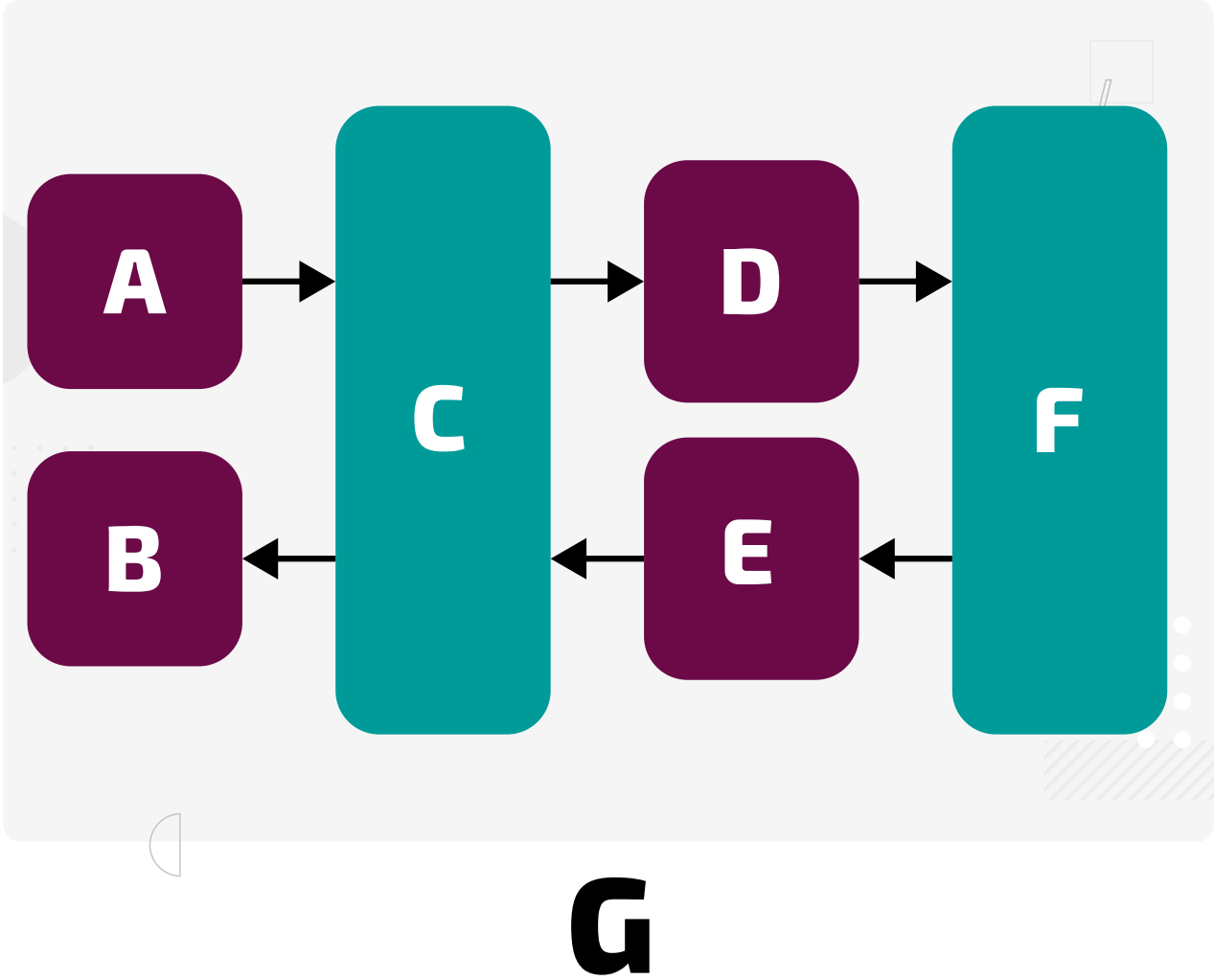# Identify the machine architecture

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

G	Von Neumann architecture
C	Processor
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

Special purpose registers

GCSE   N5

Which sentence below best describes dedicated (special-purpose) registers?

◯ Registers that have a specific role in the fetch-execute cycle.

◯ Registers that is defined in software and can be customised by the user.

◯ Registers that are used to store the results of intermediate calculations.

◯ Registers that hold memory addresses.

Von Neumann architecture 3

A Level

P P

John von Neumann proposed a general purpose computer that is sometimes referred to as the "three box model". Which of the following statements provides a correct definition of a von Neumann machine?

○ A processor, main memory, and secondary storage linked by a system bus

○ A processor, main memory, and I/O controllers linked by a system bus

○ A processor, cache, and main memory linked by a system bus

○ A processor, clock, and main memory linked by a system bus

Truth table for logic circuit 1

GCSE A Level
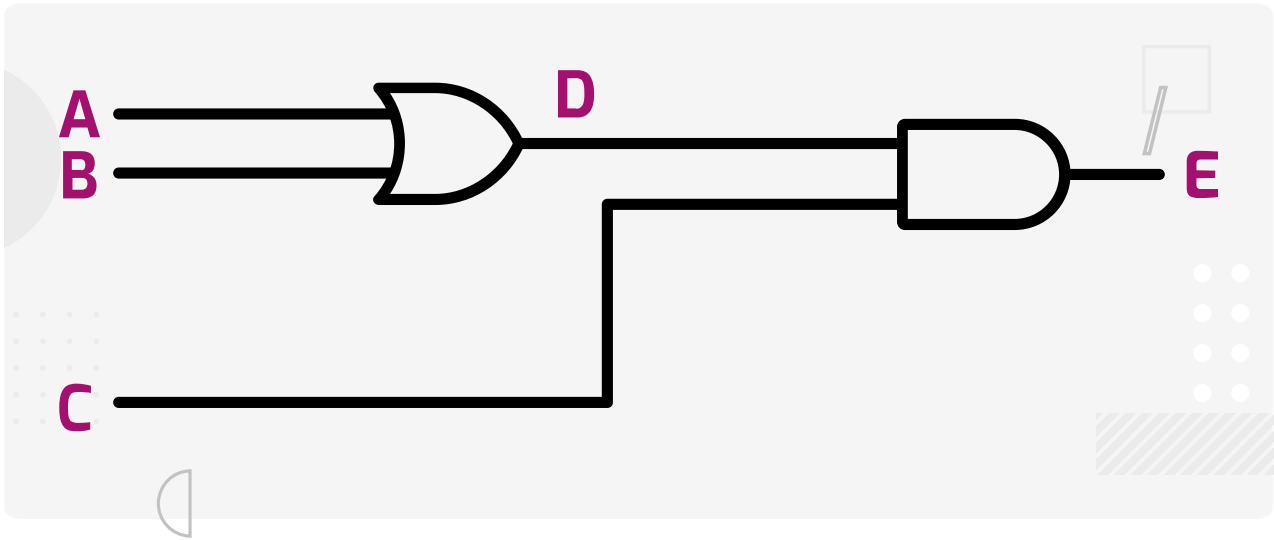
Circuit diagram

Fill in the missing values **(a)**, **(b)**, and **(c)** in the truth table for the logic circuit diagram below, given the following inputs:

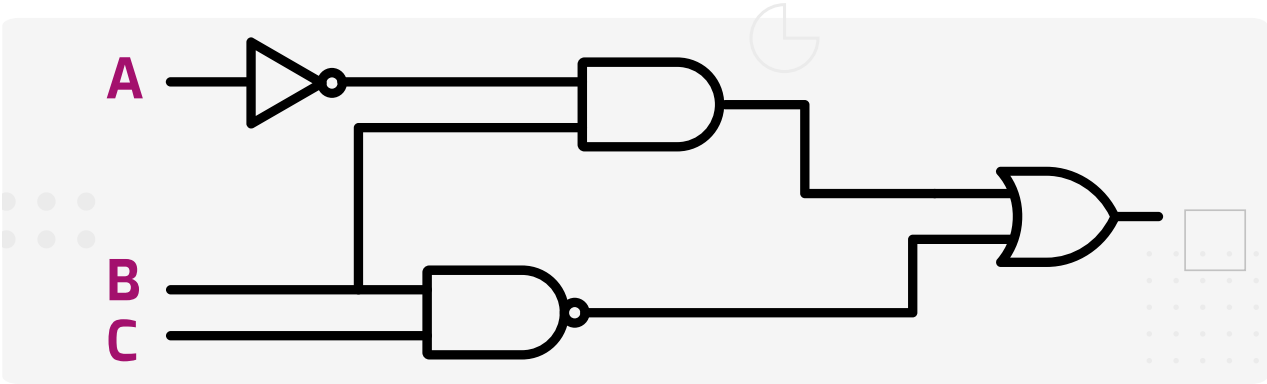| A	B	C	D	E
0	0	0	0	0
0	0	1	0	0
0	1	0	1	0
0	1	1	1	1
1	0	0		0
1	0	1	1	1
1	1	0		
1	1	1	1	1

Items:

0 1

Expression for logic circuit 1

A Level

C C

Construct the correct Boolean expression for this circuit diagram:

A circuit diagram

The following symbols may be useful: `A, B, C`

Expression for problem 2

C C

A library system needs to indicate if a user is allowed to borrow a book. The decision is based on several criteria.

- No one can borrow a book if they have an unpaid fine on their account.
- The maximum number of books a user can borrow is six unless they are an A level student or they have been waiting for the book for more than four weeks.

The following inputs represent the listed conditions:

```
D - TRUE if there is an unpaid fine on the account

M - TRUE if the account has 6 or more books on loan

S - TRUE if the account belongs to an A level student

W - TRUE if the book was requested more than 4 weeks ago
```

The output B will be TRUE if the student is allowed to borrow the book.

Choose the correct Boolean expression to match the logic of the problem statement.

- ○ $B = \neg D \land (W \lor S \lor M)$

- ○ $B = \neg D \land (W \lor S \lor \neg M)$

- ○ $B = \neg D \lor (W \lor S \lor \neg M)$

- ○ $B = \neg D \lor (W \lor S \lor M)$

Two's complement: smallest to largest
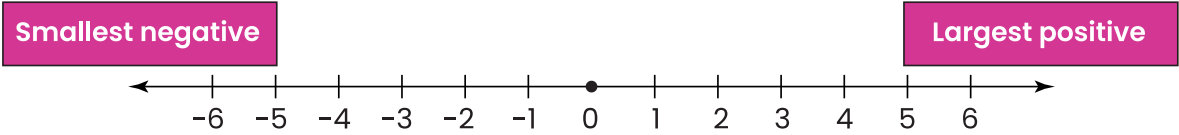
GCSE A Level Higher

(P) (P) (P) (P) (P) (P)

The integers shown below are represented using **two's complement**.

The smallest number is defined as the **negative number that is furthest away from 0** on the number line, and the largest number is defined as the **positive number that is furthest away from 0** on the number line.

A number line

Put the following two's complement numbers into order from **smallest** to **largest**. The smallest number should appear at the top of the list and the largest number at the bottom of the list.

Available items

11111111

01111111

01001110

11001110

10000000

Absolute and relative error 1

A Level

C C

Assume that the **absolute error** of the representation of the below **binary numbers** is 1_{10}.

Calculate the **relative error** for each of the binary numbers. Then, put the **binary numbers** in order, starting from the number with the **lowest relative error** to the one with the **highest relative error**.

You can calculate the **percentage of the relative error** to help you compare the numbers.

Available items

0.11
100000
0110
01111111100

Whole numbers: addition 1

GCSE A Level

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.

IP addresses 3

GCSE A Level

Select the **two** statements about IP addresses which are correct.

- [ ] Every device connected to the internet has an IP address

- [ ] IP addresses are assigned to a device by the manufacturer and can't easily be changed

- [ ] An example of an IP address is `192.168.4.23`

- [ ] Mobile phones do not have IP addresses