QUESTION 7.

9 A database has been designed to store data about salespersons and the product.

The following facts help to define the structure of the database:

- each salesperson works in a particular shop
- each salesperson has a unique first name
- each shop has one or more salespersons
- each product which is sold is manufactured by one company only
- each salesperson can sell any of the products
- the number of products that each salesperson has sold is recorded

The table `ShopSales` was the first attempt at designing the database.

FirstName	Shop	ProductName	NoOfProducts	Manufacturer
Nick	TX	television set refrigerator digital camera	3 2 6	SKC WP HKC
Sean	BH	hair dryer electric shaver	1 8	WG BG
John	TX	television set mobile phone digital camera toaster	2 8 4 3	SKC ARC HKC GK

(a) State why the table is **not** in First Normal Form (1NF).

....

....[1]

Question 9 begins on page 14.
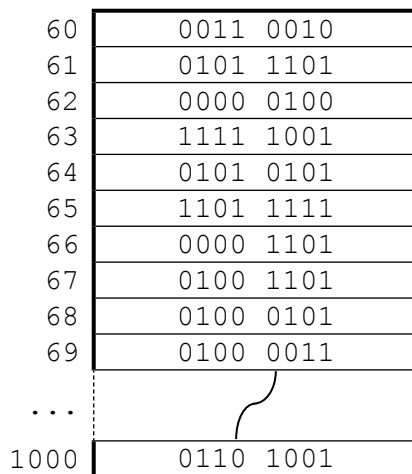
[Turn over

QUESTION 8.

QUESTION 9.

9 The table shows assembly language instructions for a processor which has one general register, the Accumulator (ACC) and an index register (IX).

Instruction		Explanation
Op code	**Operand**	
LDD	<address>	Direct addressing. Load the contents of 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.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to 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 contents of ACC with 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.
OUT		Output to screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

(a) The diagram shows the current contents of a section of main memory and the index register:

```
60        0011 0010
61        0101 1101
62        0000 0100
63        1111 1001
64        0101 0101
65        1101 1111
66        0000 1101
67        0100 1101
68        0100 0101
69        0100 0011

...

1000      0110 1001
```

Index register: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

Question 9 begins on page 12.

 [Turn over

7 A bank holds personal data about its customers and their financial data.

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

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....[4]

(b) Describe **three** security measures that the bank could implement to protect its electronic data.

Security measure 1 ....

Description ....

....

....

Security measure 2 ....

Description ....

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....

Security measure 3 ....

Description ....

....

....[6]

(e) A computer user keys in the Uniform Resource Locator (URL) of a web page into a web browser.

Describe how the browser uses the Domain Name Service (DNS) to display the web page.

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....[4]

8 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	**Operand**	
LDD	<address>	Direct addressing. Load the contents of 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.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
CMP	<address>	Compare contents of ACC with 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.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The diagram shows the contents of the main memory:

Main memory

800	0110 0100
801	0111 1100
802	1001 0111
803	0111 0011
804	1001 0000
805	0011 1111
806	0000 1110
807	1110 1000
808	1000 1110
809	1100 0010
:	
2000	1011 0101

(a) (i) Show the contents of the Accumulator after execution of the instruction:

LDD 802

Accumulator: [ ][ ][ ][ ][ ][ ][ ][ ]

[1]

(c) Employees using the new computers receive training. At the end of the training, each employee completes a series of questions.

Three answers given by an employee are shown below.

Explain why each answer is incorrect.

(i) *"Encryption prevents hackers breaking into the company's computers."*

....

....

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....[2]

(ii) *"Data validation is used to make sure that data keyed in are the same as the original data supplied."*

....

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....[2]

(iii) *"The use of passwords will always prevent unauthorised access to the data stored on the computers."*

....

....

....

....[2]

9 A health club offers classes to its members. A member needs to book into each c.

(a) The health club employs a programmer to update the class booking system. The p. has to decide how to store the records. The choice is between using a relational dat a file-based approach.

Give **three** reasons why the programmer should use a relational database.

1 ....

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....

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2 ....

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3 ....

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....[6]

(b) The programmer decides to use three tables: MEMBER, BOOKING and CLASS.

Complete the Entity-Relationship (E-R) diagram to show the relationships between these tables.

```
┌─────────────────┐                    ┌─────────────────┐
│     MEMBER      │                    │     CLASS       │
└─────────────────┘                    └─────────────────┘


            ┌─────────────────┐
            │     BOOKING     │
            └─────────────────┘
```
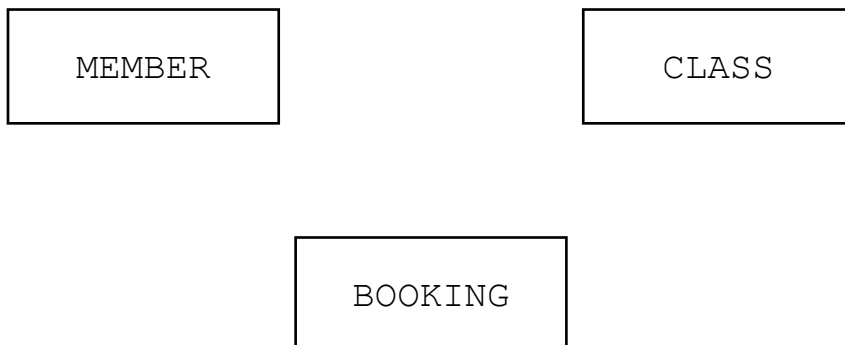
[2]

8 A programmer is writing a program that includes code from a program library.

(a) Describe **two** benefits to the programmer of using one or more library routines.

1 ....

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....

....

2 ....

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....[4]

(b) The programmer decides to use a Dynamic Link Library (DLL) file.

(i) Describe **two** benefits of using DLL files.

1 ....

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....

....

2 ....

....

....

....[4]

(ii) State **one** drawback of using DLL files.

....

....

....[2]

7 The design of a web-based application can require the use of client-side scripting

(a) Describe what is meant by **client-side scripting**.

....

....

....

....[2]

(b) A user requests a web page by keying the Uniform Resource Locator (URL) into the address bar of their web browser.

The requested page contains a client-side script.

Describe the sequence of steps leading to the display of the web page on the computer screen.

....

....

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....

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....[4]

6 (a) The operating system (OS) contains code for performing various management tasks.

The appropriate code is run when the user performs various actions.

Draw a line to link each OS management task to the appropriate user action.

OS management task	Action

Main memory management	The user moves the mouse on the desktop
Input/Output management	The user closes the spreadsheet program
Secondary storage management	The user selects the Save command to save their spreadsheet file
Human computer interface management	The user selects the Print command to output their spreadsheet document

[3]

(b) A user has the following issues with the use of his PC.

State the utility software which should provide a solution.

(i) The hard disk stores a large number of video files. The computer frequently runs out of storage space.

Utility software solution ....[1]

(ii) The user is unable to find an important document. He thinks it was deleted in error some weeks ago. This must not happen again.

Utility software solution ....[1]

(iii) The operating system reports 'Bad sector' errors.

Utility software solution ....[1]

(iv) There have been some unexplained images and advertisements appearing on the screen. The user suspects it is malware.

Utility software solution ....[1]

QUESTION 15.

6 Downloading a file from a website is an example of a client-server application.

(a) Describe what is meant by the term **client-server** for this application.

....

....

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....[2]

(b) The following sequence of steps (1 to 5) describes what happens when someone uses their personal computer (PC) to request a web page. The web page consists of HTML tags and text content only. Four of the statements from **A**, **B**, **C**, **D**, **E** and **F** are used to complete the sequence.

A	Browser software interprets the script, renders the page and displays.
B	Browser software renders the page and displays.
C	Browser software compiles the script, renders the page and displays.
D	The web server retrieves the page.
E	The Domain Name Service (DNS) uses the domain name from the browser to look up the IP address of the web server.
F	The web server sends the web page content to the browser.

Write one of the letters A to F in the appropriate row to complete the sequence.

1.   The user keys in the Uniform Resource Locator (URL) into the browser software.

2.   ....

3.   ....

4.   ....

5.   ....

[4]

(b) Each machine code instruction is encoded as 16 bits (8-bit op code followed by an 8-bit operand).

Write the machine code for these instructions:

```
LDM #67
```


```
LDX #7
```


[3]

(c) Computer scientists often write binary representations in hexadecimal.

(i) Write the hexadecimal representation for the following instruction.

0	0	0	1	0	1	0	0	0	1	0	1	1	1	1	0

....[2]

(ii) A second instruction has been written in hexadecimal as:

```
16 4D
```

Write the assembly language for this instruction with the operand in denary.

....[2]

7 A clinic is staffed by several doctors. The clinic serves thousands of patients. Eac.
one time, there is only one doctor in the clinic available for appointments.

The clinic stores patient, doctor and appointment data in a relational database.

(a) (i) Underline the primary key for each table in the following suggested table designs.

```
PATIENT(PatientID, PatientName, Address, Gender)

DOCTOR(DoctorID, Gender, Qualification)

APPOINTMENT(AppointmentDate, AppointmentTime, DoctorID, PatientID)
```

[2]

(ii) Complete the following entity-relationship (E-R) diagram for this design.
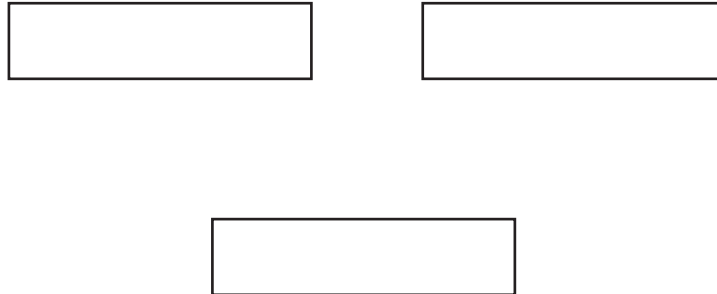
[2]

(b) The doctors are concerned that many patients make appointments but do not attend them.

Describe the changes to the table designs that could be made to store this information.

....

....[2]

Issue 2

Description ....

....

....

ACM/IEEE principle (Circle one only)

Public   Client and Employer   Product   Judgement

Management   Profession   Colleagues   Self

Possible action ....

....

....

[6]

Question 7 begins on the next page.

QUESTION 17.

7 A company takes customer service for its clients very seriously.

The client

- The client names are unique.

A visit

- The company arranges a date for a visit to gather feedback from a client.

- A visit to a client never takes more than one day.

- Over time, the client receives many visits.

Staff (Interviewers)

- One or more staff attend the visit.

- If there is more than one staff member visiting, each performs a separate interview.

Interviews

- Each interview is classified as either 'general' or by some specialism, for example, marketing, customer service or sales.

- A report is produced for each interview, `InterviewText`.

- Each interview is conducted by a single staff member.

The client, visit, staff and interview data will be stored in a relational database.

(a) (i) Underline the primary key for each table in the following suggested table designs.

`STAFF(StaffID, StaffName, Department)`

`CLIENT(ClientName, Address, Town)`

`VISIT(ClientName, VisitDate)`

`INTERVIEW(ClientName, VisitDate, StaffID, SpecialistFocus, InterviewText)`

[3]

(ii) For each of the pairs of entities, A, B and C, draw the relationship between the two entities.

A | CLIENT | | VISIT |

B | VISIT | | INTERVIEW |

C | INTERVIEW | | STAFF |

[3]

6 (a) A personal computer (PC) is extensively used for a wide range of applications, including the three shown in the following table.

Write in the table, a suitable input device, output device, or both needed for each application.

Do not give a monitor, keyboard or mouse in your answers.

Application	Input device	Output device
Capture the text from a paper document, in order that the text can be word processed		
Producing a replica of a small plastic component from a washing machine		
A museum has interactive information facilities throughout the building		

[3]

(b) Explain the basic internal operation of a hard disk drive.

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....[4]

7 A movie theatre has a relational database that stores the movie schedule, and i... the movies. The theatre has several screens that play movies at the same time.

The database has three tables to store information about the movies, the screens and t... schedule.

```
MOVIE(MovieID, Title, Length, Rating)

SCREEN(ScreenNumber, NumberSeats)

MOVIESCHEDULE(ScheduleID, MovieID, ScreenNumber, Time)
```

(a) Complete the entity-relationship (E-R) diagram to show the relationships between these tables.

```
┌─────────────────┐          ┌─────────────────┐
│     MOVIE       │          │     SCREEN      │
└─────────────────┘          └─────────────────┘


         ┌───────────────────────┐
         │    MOVIESCHEDULE      │
         └───────────────────────┘
```
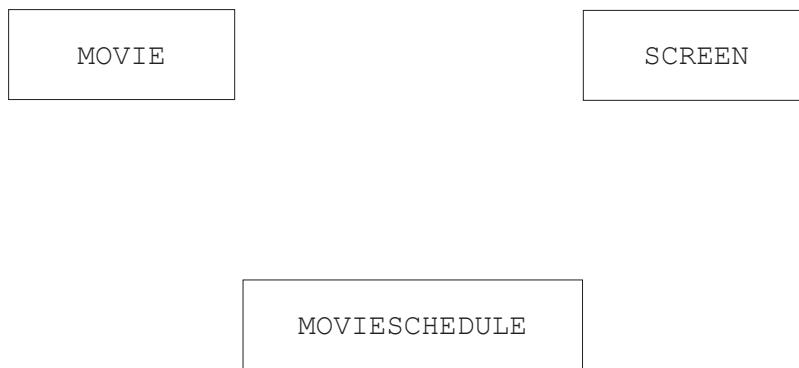
[2]

(b) Explain how primary and foreign keys are used to link the tables in the movie theatre database.

....

....

....

....

....

....

....[4]

Question 7 begins on the next page.

 [Turn over

QUESTION 19.

8 **(a)** Draw a logic circuit to represent the logic expression:

$$X = (A \text{ XOR } B) \text{ OR } (\text{NOT}(C \text{ AND } A))$$

A ————

B ———— X

C ————
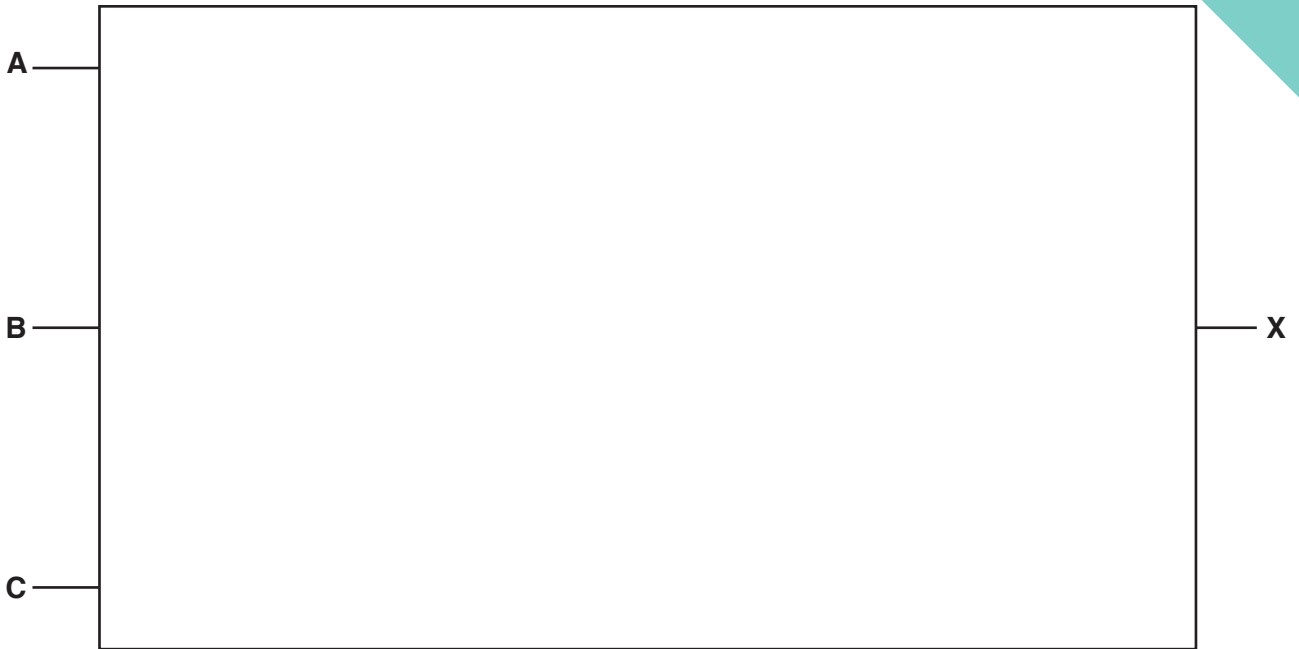
[4]

(b) Complete the truth table for the logic expression in **part (a)**.

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		

[4]

7 The network manager of a Local Area Network (LAN) has replaced the Ethernet cables with a wireless network.

(a) Give **three** benefits of a wireless network compared to a wired network.

1 ....

....

2 ....

....

3 ....

....
[3]

(b) Give **one** drawback of a wireless network compared to a wired network.

....

....[1]

6 A student records a video using a digital camera.

(a) The recording uses interlaced encoding.

Describe **interlaced encoding**.

....

....

....

....

....

....

.... [3]

(b) State **one** benefit of using interlaced encoding compared to progressive encoding.

....

.... [1]

(c) A video can be compressed using spatial redundancy or temporal redundancy.

Explain how **temporal redundancy** compresses a video.

....

....

....

....

.... [2]

(d) A sound track is recorded for the video.

(i) Describe how a computer encodes the sound track.

....

....

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....

....

.... [3]

Trace the program currently in memory using the following trace table. The first instruction has been completed for you.

Instruction address	ACC	Memory address							IX	OUTPUT
		100	101	102	103	104	300	301		
		65	67	69	69	68		33	0	
20	0									

[8]

6 **(a)** Draw a logic circuit to represent the logic expression:

X = **A** OR (**B** AND NOT **C**) OR (**A** AND **B**)

A ——————

B ——————————————————————— X

C ——————
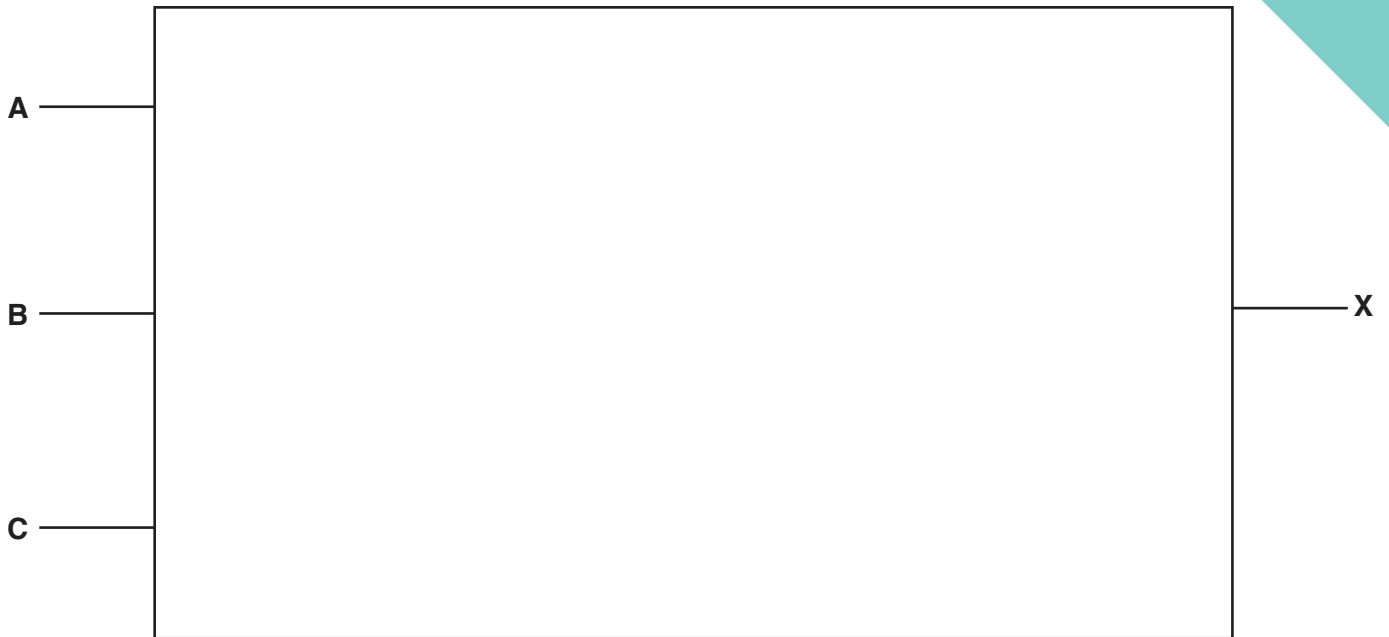
[5]

(b) Complete the truth table for the logic expression in **part (a)**.

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		

[4]

(iii) The DBMS provides software tools for the database developer.

Fill in the names of the missing software tools in the following statements.

A .... allows a developer to extract data from a database.

A .... enables a developer to create user-friendly forms and reports.

[2]

5   Xander creates a presentation that includes images, video and sound.

(a) The images are bitmap images. A bitmap image can be made up of any number
    Each colour is represented by a unique binary number.

    Draw **one** line from **each** box on the left, to the correct box on the right to identify the minim
    number of bits needed to store each maximum number of colours.

Maximum number of colours   **Minimum number of bits**

Maximum number of colours	Minimum number of bits
68	1
256	2
127	3
2	7
249	8
	9

[3]

(c) The processor handles interrupts within the fetch-execute cycle.

(i) Give **one** example of a hardware interrupt and **one** example of a software interrupt.

Hardware ....

....

Software ....

....

[2]

(ii) Explain how the processor handles an interrupt.

....

....

....

....

....

....

....

....

....

.... [5]

5 **(a)** The bit depth of an image dictates how many different colours can be repre... pixel.

    (i) State the number of different colours that can be represented by a bit depth of 8.

    ....

    (ii) One binary colour is represented by 0100 1110

    Convert the unsigned binary number 0100 1110 into denary.

    .... [1]

(b) Convert the denary number –194 into 12-bit two's complement.

.... [1]

(c) **(i)** Convert the Binary Coded Decimal (BCD) value 0110 1001 into denary.

    .... [1]

    (ii) Identify **one** practical application where BCD is used.

    ....

    .... [1]

(d) One example of a character set used by computers is ASCII.

Describe how one character is represented in a character set.

....

....

....

.... [2]

(iv) The following table has definitions of database terms.

Write the correct database term in the table for each definition.

Definition	Term
All the data about one entity	
The data in one row of a table	
A column or field in a table	

[3]

6 Dominic uses a tablet computer to complete work. He records videos of his wo.
colleagues to watch at a later date.

(a) The tablet computer has input and output devices.

(i) The table lists four devices built into the tablet.

Tick (✓) one or more boxes for each device to identify whether it is an input device, an
output device or both.

Device	Input	Output
Touchscreen		
Webcam		
Microphone		
Fingerprint scanner		

[2]

5 Mica has created some software and has copyrighted it. She wants to stop other people from copying and changing it illegally.

(a) Identify **two** ways Mica can prevent illegal copies of the software being installed.

1 ....

....

2 ....

....
[2]

(b) Identify **one** way Mica can distribute the software without the source code.

....

.... [1]

(c) Mica is releasing the software under a commercial licence.

(i) Give **two** benefits to Mica of using a commercial licence.

1 ....

....

2 ....

....
[2]

(ii) Name **two** other types of software licence.

1 ....

....

2 ....

....
[2]

7 The following table has descriptions of modes of addressing.

Complete the table by writing the name of the addressing mode for each description.

Addressing mode	Description
	Form the address by adding the given number to a base address. Load the contents of the calculated address to the Accumulator (ACC).
	Load the contents of the address held at the given address to ACC.
	Load the contents of the given address to ACC.
	Form the address from the given address + the contents of the Index Register. Load the contents of the calculated address to ACC.
	Load the given value directly to ACC.

[5]

(iv) Describe the purpose of the code on line `16`.

....

....

....

.... [2]

(b) Willow used functions from a JavaScript program library in the web page.

Describe the benefits to Willow of using program libraries to create the web page.

....

....

....

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.... [4]