1 Raj owns houses that other people rent from him. He has a database that stores details about the people who rent houses, and the houses they rent. The database, HOUSE_RENTALS, has the following structure:

CUSTOMER(CustomerID, FirstName, LastName, DateOfBirth, Email)

HOUSE(HouseID, HouseNumber, Road, Town, Bedrooms, Bathrooms)

RENTAL(RentalID, CustomerID, HouseID, MonthlyCost, DepositPaid)

(a) Give the definition of the following database terms, using an example from the database HOUSE_RENTALS for each definition.

Term	Definition and example
Field	....
Entity	....
Foreign key	....

[6]

(b) Tick (✓) **one** box to identify whether the database HOUSE_RENTALS is in Third Normal Form (3NF) or not in 3NF.
Justify your choice using one or more examples from the database HOUSE_RENTALS.

In 3NF	
Not in 3NF	

Justification .....

.....

.....

..... [2]

(c) Example data from the table `RENTAL` are given:

RentalID	CustomerID	HouseID	MonthlyCost	DepositPaid
1	22	15B5L	1000.00	Yes
2	13	3F	687.00	No
3	1	12AB	550.00	Yes
4	3	37	444.50	Yes

(i) Complete the following Data Definition Language (DDL) statement to define the table `RENTAL`.

```
CREATE ..... ..... (
      RentalID INTEGER NOT NULL,
      CustomerID INTEGER NOT NULL,
      HouseID ..... (5) NOT NULL,
      MonthlyCost ..... NOT NULL,
      DepositPaid BOOLEAN NOT NULL,
      ..... (RentalID)
);
```

[4]

(ii) Write a Data Manipulation Language (DML) script to return the first name and last name of all customers who have **not** paid their deposit.

.....

.....

.....

.....

.....

..... [4]

2 Aisha manages a team of software developers.

(a) Explain the reasons why it is important that Aisha acts ethically in relation to her team members.

.....

.....

.....

..... [2]

(b) The team are developing a computer game where the user plays a board game (such as chess) against the computer.

Describe how the computer would use Artificial Intelligence (AI) to play the board game.

.....

.....

.....

.....

.....

..... [3]

(c) The final game will be released under a licence.

Tick (✓) **one or more** boxes in each row to identify the licence(s) each statement describes.

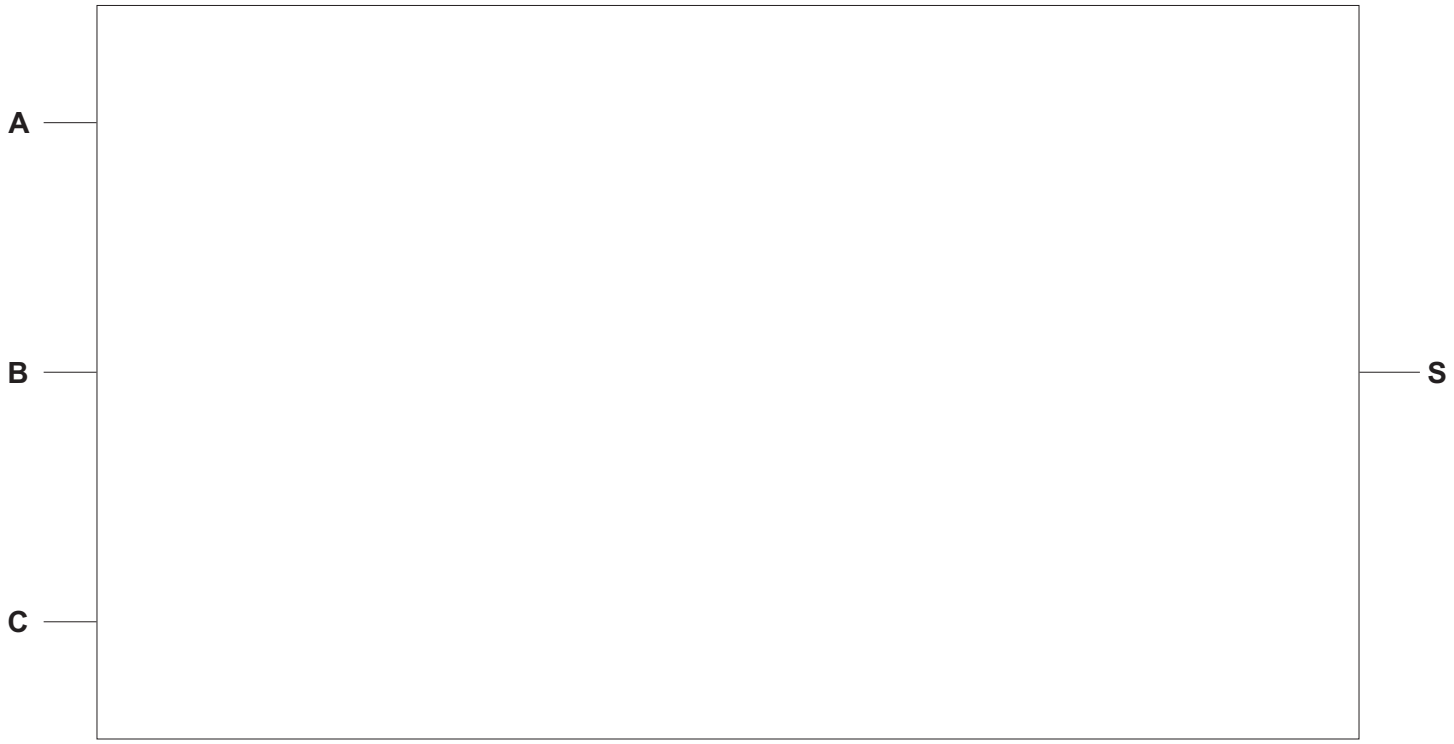
Statement	Free Software Foundation	Open Source Initiative	Shareware	Commercial Software
The user can edit the source code				
The user **must** always pay before being able to use the software				
The user can redistribute the software				
The user always gets a trial period				

[4]

3 A logic expression is given:

S = (**A** AND **B** AND **C**) OR (**B** XOR **C**)

(a) Draw the logic circuit for the given expression.



[4]

(b) Complete the truth table for the logic expression:

S = (**A** AND **B** AND **C**) OR (**B** XOR **C**)

A	B	C	Working space	S
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]

4 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
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)
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
# denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are:

Address	Instruction
70	IN
71	CMP 100
72	JPE 80
73	CMP 101
74	JPE 76
75	JMP 80
76	LDD 102
77	INC ACC
78	STO 102
79	JMP 70
80	LDD 102
81	DEC ACC
82	STO 102
83	JMP 70
...	
100	68
101	65
102	100

ASCII code table (selected codes only)

ASCII code	Character
65	A
66	B
67	C
68	D

(a) Complete the trace table for the program currently in main memory when the following characters are input:

```
A D
```

Do not trace the program any further when the third input is required.

Instruction address	ACC	Memory address		
		100	101	102
		68	65	100

[4]

(b) Some bit manipulation instructions are shown in the table:

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The contents of the memory address 300 are shown:

Bit Number	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
300	0	1	1	0	0	1	1	0

(i) The contents of memory address 300 represent an unsigned binary integer.

Write the denary value of the unsigned binary integer in memory address 300.

..... [1]

(ii) An assembly language program needs to test if bit number 2 in memory address 300 is a 1.

Complete the assembly language instruction to perform this test.

..... #4

[1]

(iii) An assembly language program needs to set bit numbers 4, 5, 6 and 7 to 0, but keep bits 0 to 3 with their existing values.

Write the assembly language instruction to perform this action.

.....

..... [2]

5 Seth uses a computer for work.

(a) Complete the following descriptions of internal components of a computer by writing the missing terms.

The ..... transmits the signals to coordinate events based on the electronic pulses of the ..... .

The ..... carries data to the components, while the ..... carries the address where data needs to be written to or read from.

The ..... performs mathematical operations and logical comparisons.

[5]

(b) Describe the ways in which the following factors can affect the performance of his laptop computer.

Number of cores

.....

.....

.....

.....

Clock speed

.....

.....

.....

.....

[4]

(c) Seth accesses both software and data using cloud computing.

(i) Give **two** benefits of storing data using cloud computing.

1 .....

.....

2 .....

.....

[2]

(ii) Give **two** drawbacks of Seth using cloud computing.

1 .....

.....

2 .....

.....

[2]

(d) Draw **one** line from each term to its **most appropriate** description.

Term	Description
Public IP address	It is only visible to devices within the Local Area Network (LAN)
Private IP address	It increments by 1 each time the device connects to the internet
Dynamic IP address	A new one is reallocated each time a device connects to the internet
Static IP address	It can only be allocated to a router
	It is visible to any device on the internet
	It does not change each time a device connects to the internet

[4]

6 A computer uses the ASCII character set.

(a) State the number of characters that can be represented by the ASCII character set and the extended ASCII character set.

ASCII .....

Extended ASCII .....

[2]

(b) Explain how a word such as 'HOUSE' is represented by the ASCII character set.

.....

.....

.....

..... [2]

(c) Unicode is a different character set.

The Unicode value for the character '1' is denary value 49.

(i) Write the hexadecimal value for the Unicode character '1'.

..... [1]

(ii) Write the denary value for the Unicode character '5'.

..... [1]

7 Jennifer is writing a computer program for her A Level homework.

(a) Jennifer uses a program library to help her write her computer program.

Describe how a program library can be used while writing a computer program.

.....

.....

.....

..... [2]

(b) Jennifer uses an Integrated Development Environment (IDE) to write her computer program.

(i) The IDE allows Jennifer to use both an interpreter and a compiler while creating her computer program.

Describe the ways in which Jennifer can use **both** a compiler **and** an interpreter while developing the program.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) Identify **two** debugging tools that a typical IDE can provide.

1 .....

.....

2 .....

.....

[2]

8 A company has several security measures in place to prevent unauthorised access to the data on its computers.

(a) Describe the difference between the security and privacy of data.

.....

.....

.....

..... [2]

(b) Each employee has a username and password to allow them to log onto a computer. An employee's access rights to the data on the computers is set to either read-only, or read and write.

Identify **one** other software-based measure that could be used to restrict the access to the data on the computers.

.....

..... [1]

(c) The company is also concerned about threats posed by networks and the internet.

Identify **two** threats to the data that are posed by networks and the internet.

Threat 1 .....

.....

Threat 2 .....

.....

[2]