1 A factory makes chocolate bars.

The factory uses a conveyor belt that moves the products from one stage of production to the next stage.

(a) An automated system counts the number of chocolate bars made at the end of production.

The system includes a sensor positioned above the conveyor belt.

Identify **one** appropriate type of sensor that can be used.

..... [1]

(b) A second automated system removes chocolate bars with an incorrect weight from the production line.

Describe the role of an **actuator** in this second system.

.....

.....

.....

..... [2]

(c) The factory has many different machines with embedded systems.

(i) Identify **two** features of embedded systems.

1 .....

.....

2 .....

.....

[2]

(ii) Identify **one** drawback of embedded systems.

.....

..... [1]

2 **(a)** State what is meant by the following terms in a relational database model.

Entity .....

.....

.....

Primary key .....

.....

.....

Referential integrity .....

.....

.....
[3]

(b) Authentication is one method a Database Management System (DBMS) can use to improve the security of a database.

Describe **other** methods that a DBMS can use to improve the security of a database.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) The following database table is not normalised.

StudentName	DateOfBirth	TutorGroup	Subject	SubjectCode
Yuwei Chen	01/09/2004	SMH	English, Maths, Computer Science	EN, MA, CS
Claudia Raj	23/02/2005	JMB	Maths, Physics, Art	MA, PY, AR
Aamil Akram	24/01/2005	KMB	Art, Design, English language	AR, DE, EN
Areeba Faraz	21/12/2004	SMH	English language, Chemistry, Design	EN, CH, DE

Explain how to modify the table to put it into First Normal Form (1NF).

.....

.....

.....

.....

.....

.....

.....

..... [4]

3 **(a)** State **one** difference between a kibibyte and a megabyte.

.....

..... [1]

(b) **(i)** Convert the denary value into a 12-bit two's complement binary integer.

−196

Answer ..... [1]

(ii) Convert the Binary Coded Decimal (BCD) into denary.

100001100101

Answer ..... [1]

(iii) Convert the unsigned binary integer into denary.

000111010110

Answer ..... [1]

(c) Identify **one** practical application of BCD **and** justify why BCD is used in this application.

Application .....

.....

Justification .....

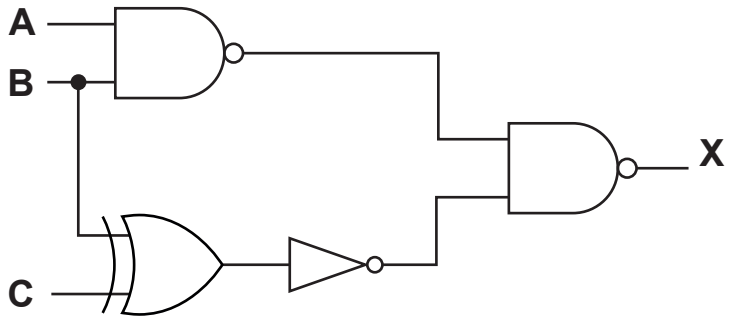
.....

.....

.....

[2]

4 **(a)** Write the Boolean expression that corresponds to the following logic circuit.



.....

..... [3]

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

X = **A** XOR (**B** AND (**A** NAND **B**) 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]

5 **(a)** State the meaning of **privacy of data**.

.....

..... [1]

(b) State the meaning of **integrity of data**.

.....

..... [1]

(c) Describe the following threats to a computer system.

Phishing email .....

.....

.....

.....

Spyware .....

.....

.....

.....

[4]

6 **(a)** A real-time video of a music concert needs to be streamed to subscribers.

Tick (✓) **one** box to identify the most appropriate type of compression **and** justify your answer.

Lossy	Lossless

Justification .....

.....

.....

.....

.....

..... [3]

(b) Explain the impact of changing the sampling resolution on the accuracy of a sound recording.

.....

.....

.....

.....

.....

..... [3]

(c) A bitmap image has a resolution of 2048 pixels wide and 1024 pixels high.

The image has a bit depth of 10 bits per pixel.

Estimate the file size of the bitmap image in mebibytes. Show your working.

Working .....

.....

.....

.....

.....

.....

Estimated file size in mebibytes .....

[2]

7 A Local Area Network (LAN) contains four devices:

- a router
- two laptop computers
- a server.

(a) The server has the IP address 192.168.3.2

Explain why this is **not** an IPv6 address.

.....

.....

.....

..... [2]

(b) **(i)** The LAN is set up as a star topology.

Draw a diagram of the topology of the LAN.

[2]

(ii) Explain how data is transmitted between the two laptops in the LAN.

.....

.....

.....

..... [2]

(iii) Subnetting can be used to separate a network into logical segments.

Describe **two other** reasons why subnetting is used in a network.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(c) State **three** tasks performed by devices to deal with collisions when using the Carrier Sense Multiple Access / Collision Detection (CSMA/CD) protocol in a network.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(d) The following incomplete table contains types of IP addresses and their descriptions.

Complete the table by writing the missing types of IP addresses and the missing descriptions.

Type of IP address	Description
....	an IP address that is assigned to a device to allow direct access on the internet
static IP address	....
....	an IP address used for internal LAN communication only
dynamic IP address	....

[4]

8 A computer has an Operating System (OS).

(a) State **one** purpose of the Operating System.

.....

..... [1]

(b) The Operating System has utility software.

The purpose of some utility software is to improve security.

Identify **one** example of utility software that is **not** intended to improve security.

Explain why this software is needed.

Utility software .....

Explanation .....

.....

.....

.....

.....

[3]

(c) An optical disc reader/writer is connected to the computer.

(i) Give the name of **one** port that can provide a connection for the optical disc reader/writer.

..... [1]

(ii) Describe the roles of the address bus, the data bus **and** buffers in the process of writing data to the optical disc reader/writer.

.....

.....

.....

.....

.....

..... [3]

9 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**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store the contents of ACC at the given address
ADD	#n	Add the denary number n to the ACC
JMP	<address>	Jump to the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
CMI	<address>	Indirect addressing. The address to be used is at the given address. Compare the contents of ACC with the contents of this second address
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
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
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123		

(a) The instructions in the processor's instruction set can be grouped according to their function.

Identify the instruction group for each of the following opcodes.

IN .....

ADD .....

JPE .....

CMI .....

[4]

(b) The current contents of main memory and selected values from the ASCII character set are given on page 15.

Trace the program currently in memory using the trace table when the input is '1'.

Address	Instruction
10	LDR #0
11	IN
12	STO 101
13	LDX 110
14	CMP 100
15	JPE 21
16	LDD 101
17	ADD #16
18	INC IX
19	STO 100
20	JMP 13
21	OUT
22	END
...	
100	0
101	0
...	
110	51
111	65

ASCII value	Character
49	1
50	2
51	3
52	4
...	
65	A
66	B
67	C
68	D

Instruction address	ACC	IX	Memory address				Output
			100	101	110	111	
			0	0	51	65	

[4]