1 **(a)** Draw **one** line from each vector graphic term to its most appropriate description.

Term	Description
drawing list	a component created using a formula
drawing object	defines one characteristic of a component
property	data required to create all components in the graphic

[2]

(b) State what is meant by the **bit depth** of a bitmap image **and** explain how changing the bit depth affects the image.

Definition .....

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Explanation .....

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[3]

(c) Explain why a bitmap image is often compressed before it is attached to an email.

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..... [2]

2 A school has a Local Area Network (LAN).

(a) The LAN connects to the internet using a router.

Describe the function of a router in a network.

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..... [3]

(b) Complete the following table by writing the purpose of each of these other hardware devices used to support the LAN.

Hardware device	Purpose
switch	....
Wireless Access Point (WAP)	....
bridge	....

[3]

(c) The students can save their school files on a public cloud.

Identify **two** drawbacks of the students storing their files on the public cloud.

1 .....

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2 .....

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[2]

(d) A new classroom is being set up with 20 computers and a switch.

Explain **one** advantage of implementing a star topology instead of a bus topology in the new classroom.

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..... [2]

3 A shop manager has designed a relational database to store customer orders.

The database will have the following tables:

CUSTOMER(CustomerID, FirstName, LastName, Town)

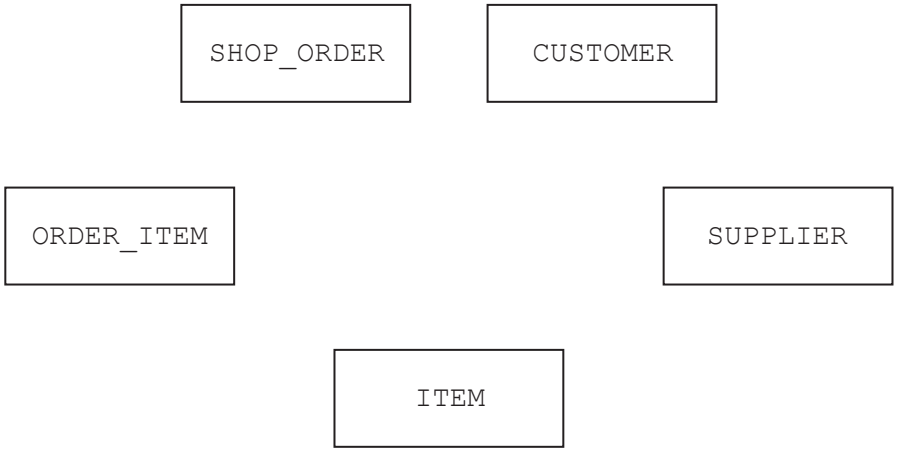
SHOP_ORDER(OrderNo, CustomerID, OrderDate)

SUPPLIER(SupplierID, EmailAddress, TelephoneNumber)

ITEM(ItemNumber, SupplierID, Description, Price)

ORDER_ITEM(ItemNumber, OrderNo, Quantity)

(a) Complete the entity-relationship (E-R) diagram for the relational database.



[3]

(b) Identify **three** advantages of a relational database compared to a file-based approach.

1 .....

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2 .....

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3 .....

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[3]

(c) **(i)** Write a Structured Query Language (SQL) script to define the database called `SHOP`.

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..... [1]

(ii) Write the SQL script to return the total quantity of items that the customer with the ID of HJ231 has ordered.

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..... [4]

4 **(a)** Complete the truth table for the logic expression:

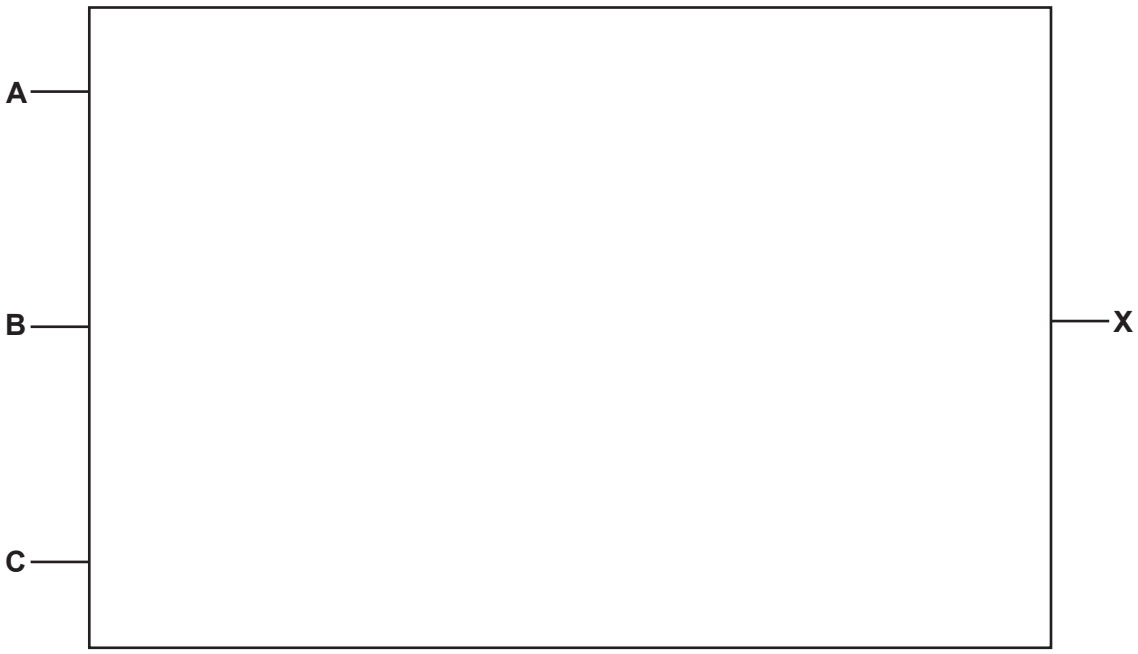
X = NOT (**A** NAND **B**) XOR (NOT **B** AND (**B** NOR **C**))

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(b) Draw a logic circuit for the logic expression:

X = (**A** AND NOT (**B** OR **C**)) AND (**B** NOR **C**)



[2]

5 The Central Processing Unit (CPU) of the basic Von Neumann model for a computer system contains several special purpose registers.

(a) The Memory Data Register (MDR), Index Register (IX) and the Accumulator (ACC) are examples of special purpose registers.

Identify **two other** special purpose registers **and** state their role in the CPU.

Special purpose register 1 .....

Role .....

.....

.....

Special purpose register 2 .....

Role .....

.....

.....

[4]

(b) Describe what is meant by the **Immediate Access Store (IAS)** in a computer system.

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..... [2]

(c) A computer has a single 2.1 GHz CPU.

(i) Describe how increasing the clock speed to 4 GHz can increase the performance of the computer.

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..... [1]

(ii) A second computer has a CPU with two 2.1 GHz cores.

Explain why the second computer does not always run twice as fast as the computer with one 2.1 GHz CPU.

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..... [5]

6 A programmer uses both a compiler and an interpreter to translate a program written in a high-level language.

(a) Describe the advantages of using the interpreter compared to the compiler to translate the program.

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..... [4]

(b) State **one** reason why some high-level languages are partially compiled and partially interpreted.

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..... [1]

(c) **(i)** Identify **two** features that support the visual presentation of the code in a typical Integrated Development Environment (IDE).

1 .....

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2 .....

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[2]

(ii) Identify **two** features that support the debugging of the code in a typical IDE.

1 .....

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2 .....

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[2]

7 **(a)** Describe the principal operations of a 3D printer.

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..... [3]

(b) Describe the purpose of a temperature sensor within the 3D printer.

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..... [2]

(c) A 3D printer contains 1 GB of Dynamic RAM (DRAM) to store print data.

State **two** advantages of the printer having Dynamic RAM instead of Static RAM (SRAM).

1 .....

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2 .....

.....

[2]

8 **(a)** Identify the purpose of the first pass of a two-pass assembler.

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..... [1]

(b) The following table shows part of the instruction set for a processor. The processor has two registers, the Accumulator (ACC) and the Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	#n	Compare the contents of ACC with number n
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
OUT		Output to the screen the character whose ASCII value is stored in ACC
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

(i) Give **one** example of an instruction that belongs to **each** of the following instruction groups.

Only use the instructions given in the table. Each instruction must have a suitable operand.

Data movement .....

Arithmetic operation .....

Conditional instruction .....

[3]

(ii) The instruction `LDR #2` uses immediate addressing.

Give **one** similarity and **one** difference between direct addressing and indexed addressing.

Similarity .....

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Difference .....

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[2]

(iii) Identify **one other** mode of addressing.

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..... [1]

(c) The following table shows another part of the instruction set for the same processor.

Instruction		Explanation
Opcode	**Operand**	
AND	Bn	Bitwise AND operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the operand
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
# denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(i) The current contents of the ACC are:

0	1	0	0	1	1	1	1

Show the contents of the ACC after the execution of the following instruction.

```
AND B10100101
```

.....

.....

[1]

(ii) The current contents of the ACC are:

0	0	0	1	0	1	1	1

Show the contents of the ACC after the execution of the following instruction.

```
LSR #3
```

.....

.....

[1]

(iii) The current contents of the ACC are:

1	1	1	1	0	1	1	1

Show the contents of the ACC after the execution of the following instruction.

```
XOR B00100101
```

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[1]

9 **(a)** Explain the importance of feedback in a control system.

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..... [2]

(b) Give **one** example of an embedded system **and** explain why it is an example of an embedded system.

Example .....

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Explanation .....

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[3]