



Cambridge International AS & A Level

CANDIDATE
NAME

Model Answers

CENTRE
NUMBER

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0123456789

COMPUTER SCIENCE

9618/01

Paper 1 Theory Fundamentals

For examination from 2021

SPECIMEN PAPER

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **14** pages. Blank pages are indicated.

- 1 (a) State **one** difference between a **kibibyte** and a **kilobyte**.

A kibibyte has 1024bytes while a kilobyte has 1000bytes.

A kibibyte has a binary prefix and a kilobyte has a denary prefix

..... [1]

- (b) Give the number of bytes in a **mebibyte**.

A mebibyte has 1024*1024bytes

..... [1]

- (c) (i) Complete the following binary addition. Show your working.

$$\begin{array}{r}
 11111 \\
 10011010 \\
 + 11110111 \\
 \hline
 110010001
 \end{array}$$

[2]

- (ii) Describe the error that occurred when you added the binary numbers in **part (c)(i)**.

The above addition gave the answer in 9 bits and the 9th bit is ignored as there are only 8 bits available. It is called an Overflow error.

..... [2]

- (d) Complete the binary subtraction. Show your working.

$$\begin{array}{r}
 01100111 \\
 - 00110010 \\
 \hline
 \end{array}
 \rightarrow \text{One's complement} = 11001101 \\
 \text{Two's complement} = 11001110$$

$$\begin{array}{r}
 01100111 \\
 + 11001110 \\
 \hline
 (1)00110101
 \end{array}$$

[2]

2 Yvette runs a company that books walking holidays for groups of people. She has a website that customers use to book the holidays.

(a) The website has a URL and an IPv6 address.

Describe, using an example, the format of an IPv6 address.

**An IPv6 address has a set of 8 numbers.
Each number has four hexadecimal digits.
Each number is separated by a colon..
e.g: DA59:1234:1A2B:22BB:41FB:1010:FF51:ABCD**

..... [4]

(b) An IP address can be static or dynamic. Describe static and dynamic IP addresses.

Static

Static IP address given to a user remains the same, every time he connects to the Internet. User has to pay a high price to ISP to obtain a static IP address.

Dynamic

Every time the user connects to the Internet, his IP address will be different to the one in the previous session. It is allocated by the network operating system

..... [4]

(c) Yvette’s company has a LAN (Local Area Network) that has hybrid topology.

(i) Describe the characteristics of a LAN.

LAN has its devices connected within a small geographical area. The user or the company owns the dedicated infrastructure.

..... [2]

(ii) The LAN has a range of different topologies. One subnetwork connects four computers and one server set up as a star topology.

Describe how packets are transmitted between two of the computers in this subnetwork.

**A packet has a header which gives the recipient’s address.
These packets are transmitted directly to the relevant server.
Server identifies the recipient’s location and delivers directly to the correct destination.**

..... [3]

(d) The LAN has both wired and wireless connections.

(i) Ethernet cables connect the computers to the server.

Identify **three** other hardware components that might be used to set up the LAN.

**1 A LAN must have a Network Interface Card (NIC)
2 It needs a Hub
3 A switch also can be used for the LAN**

..... [3]

- (ii) Describe how Carrier Sense Multiple Access/Collision Detection (CSMA/CD) manages collisions during data transmission.

A collision occurs when two devices transmit signals at the same time. CSMA/CD makes the devices listen to the communication channel. If no data is being transmitted, the computer can send its data.

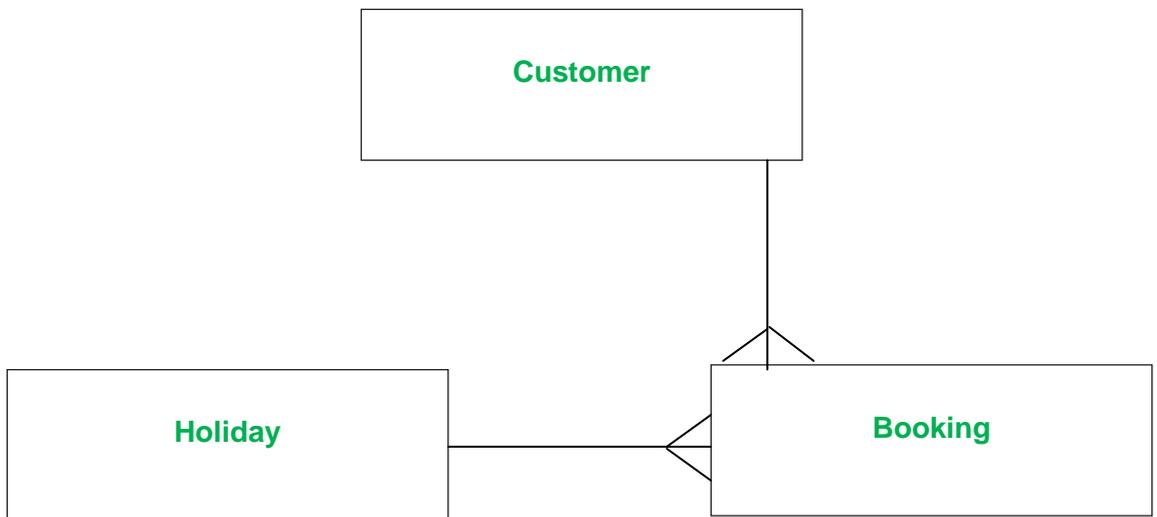
..... [3]

3 Mehrdad has a holiday company database that includes:

- data about holidays, such as the location, date, duration (in days)
- data about the customers and the holidays they have booked.

(a) Mehrdad has **normalised** the database, which has three tables.

- (i) Draw an entity–relationship (E–R) diagram for the **normalised** tables.



[3]

- (ii) Complete the table to identify the primary key and foreign key(s) for each of the tables you identified in **part (a)(i)**. If the table has no foreign key(s), write 'None'.

Table name	Primary key	Foreign key
Customer	CustomerID	None
Booking	BookingID	CustomerID HolidayID
Holiday	HolidayID	None

[3]

- (iii) Explain why the holiday database is in Third Normal Form (3NF).

All fields in each of these three tables are fully dependent on their respective primary keys. These tables do not have many-to many relationships.

[2]

- (b) The holiday company has several members of staff. The database has **two** additional tables to store data about the staff.

STAFF(StaffID, FirstName, SecondName, DateOfBirth, Role, Salary)

SCHEDULE(ScheduleID, StaffID, WorkDate, Morning, Afternoon)

The following table shows some sample data from the table SCHEDULE.

ScheduleID	StaffID	WorkDate	Morning	Afternoon
210520-1	BC	21/05/2020	TRUE	TRUE
210520-2	JB	21/05/2020	TRUE	FALSE
220520-1	BC	22/05/2020	FALSE	TRUE
220520-2	LK	22/05/2020	TRUE	FALSE

- (i) Write an SQL script to display the first name and second name of all staff members working on 22/05/2020.

```
SELECT STAFF.FirstName, STAFF.SecondName
FROM STAFF, SCHEDULE
WHERE SCHEDULE.WorkDate = '22/05/2020'
AND SCHEDULE.StaffID = STAFF.StaffID;
```

..... [4]

- (ii) Write an SQL script to count the number of people working on the morning of 26/05/2020.

```
SELECT COUNT(StaffID)
FROM SCHEDULE
WHERE WorkDate = '26/05/2020' AND Morning = TRUE;
```

..... [3]

4 A cake factory uses machines to make cakes .

- (a) Complete the following descriptions of types of system. Write the correct missing term in the spaces.

The factory uses a **Monitoring** system to record data such as the number of cakes being produced each hour.

When the data collected from sensors are analysed and used as

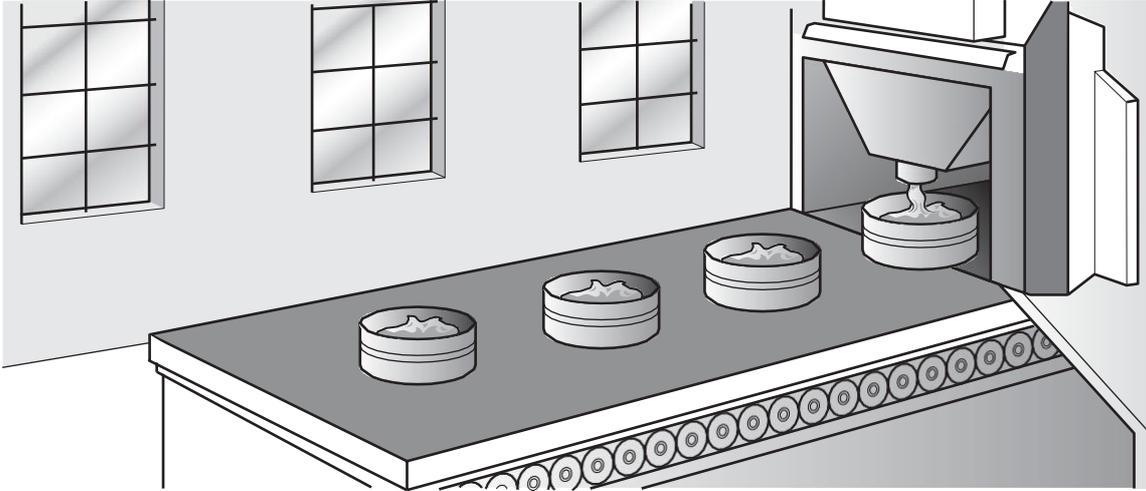
..... **feedback** it is a **control**..... system. One example

of this system, used in the factory, is to maintain a constant temperature in the ovens. It uses

a **temperature sensor**to measure the values.

[4]

- (b) Cake mixture is mixed in a large pot. A conveyer belt moves the cake tins beneath the pot. The conveyer belt stops and a set quantity of the cake mixture fills the cake tin. The conveyer belt then moves and another cake tin is positioned beneath the pot.



Explain how the control system will ensure the correct amount of mixture is placed in the cake tins.

Either an infra-red or pressure sensor will detect that the tin has come to the correct

place and a signal will be sent to the microprocessor.

The microprocessor will send a signal to an actuator to stop the conveyor belt.

Another signal will be sent to open the nozzle to fill the tin with cake batter.

A pressure sensor will continuously send the readings of the weight of the tin that is being filled currently

Microprocessor will compare the weight of the tin with a pre-set value and sends a signal to an actuator to stop filling.

Another signal is sent to another actuator to move the tin away.

..... [5]

- (c) The cake factory has servers that store its confidential recipes and control the factory machines.

- (i) Describe the implications of a hacker gaining access to the cake factory's servers.

The hacker can steal confidential information including the company's secret recipes.

It can cause losses to the company, if he sells recipes to the company's rivals.

The hacker can stop or change the way the machines work.

That also can cause losses to the company.

[4]

- (ii) Explain how the company could protect its data against hackers.

The company can install and run a firewall which would block receiving any disallowed data.

The company should keep the firewall software upto date.

The company can use strong passwords.

They can implement other authentication methods involving biometrics.

..... [4]

- (d) The machines have a counter to record the number of cake tins filled. Each time a cake tin is filled, the counter is increased by 1. The value is stored in an 8-bit register, the current value is shown.

0	0	0	0	1	0	0	1
---	---	---	---	---	---	---	---

- (i) Show the value of the binary number after another five cake tins have been filled.

0	0	0	0	1	1	1	0
---	---	---	---	---	---	---	---

[1]

- (ii) The following table shows some assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	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>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end.

At the end of each day, the register is reset to 0.

Write the assembly language statement to reset the register to 0.

If you use bitwise AND #0 all bits will become zero.

..... [2]

- (iii) A **two-place logical shift** to the **left** is performed on the binary number shown in **part (d)**.

Show the result of this logical shift.

0	0	1	0	0	1	0	0
---	---	---	---	---	---	---	---

[1]

- (iv) State the mathematical result of a **one-place logical shift** to the **right** on a binary number.

When one-place logical shift to the right takes place on a binary number, it has the effect of division by two.

..... [1]

- (e) The factory servers run software that makes use of Artificial Intelligence (AI).

Explain how the use of AI can help improve the safety and efficiency of the factory.

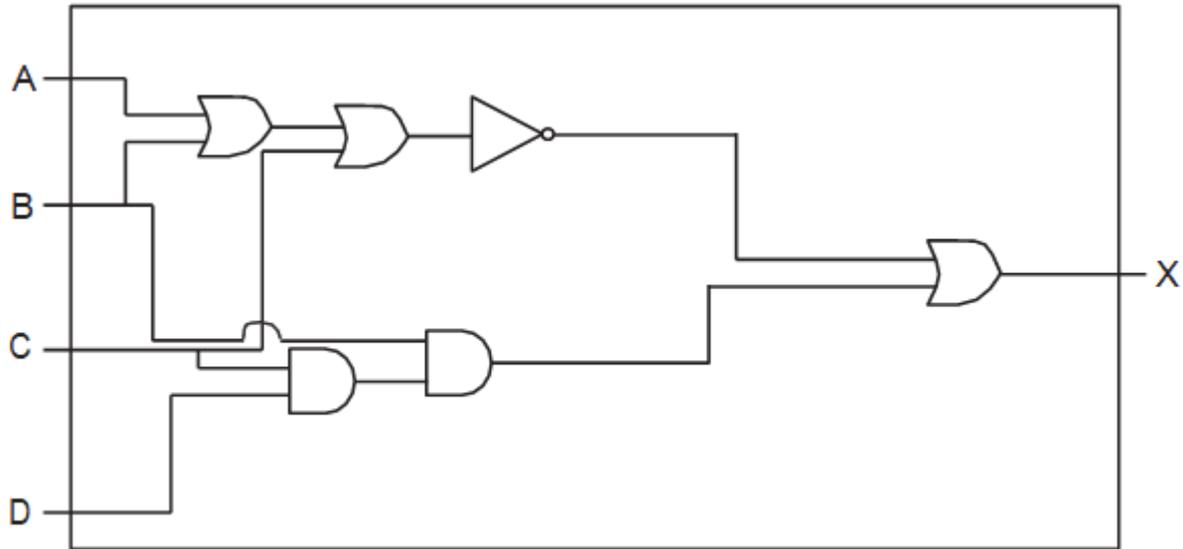
**Using AI, machines can learn from the past experience and mistakes.
They can prevent the same problem occurring in the future.
They can learn to predict what can happen and raise an alarm if in danger.**

..... [3]

- 5 (a) Draw a logic circuit diagram for the logic expression:

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

[Answer]



[4]

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

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

A	B	C	A XOR B	Working space		X
				(A OR B OR C)	NOT (A OR B OR C)	
0	0	0	0	0	1	1
0	0	1	0	1	0	0
0	1	0	1	1	0	1
0	1	1	1	1	0	1
1	0	0	1	1	0	1
1	0	1	1	1	0	1
1	1	0	0	1	0	0
1	1	1	0	1	0	0

[4]

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