1 Text and numbers are examples of data stored in a computer.

(a) A character set is used to represent characters in a computer.

(i) Describe what is meant by a **character set**.

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..... [2]

(ii) Identify **two** character sets and state **one** difference between them.

Character set 1 .....

Character set 2 .....

Difference .....

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[3]

(iii) Describe how lossless compression can be used to reduce the file size of a text file.

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(iv) Explain why lossy compression should **not** be used on a text file.

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..... [2]

(b) A computer can represent numerical data in different forms.

Complete the table by writing the answer to each statement.

Statement	Answer
The hexadecimal value 11 represented in denary	
The smallest denary number that can be represented by an unsigned 8-bit binary integer	
The denary number 87 represented in Binary Coded Decimal (BCD)	
The denary number 240 represented in hexadecimal	
The denary number –20 represented in 8-bit two's complement binary	

[5]

Working space

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2 **(a)** The Fetch-Execute (F-E) cycle is represented in register transfer notation.

Describe each of the given steps.

Step	Description
PC ← [PC] + 1	....
MDR ← [[MAR]]	....
MAR ← [PC]	....

[3]

(b) Explain how interrupts are handled during the F-E cycle.

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..... [5]

3 **(a)** The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

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
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

The current contents of main memory are:

Address	
100	101
101	67
102	104
103	100
104	68

Complete the table by writing the value stored in the accumulator after the execution of each instruction.

Instruction	Accumulator
LDM #103	
LDD 102	
LDI 103	

[3]

(b) The instructions in **part (a)** are examples of the data movement group.

Describe **two other** instruction groups.

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2 .....

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[4]

(c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

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
OR	Bn	Bitwise OR operation of the contents of ACC with the operand
B denotes a binary number, e.g. B01001010		

The binary value `00111101` is stored in the memory address 200.

Each instruction in the diagram is performed on the data in memory address 200.

Draw **one** line from each instruction to its correct result.

Instruction	**Result**
	01111101
XOR B11110000	00111101
OR B01010101	11111111
AND B11111111	11000010
	11001101

[3]

4 A computer has system software including an operating system.

(a) Describe the key management tasks of an operating system.

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..... [4]

(b) Utility software is a type of system software.

(i) Describe the purpose of back-up software and defragmentation software.

Back-up software .....

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Defragmentation software .....

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[4]

(ii) Give **one other** example of utility software.

..... [1]

5 A company wants to store data about its employees in a computer system. The owner of the company wants to ensure the security and integrity of the data.

(a) (i) State why data needs to be kept secure.

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..... [1]

(ii) One way the data stored in a computer can be kept secure is by using back-up software.

Give **two other** ways the data stored in a computer can be kept secure.

1 .....

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2 .....

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[2]

(b) The data about the employees is currently stored on paper. The data needs to be transferred into the computer system.

Data validation and verification are used to help maintain the integrity of the data.

(i) Identify **and** describe **one** method of data verification that can be used when transferring the data from paper to the computer.

Method .....

Description .....

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[2]

(ii) The company needs to transfer the date of birth of each employee into the computer system.

Give **one** example of how each of the following data validation rules can be used to validate the date of birth when it is entered into the system.

Range check .....

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Presence check .....

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Length check .....

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[3]

(iii) Explain why the data in the system may **not** be correct even after validating and verifying the data.

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..... [2]

6 A relational database, TECHNOLOGY, stores data about the staff in a company and the computer devices used by the staff.

The database has the following tables:

STAFF(StaffID, FirstName, LastName, DateOfBirth, JobTitle)

DEVICE(DeviceID, Type, DatePurchased, StaffID)

(a) Describe the relationship between the two tables. Refer to the primary and foreign keys in your answer.

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..... [4]

(b) The database uses a Data Definition Language (DDL) and Data Manipulation Language (DML).

(i) Complete the SQL script to return the number of devices stored in the database for the staff member with the first name 'Ali' and last name 'Khan'.

```
SELECT ..... (STAFF.StaffID)

FROM .....

INNER JOIN DEVICE

..... STAFF.StaffID = DEVICE.StaffID

WHERE STAFF.FirstName = 'Ali'

..... STAFF.LastName = 'Khan';
```

[4]

(ii) The table `DEVICE` needs a new attribute to store whether the device has been returned by the staff member, or not.

Write a Structured Query Language (SQL) script to insert the new attribute into the table `DEVICE`.

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..... [2]

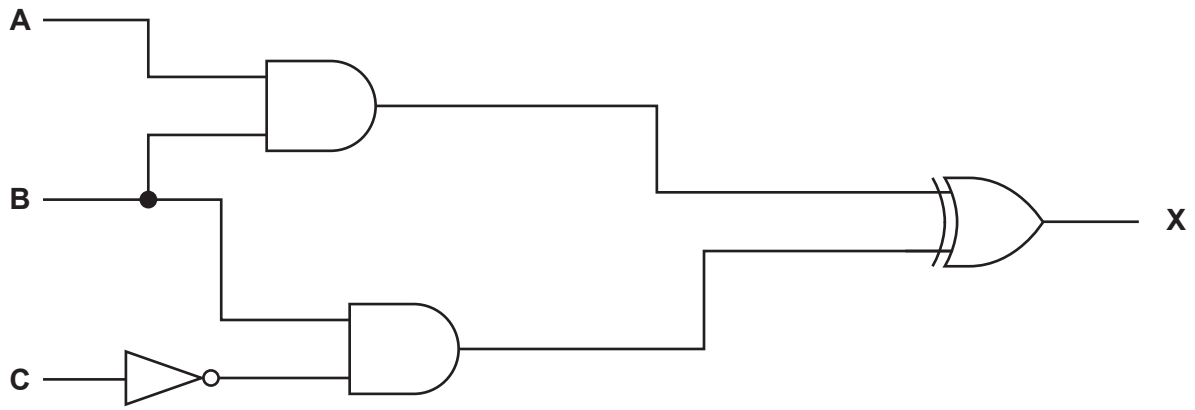
(c) The database is in Third Normal Form (3NF).

Complete the table by describing the three normal forms.

Normal Form	Description
First Normal Form (1NF)	....
Second Normal Form (2NF)	....
Third Normal Form (3NF)	....

[3]

7 **(a)** Write the logic expression for the following logic circuit.



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..... [3]

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

X = (**A** NAND **B**) OR (**A** AND NOT **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]

8 A company uses cloud computing.

(a) Define cloud computing.

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..... [1]

(b) State what is meant by a public cloud and a private cloud.

Public cloud .....

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Private cloud .....

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[2]

(c) Give **two** benefits and **one** drawback of using cloud computing.

Benefit 1 .....

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Benefit 2 .....

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Drawback .....

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[3]