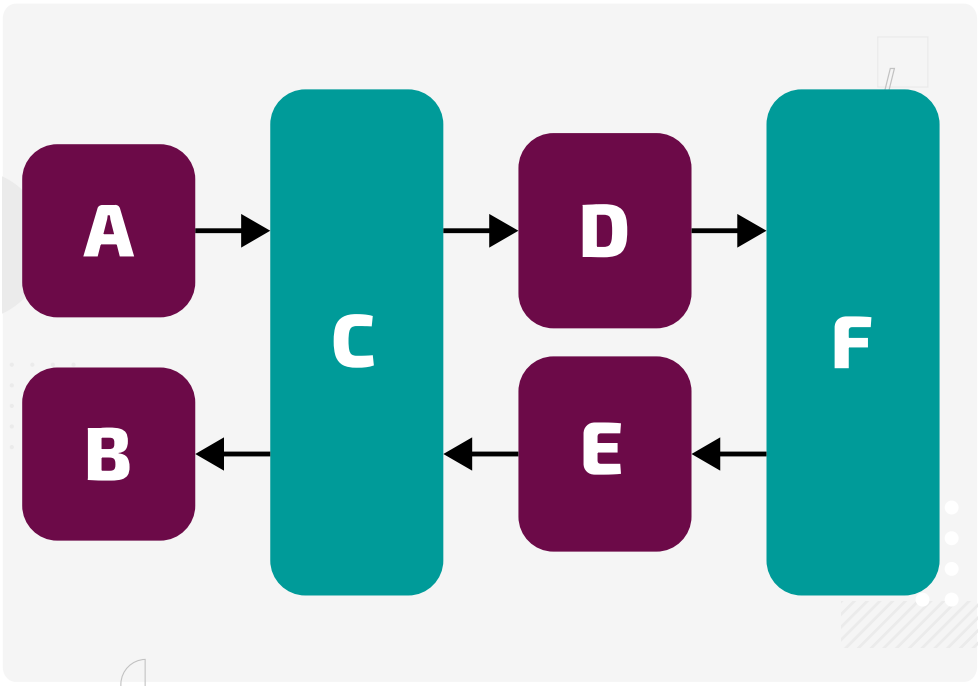
Which **five** statements relate to the architecture of a von Neumann machine?

- [ ] Registers are used to minimise the number of times that main memory needs to be acessed.
- [ ] The accumulator is a data register that is used to store the results of calculations.
- [ ] The program counter holds the memory address of the instruction that needs to be fetched next.
- [ ] The memory address register holds the address in main memory that is currently being read from or written to.
- [ ] Instructions and data are held in separate units of main memory.
- [ ] The memory data (buffer) register holds data fetched from memory or data waiting to be stored in memory.

Identify the machine architecture

Challenge 1

The following diagram represents a well known computer architecture. The labels have not yet been added to identify the components, along with the label of the architecture itself. Identify the architecture and select the correct labels to complete the diagram.



G

G	Harvard architecture
A	Input devices
B	Output devices
C	Processor
D	Instruction memory
E	Data memory
F	Secondary Storage

G	Von Neumann architecture
A	Input devices
B	Output devices
C	Processor

G	Von Neumann architecture
D	Instruction memory
E	Data memory
F	Secondary Storage

G	Harvard architecture
A	Output devices
B	Input devices
C	Processor
D	Instruction memory
E	Data memory
F	Secondary Storage

G	Von Neumann architecture
A	Input devices
B	Output devices
C	Processor
D	Instruction memory
E	Data memory
F	Address bus

Quiz:
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Arithmetic logic unit (ALU) operations

Practice 2

LLM marked question

The Arithmetic Logic Unit (ALU) is a crucial component within a computer's processor. The ALU can carry out several different types of operation, such as arithmetic operations.

State one other operation that an ALU carries out and provide an example of how that operation is used. **[2 marks]**

Quiz:
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Registers

Practice 1

Every processor has a set of registers. Some of them are general purpose registers and others have a specific purpose. From the following list, match each description to the appropriate register.

Register	Description
	Holds the address of the next instruction to be executed by the processor
	Holds the instruction that the processor is currently executing
	Holds the address of the memory location (in main memory) that the processor needs to access, either to read from (i.e., load data) or write (i.e., store data) to
	Holds the data (data values or instructions) that are read from or written to the main memory
	Holds the immediate result of an instruction executed by the ALU
	Holds information about the result of the last instruction that the ALU executed

Items:

PC CIR SR MBR (MDR) MAR ACC

Quiz:
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Breakdown of a URL

Challenge 1

A URL contains lots of information. Consider this URL:

```
https://mail.google.com/mail/u/0/#inbox
```

Three facts in the list below can be determined by studying the URL. Select the three that are correct.

- [ ] **google.com** is a fully qualified domain name
- [ ] The request will use server port 143
- [ ] The TLD is **com**
- [ ] **mail** is a subdomain
- [ ] The data exchanged between client and server will be encrypted

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Quiz:
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Domain name server hierarchy

Practice 2

The domain name system is used to convert user-friendly domain names into IP addresses. The mapping from a specific domain name to a specific IP address is stored on an **authoritative name server**. This information is maintained by the person or organisation who manages the domain name.

When a domain name look-up is performed, many servers in the domain name server hierarchy may be used. Put the following steps into order so they correctly describe the look-up sequence.

Available items

- The TLD name server is contacted and returns the details of the authoritative name server.
- The authoritative name server is queried and returns the IP address.
- Otherwise, a root server is contacted and returns the details of the top level domain (TLD) name server.
- If the recursive DNS resolver has the relevant IP address, it is returned to the client.
- A server known as a recursive DNS resolver (or caching server) is contacted.

Quiz:
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Complete truth table for logic circuit 1

Practice 2

Study the logic circuit shown in **Figure 1** and the truth table below.

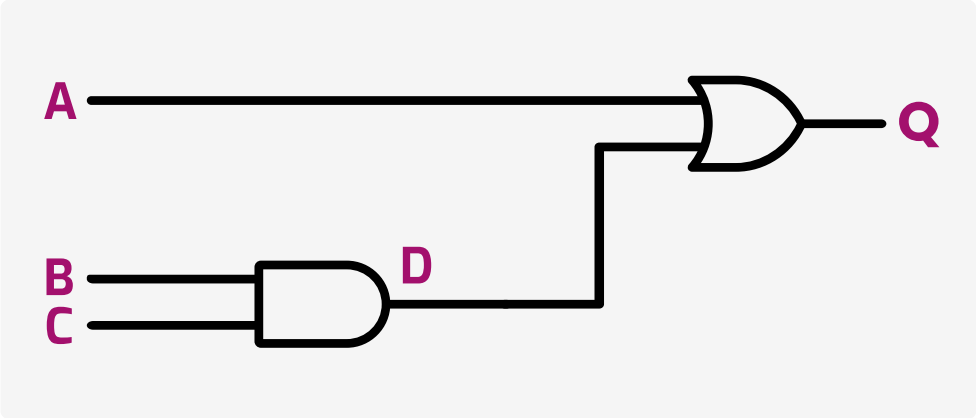

Figure 1: A circuit diagram

Complete the truth table for the logic circuit diagram in **Figure 1**. The column **D** represents the output of the logic gate with inputs B and C. The final output is in column **Q**.

A	B	C	D	Q
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Quiz:

Complete truth table of expression 1

Practice 2

A truth table can be used to check the logic of a Boolean expression. Consider the following expression:

$Q = \neg A \vee B$

Complete the truth table for the Boolean expression above. Each part of the expression has been entered as a separate column heading after the inputs. The final output is in column **Q**.

Inputs			Output Q
A	**B**	$\neg A$	$\neg A \vee B$
0	0		
0	1		
1	0		
1	1		

Quiz:
STEM SMART 2025 Residential Catch Up Quiz 1 - Theory

Whole numbers: addition 1

Practice 1

What is the result of adding 111110_2 and 10101_2?

Both values are **whole numbers** (unsigned binary integers). Express your answer as 8-bit whole number in binary.

Quiz:
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Two's complement: range 2

Practice 2

Part A

What is the largest **positive** denary value that can be stored using 16 bits if the number is represented in **two's complement**?

Part B

What is the smallest **negative** denary value that can be stored using 16 bits if the number is represented in **two's complement**?