1(a) OCR Insurance uses a computer system to calculate the price that customers pay for car insurance.

The computer system contains a CPU, GPU, RAM and ROM.

i. State **two** factors that affect the performance of a CPU.

1 _____

2 _____

[2]

ii. Explain the difference between RAM and ROM, including how these are used by the computer system.

_____

_____

_____

_____

_____

_____

_____

_____

[4]

iii. Describe **one** non-graphical use for a GPU.

_____

_____

_____

_____

[2]

(b) The CPU uses pipelining to improve efficiency.

Explain what is meant by the term 'pipelining'.

[3]

(c) * OCR Insurance's computer system uses secondary storage across the company in servers, client machines and for backup purposes.

For each of these, discuss whether magnetic storage or solid state storage would be most suitable, taking into account the advantages and disadvantages of both.

[9]

(d) Customers' details are stored in the flat file database table `Customer`. An extract of the table is shown below.

CustomerID	**Surname**	**Title**	**Phone**	**CarReg**
JJ178	James	Mr	(0121) 343223	DY51 KKY
HG876	Habbick	Miss	(01782) 659234	PG62 CRG
EV343	Elise	Mrs	(07834) 123998	HN59 GFR
PG127	Pleston	Mr	(07432) 234543	JB67 DSF

i. State what is meant by the term 'primary key', identifying the primary key in the table above.

[2]

ii. Write the SQL statement that would show only the `CustomerID` and `Surname` fields for customers with the `Title` "Miss" or "Mrs".

[4]

iii. Describe **one** problem that would arise with the flat file database structure if a customer wanted to insure more than one car at the same time.

[2]

iv. Describe how the flat file database structure could be altered to efficiently allow each customer to insure multiple cars at the same time. (You may assume each car is insured to only one customer.)

[5]

2(a)

i. Convert the denary number 231 to an unsigned 8-bit binary number.

[1]

ii. Convert the hexadecimal number 6F to an unsigned 8-bit binary number.

[1]

(b) The floating point number 001101 0100 is stored using 6 bits for the mantissa and 4 bits for the exponent, both in two's complement. This number is not normalised.

i. Give the normalised version of this number, showing your working.

[4]

ii. Convert your answer to part **(i)** to denary, showing your working.

[3]

(c) Add together the two numbers below. Both numbers are stored in normalised floating point format, using 6 bits for their mantissa and 4 bits for their exponent which are both in two's complement. Show the result in the same format and show your working.

```
0110000110    +
0101000100
```

[5]

3(a) A website sells tickets for sporting events. The website uses HTML, CSS and JavaScript.

Describe the purpose of HTML and CSS within the code of the website.

HTML

CSS

[4]

(b) One page in the website contains a hyperlink on an image. When the image stored as “ticket.png” is clicked, the user is hyperlinked to the page stored as “booking.htm”.

Write the HTML code to implement this hyperlink.

[3]

(c) A website charges a booking fee of £2.99 on each ticket sold. In addition, if the tickets are purchased from outside of the UK, £4.99 is added to the booking fee. The booking fee is calculated using a JavaScript function named `bookingfee()`.

Complete the definition of the `bookingfee()` function below.

```
function bookingfee(numtickets, country) {

    var nonUKprice = 4.99;

    var perTicketPrice = ……;

    var total = 0;

    if (country!="UK") {

         total = total + ……;

    }

    total = total + (…… * perTicketPrice);

     …… total;

}
```

[4]

(d) The JavaScript function above is used to show users the booking fee. When users click to buy the tickets, the booking fee is calculated again on the server.

i. Explain why server side processing is used to recalculate the booking fee.

---

[3]

ii. Explain **one** advantage of client side processing to either the customer buying the tickets, or to company who own the website.

---

[2]

(e) Users are able to search for and find the ticket website using a search engine. Search engines can use indexing and ranking.

i. Describe how a website is indexed by a search engine.

[4]

ii. A search engine can use the PageRank algorithm to determine a website's ranking. The PageRank algorithm utilises a damping factor.

State what is meant by the term 'damping factor'.

[1]

iii. Give **two** other factors that affect the output value given by the PageRank algorithm for a website.

1

2

[2]

4 * *"The Computer Misuse Act means that computer users are criminalised for simply trying to learn how systems work."*

Discuss whether or not you agree with this statement.

---

[9]

5(a) All users of a computer system have a unique username and password. The computer system has implemented two-factor authentication so that users must respond to either an email or text message containing a secret code to be able to access the system.

Let:

A be a Boolean value for if a user enters a valid username

B be a Boolean value for if a user enters a password that matches their username

C be a Boolean value for if a user is able to respond to an email containing a secret code

D be a Boolean value for if a user is able to respond to a text message containing a secret code

Q be a Boolean value for if entry to the computer system is allowed

Complete the Boolean expression below:

$Q \equiv$ ---

(b) Another Boolean expression for a logic system is shown below:

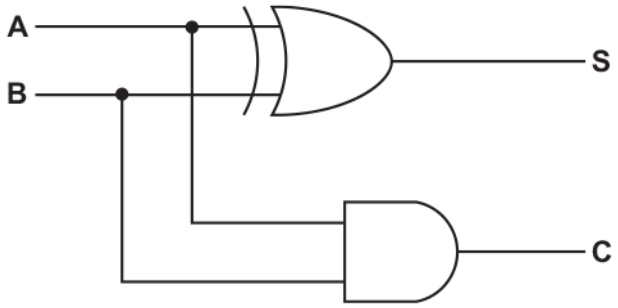
$Q \equiv \neg (\neg A \wedge \neg B)$

i. Simplify this Boolean expression so that it does not include any negation. You must explain which Boolean algebra rule(s) you are using at each step.

---

[2]

(c)



The logic circuit above has two inputs (**A, B**) and two outputs (**S, C**).

i. Give the Boolean expressions for the outputs **S** and **C**.

S ≡ ----------

C ≡ ----------

[2]

ii. Complete the truth table for this logic circuit.

A	B	S	C
0	0		
0	1		
1	0		
1	1		

iii. Describe how this logic circuit can be adapted to add together two 4-bit binary numbers.

---

[4]

6(a) A program written using the Little Man Computer instruction set is shown in **Fig. 1**.

```
        INP
        STA  numone
        INP
        STA  numtwo
main    LDA  numone
        SUB  numtwo
        BRP  pos
notpos  LDA  count
        OUT
        LDA  numone
        OUT
        HLT
pos     STA  numone
        LDA  count
        ADD  one
        STA  count
        BRA  main
numone  DAT
numtwo  DAT
one     DAT 1
count   DAT 0
```

Fig. 1

various registers are used when the program above is executed.

i. State what is meant by the term 'register'.

---

[2]

ii. Explain how the accumulator is used when the line `BRP  pos` is executed.

---

[2]

(b) Complete the table below to show the output(s) from this program given the inputs.

Inputs	Output(s)
12, 5	
18, 2	
16, 4	
3, 7	

[4]

(c) Write an algorithm using pseudocode that has the same functionality as the code in **Fig. 1**.

[4]

(d) * In assembly language, different modes of addressing memory can be used.

Discuss the different modes used. You should include:

- How the operand value is determined
- What an operand of 27 would refer to in that mode
- The reasons for requiring multiple modes of addressing **[12]**

7(a)

A business uses an array with the identifier `wNames` to store workers' names. A variable with the identifier top is used to store the index of the last element to be added to the array, which is also the element which will next be removed.

`wNames`

0	1	2	3	4	5	6
Kirstie	Martyn	Louise	Alex	Anna		

`top`

4

i. State the name of the type of data structure described above.

---

[1]

ii. Using pseudocode, write an algorithm that allows the user to enter a name which is then pushed onto the data structure above, checking first that the data structure is not full.

---

[4]

(b) The same workers' names are stored in a binary search tree which is ordered alphabetically.

Kirstie is set as the root node, with Martyn, Louise, Alex and Anna added one by one.

i. Complete the tree diagram above to show where Martyn, Louise, Alex and Anna would be added to this binary search tree.

[4]

ii. Describe the process of using the binary search tree above to search for the name "Zoe".

---

[3]

iii. Compare the efficiency of a binary search tree to a linked list when searching for data.

---

[2]

iv. Compare the efficiency of a binary search tree to a hash table when searching for data.

[2]

(c) An object oriented system is implemented to organise further information about each worker's attendance. Classes, objects, methods and attributes are used in this system.

i. State the meaning of each of the following terms:

Object

Method

Attribute

[3]

ii. Each worker has a name and an attendance figure which can be between 0 and 100.

Write a definition for a fully encapsulated worker class, providing both get and set methods for all attributes. You do **not** have to write code for the constructor method.

[5]

END OF QUESTION PAPER