

# Cambridge International AS & A Level

CANDIDATE  
NAME

**Specimen Answers**

CENTRE  
NUMBER

--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

**COMPUTER SCIENCE**

**9618/12**

Paper 1 Theory Fundamentals

**May/June 2021**

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.



- 1 Raj owns houses that other people rent from him. He has a database that stores details about the people who rent houses, and the houses they rent. The database, HOUSE\_RENTALS, has the following structure:

```
CUSTOMER(CustomerID, FirstName, LastName, DateOfBirth, Email)
HOUSE(HouseID, HouseNumber, Road, Town, Bedrooms, Bathrooms)
RENTAL(RentalID, CustomerID, HouseID, MonthlyCost, DepositPaid)
```

- (a) Give the definition of the following database terms, using an example from the database HOUSE\_RENTALS for each definition.

Term	Definition and example
<b>Field</b>	<p><b>It is a column in a database table. It is also called an attribute.</b>  <b>e.g. HouseNumber in the house table</b></p> <p>.....</p> <p>.....</p>
<b>Entity</b>	<p><b>If data can be stored about a thing, it is called an entity.</b>  <b>e.g. a customer</b></p> <p>.....</p> <p>.....</p>
<b>Foreign key</b>	<p><b>It is a field of a table matching the primary key of another table.</b>  <b>e.g. HouseID in Rental table is a foreign key to the table House.</b></p> <p>.....</p> <p>.....</p>

- (b) Tick (✓) **one** box to identify whether the database `HOUSE_RENTALS` is in Third Normal Form (3NF) or not in 3NF.  
Justify your choice using one or more examples from the database `HOUSE_RENTALS`.

In 3NF	
Not in 3NF	

Justification .....

..... [2]

- (c) Example data from the table `RENTAL` are given:

RentalID	CustomerID	HouseID	MonthlyCost	DepositPaid
1	22	15B5L	1000.00	Yes
2	13	3F	687.00	No
3	1	12AB	550.00	Yes
4	3	37	444.50	Yes

- (i) Complete the following Data Definition Language (DDL) statement to define the table `RENTAL`.

```
CREATE TABLE RENTAL (
    RentalID INTEGER NOT NULL,
    CustomerID INTEGER NOT NULL,
    HouseID VARCHAR (5) NOT NULL,
    MonthlyCost REAL NOT NULL,
    DepositPaid BOOLEAN NOT NULL,
    PRIMARY KEY (RentalID)
);
```

[4]

- (ii) Write a Data Manipulation Language (DML) script to return the first name and last name of all customers who have **not** paid their deposit.

```
SELECT FirstName, LastName
FROM CUSTOMER, RENTAL
WHERE DepositPaid = No
AND RENTAL.CustomerID = CUSTOMER.CustomerID;
```

..... [4]



2 Aisha manages a team of software developers.

(a) Explain the reasons why it is important that Aisha acts ethically in relation to her team members.

**If Aisha acts ethically, it can make the team members feel that their work is valued. That will make them do their best**

..... [2]

(b) The team are developing a computer game where the user plays a board game (such as chess) against the computer.

Describe how the computer would use Artificial Intelligence (AI) to play the board game.

**In a game like this, the software will have the rules, past moves and decision making algorithms stored for reference. The AI program is usually trained by playing the game many times. Making use of the past moves and results, the program will choose the most successful moves currently available.**

..... [3]

(c) The final game will be released under a licence.

Tick (✓) **one or more** boxes in each row to identify the licence(s) each statement describes.

Statement	Free Software Foundation	Open Source Initiative	Shareware	Commercial Software
The user can edit the source code	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
The user <b>must</b> always pay before being able to use the software				<input checked="" type="checkbox"/>
The user can redistribute the software	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
The user always gets a trial period			<input checked="" type="checkbox"/>	

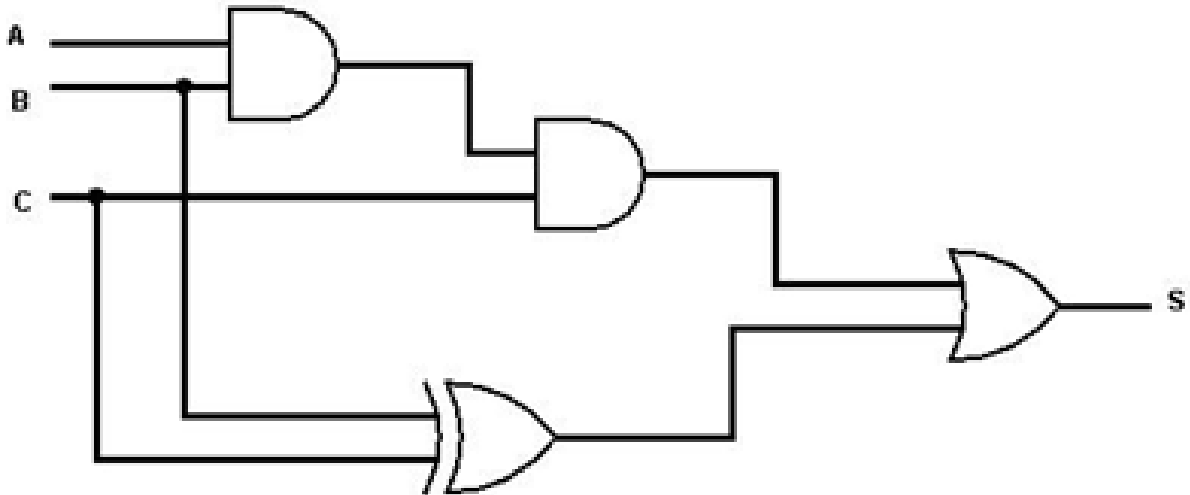
[4]

3 A logic expression is given:

$$S = (A \text{ AND } B \text{ AND } C) \text{ OR } (B \text{ XOR } C)$$

(a) Draw the logic circuit for the given expression.

[Answer]



[4]

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

$$S = (A \text{ AND } B \text{ AND } C) \text{ OR } (B \text{ XOR } C)$$

[2]

A	B	C	A . B	A.B.C	B XOR C	(A.B.C) +(B⊕ C)
0	0	0	0	0	0	0
0	0	1	0	0	1	1
0	1	0	0	0	1	1
0	1	1	0	0	0	0
1	0	0	0	0	0	0
1	0	1	0	0	1	1
1	1	0	1	0	1	1
1	1	1	1	1	0	1


- 4 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

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
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the 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 the contents of ACC with the 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
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

# denotes a denary number, e.g. #123

The current contents of the main memory and selected values from the ASCII character set are:

**Address Instruction**

70	IN
71	CMP 100
72	JPE 80
73	CMP 101
74	JPE 76
75	JMP 80
76	LDD 102
77	INC ACC
78	STO 102
79	JMP 70
80	LDD 102
81	DEC ACC
82	STO 102
83	JMP 70
...	
100	68
101	65
102	100

**ASCII code table (selected codes only)**

ASCII code	Character
65	A
66	B
67	C
68	D

- (a) Complete the trace table for the program currently in main memory when the following characters are input:

A D

Do not trace the program any further when the third input is required.

[4]

Instruction Address	ACC	Memory address		
		100	101	102
		68	65	100
70	65			
71				
72				
73				
74				
76	100			
77	101			
78				101
79				
70	68			
71				
72				
80	101			
81	100			
82				100
83				
(70)				

(b) Some bit manipulation instructions are shown in the table:

Instruction		Explanation
Opcode	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>

<address> can be an absolute address or a symbolic address  
# denotes a denary number, e.g. #123

The contents of the memory address 300 are shown:

Bit Number	7	6	5	4	3	2	1	0
300	0	1	1	0	0	1	1	0

(i) The contents of memory address 300 represent an unsigned binary integer.

Write the denary value of the unsigned binary integer in memory address 300.

**102** ..... [1]

(ii) An assembly language program needs to test if bit number 2 in memory address 300 is a 1.

Complete the assembly language instruction to perform this test.

**AND #4** ..... [1]

(iii) An assembly language program needs to set bit numbers 4, 5, 6 and 7 to 0, but keep bits 0 to 3 with their existing values.

Write the assembly language instruction to perform this action.

**AND #15** ..... [2]



5 Seth uses a computer for work.

(a) Complete the following descriptions of internal components of a computer by writing the missing terms.

The **control unit** transmits the signals to coordinate events based on the electronic pulses of the .... **(system) clock** .

The **data bus** carries data to the components, while the **address bus** carries the address where data needs to be written to or read from.

The **arithmetic logic unit** performs mathematical operations and logical comparisons.

[5]

(b) Describe the ways in which the following factors can affect the performance of his laptop computer.

Number of cores

- **Each core processes one instruction per clock pulse.**
- **Therefore more cores decreases the time taken to complete task**

.....

Clock speed

- **Each instruction is executed on a clock pulse and the clock speed determines the number of instructions that can be run per second.**
- **If the clock speed is fast, then more instructions can be executed per second.**

.....

[4]

(c) Seth accesses both software and data using cloud computing.

(i) Give **two** benefits of storing data using cloud computing.

- 1 **..Cloud storage is available free of charge.**
- 2 **When you have cloud storage, you can access your data from any computer and from anywhere, with Internet access.**

.....

[2]

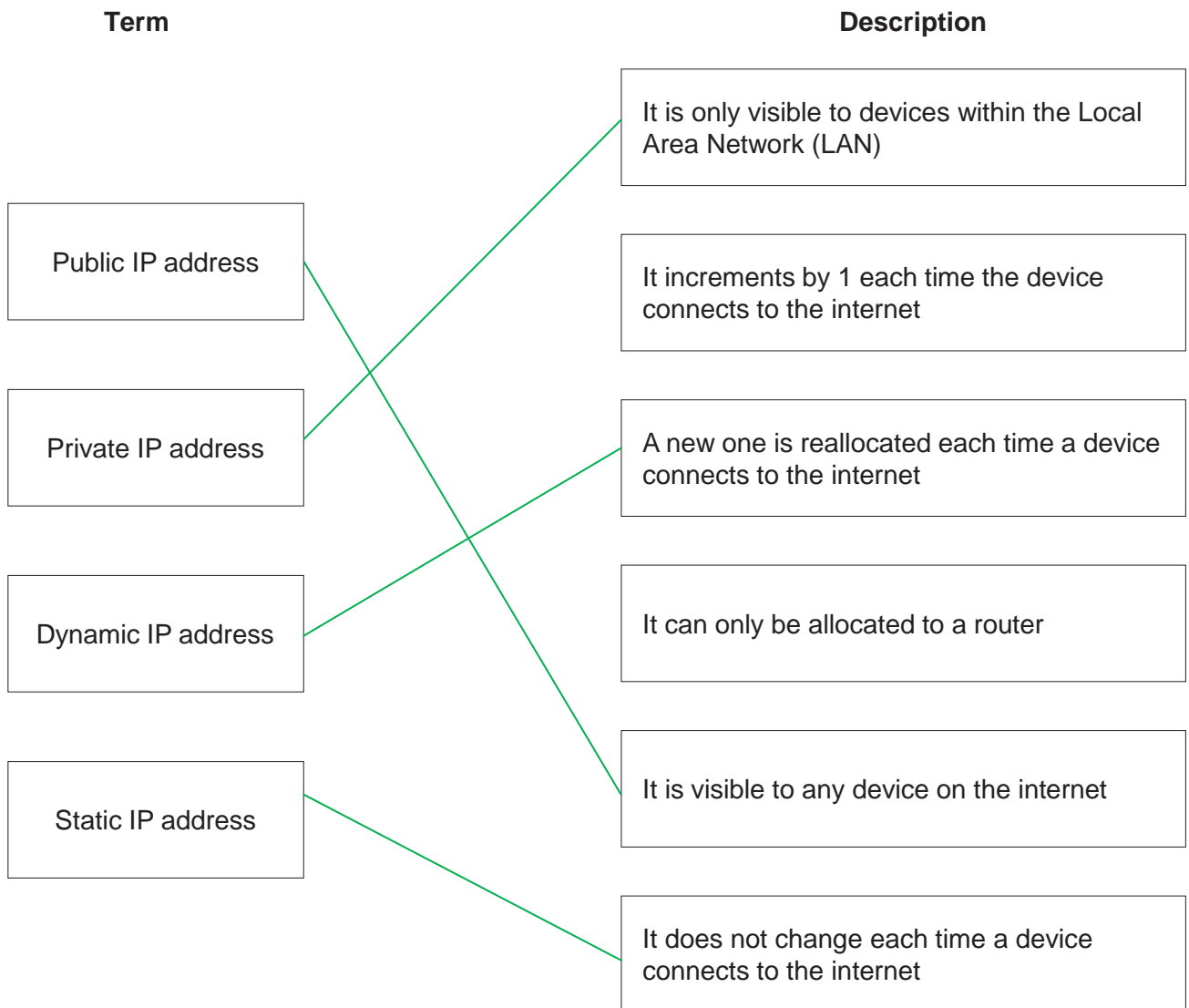
(ii) Give **two** drawbacks of Seth using cloud computing.

- 1 **If Internet becomes unavailable, you cannot access your data.**
- 2 **You cannot be sure of the security of the data, when the data is not with you.**

.....

[2]

(d) Draw **one** line from each term to its **most appropriate** description.



[4]

6 A computer uses the ASCII character set.

- (a) State the number of characters that can be represented by the ASCII character set and the extended ASCII character set.

ASCII character set has 128 characters.

Extended ASCII **character set has 256 characters**

[2]

- (b) Explain how a word such as 'HOUSE' is represented by the ASCII character set.

**The ASCII character set provides a unique binary code for each character. The relevant code for each letter is used for 'H', 'O', etc to make the word 'HOUSE'**  
 ..... [2]

- (c) Unicode is a different character set.

The Unicode value for the character '1' is denary value 49.

- (i) Write the hexadecimal value for the Unicode character '1'.

**31 (hex)**

[1]

- (ii) Write the denary value for the Unicode character '5'.

**53 (denary)**

[1]

7 Jennifer is writing a computer program for her A Level homework.

(a) Jennifer uses a program library to help her write her computer program.

Describe how a program library can be used while writing a computer program.

**A program library has already written and tested program modules which are useful. Instead of writing her own routines (modules), Jennifer can 'import' and use them in her program.**

..... [2]

(b) Jennifer uses an Integrated Development Environment (IDE) to write her computer program.

(i) The IDE allows Jennifer to use both an interpreter and a compiler while creating her computer program.

Describe the ways in which Jennifer can use **both** a compiler **and** an interpreter while developing the program.

**Interpreter:**

**Jennifer can use an interpreter at the initial stage of writing the program.**

**With interpreter it is easy to test a program even before it's completed.**

**Interpreter lets you stop a program and check for variable values at any point and find where an error takes place.**

**Compiler:**

**She can use a compiler to create the executable file when the program is completed.**

**Then she can run the executable file several times without re-interpreting or re-compiling, for testing the program.**

..... [4]

(ii) Identify **two** debugging tools that a typical IDE can provide.

**1 It provides breakpoints**

**2 It can also provide a facility to step through the program, for debugging purposes.**

[2]

8 A company has several security measures in place to prevent unauthorised access to the data on its computers.

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

**The security of data is involved in keeping the data safe against loss.  
Privacy of data ensures the data would not fall into unauthorized hands.**

..... [2]

(b) Each employee has a username and password to allow them to log onto a computer. An employee’s access rights to the data on the computers is set to either read-only, or read and write.

Identify **one** other software-based measure that could be used to restrict the access to the data on the computers.

**Another software-based method is two factor authentication, where the user’s phone number or email address can be used to confirm that it is the genuine user.**

..... [1]

(c) The company is also concerned about threats posed by networks and the internet.

Identify **two** threats to the data that are posed by networks and the internet.

Threat 1 **Malware such as virus, spyware, etc.**

Threat 2 **Hacking also can be a threat to the security of the data.**

..... [2]

