Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4158944315

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 2022**

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 **16** pages. Any blank pages are indicated.

1 Text and numbers are examples of data stored in a computer.

(a) A character set is used to represent characters in a computer.

(i) Describe what is meant by a **character set**.

All of the characters/symbols that the computer can use/represent

Each character has a unique number/binary number/hexadecimal number

[2]

(ii) Identify **two** character sets and state **one** difference between them.

Character set 1 ASCII / Extended ASCII / UNICODE

Character set 2 ASCII has 7 bits whereas UNICODE has 16 bits

Difference Extended ASCII has 8 bits whereas UNICODE has 16 bits

ASCII has 7 bits whereas extended ASCII has 8 bits

[3]

(iii) Describe how lossless compression can be used to reduce the file size of a text file.

Can use run-length encoding

Identifies groups of repeated characters ... replaces them with one copy

of the character and the number of times it occurs

[2]

(iv) Explain why lossy compression should **not** be used on a text file.

None of the original data can be lost / deleted

The (text) file would be corrupted // the (text) file cannot be opened

[2]

(b) A computer can represent numerical data in different forms.

Complete the table by writing the answer to each statement.

Statement	Answer
The hexadecimal value 11 represented in denary	17
The smallest denary number that can be represented by an unsigned 8-bit binary integer	0
The denary number 87 represented in Binary Coded Decimal (BCD)	1000 0111
The denary number 240 represented in hexadecimal	F0
The denary number –20 represented in 8-bit two's complement binary	1110 1100

[5]

Working space

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2 **(a)** The Fetch-Execute (F-E) cycle is represented in register transfer notation.

Describe each of the given steps.

Step	Description
PC ← [PC] + 1	Address in PC is incremented
MDR ← [[MAR]]	The data in the address held in the MAR is copied to the MDR
MAR ← [PC]	The contents of the PC are copied to the MAR

[3]

(b) Explain how interrupts are handled during the F-E cycle.

Check for interrupt at start/end of an F-E cycle

Priority is checked

If lower priority than current process continue with F-E cycle

If higher priority than current process … state of current process is stored on stack

Location/type of interrupt identified

Appropriate ISR is called to handle the interrupt

When ISR finished, check for further interrupts (of higher priority)

Otherwise load data from stack and continue with next F-E cycle (of process)

[5]

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3 **(a)** The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

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
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

The current contents of main memory are:

Address	
100	101
101	67
102	104
103	100
104	68

Complete the table by writing the value stored in the accumulator after the execution of each instruction.

Instruction	Accumulator
LDM #103	103
LDD 102	104
LDI 103	101

[3]

(b) The instructions in **part (a)** are examples of the data movement group.

Describe **two other** instruction groups.

1 1. Input and output of data

Takes an input from the user // outputs the character of the binary number

2 2. Arithmetic operations

Perform addition and subtraction

3. Unconditional and conditional instructions

Move to another instruction (identified by a label)

[4]

4. Compare instructions

Compare the result to another value

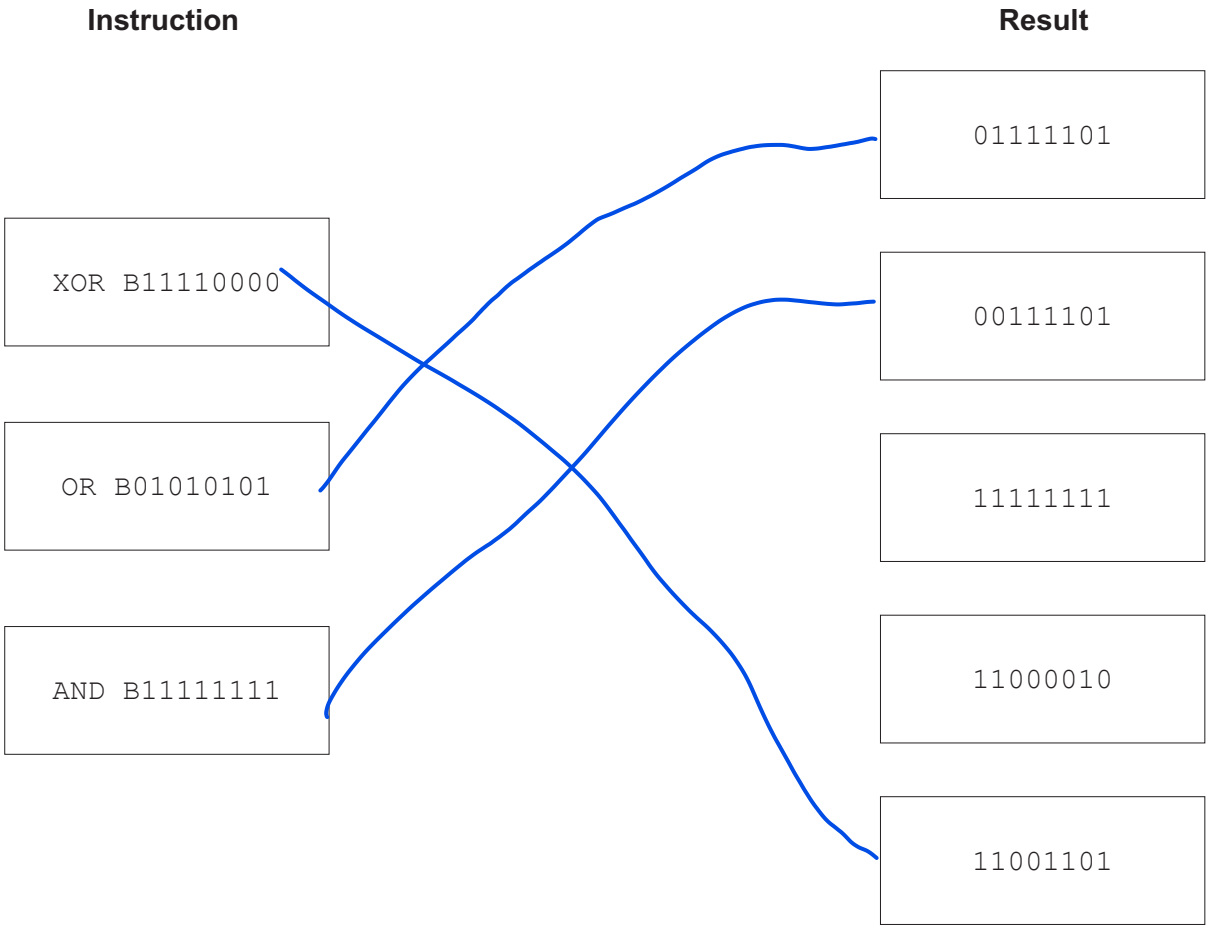
(c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
AND	Bn	Bitwise AND operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the operand
B denotes a binary number, e.g. B01001010		

The binary value `00111101` is stored in the memory address 200.

Each instruction in the diagram is performed on the data in memory address 200.

Draw **one** line from each instruction to its correct result.



[3]

1 mark for identifying task, max 2 for each description Max 2 for only identifying tasks without descriptions

4 A computer has system software including an operating system.

(a) Describe the key management tasks of an operating system.

Memory management

Controls the movement of data between RAM, processor, VM etc

Allocates memory to processes

File management

Creates files/ folders Renames files/folders

Security management

Creates accounts/passwords Provide/upgrade firewall / anti-malware

Hardware management

Receives data from input devices ///sends data to output device

Use of device drivers

Process Management

Decides which process to run next supports multitasking [4]

(b) Utility software is a type of system software.

(i) Describe the purpose of back-up software and defragmentation software.

Back-up software

To make a copy of data at regular intervals

So that if it is lost/corrupted it can be retrieved

Defragmentation software

Make individual files occupy contiguous blocks // move free space together

Improve disk access times // Data/files can be loaded faster

[4]

(ii) Give **one other** example of utility software.

Compression software (Hard) disk formatter Virus checker

Disk analysis software Disk repair software [1]

5 A company wants to store data about its employees in a computer system. The owner of the company wants to ensure the security and integrity of the data.

(a) (i) State why data needs to be kept secure.

To stop the data being lost / corrupted / amended

To make sure it can be recovered To prevent unauthorised access [1]

(ii) One way the data stored in a computer can be kept secure is by using back-up software.

Give **two other** ways the data stored in a computer can be kept secure.

1 Install / run a firewall

Up to date Anti-virus / anti-malware

2 (Username and) (strong) password

Encryption

[2]

(b) The data about the employees is currently stored on paper. The data needs to be transferred into the computer system.

Data validation and verification are used to help maintain the integrity of the data.

(i) Identify **and** describe **one** method of data verification that can be used when transferring the data from paper to the computer.

Method Visual check

Description Manually compare the data entered with the original (document)

Double data entry

Enter the data twice and the system compares them to see if they are the same

[2]

(ii) The company needs to transfer the date of birth of each employee into the computer system.

Give **one** example of how each of the following data validation rules can be used to validate the date of birth when it is entered into the system.

Range check Make sure it is after and before a specific date

Presence check Make sure the date of birth has been entered

Length check Must be 8 characters /

Make sure there are at least 1 for day, 1 for month, 2/4 for year

[3]

(iii) Explain why the data in the system may **not** be correct even after validating and verifying the data.

Validation checks data is reasonable/within bounds it does not check that accurate data has been entered

Verification checks if the data matches the data given it does not check if the original data is accurate

..... [2]

Need to write both of the above points

6 A relational database, TECHNOLOGY, stores data about the staff in a company and the computer devices used by the staff.

The database has the following tables:

STAFF(StaffID, FirstName, LastName, DateOfBirth, JobTitle)

DEVICE(DeviceID, Type, DatePurchased, StaffID)

(a) Describe the relationship between the two tables. Refer to the primary and foreign keys in your answer.

Primary key StaffID in STAFF ... links to foreign key StaffID in DEVICE

One staff member can have many devices

Each device can only be with one member of staff

[4]

(b) The database uses a Data Definition Language (DDL) and Data Manipulation Language (DML).

(i) Complete the SQL script to return the number of devices stored in the database for the staff member with the first name 'Ali' and last name 'Khan'.

```
SELECT COUNT (STAFF.StaffID)
FROM STAFF

INNER JOIN DEVICE
ON STAFF.StaffID = DEVICE.StaffID

WHERE STAFF.FirstName = 'Ali'
AND STAFF.LastName = 'Khan';
```

[4]

(ii) The table `DEVICE` needs a new attribute to store whether the device has been returned by the staff member, or not.

Write a Structured Query Language (SQL) script to insert the new attribute into the table `DEVICE`.

ALTER TABLE DEVICE
ADD Returned Boolean;

[2]

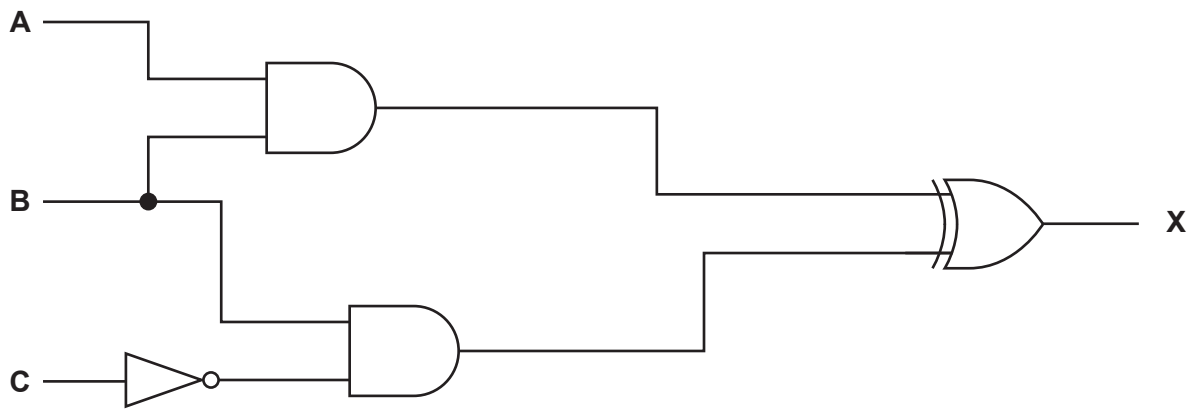
(c) The database is in Third Normal Form (3NF).

Complete the table by describing the three normal forms.

Normal Form	Description
First Normal Form (1NF)	No repeating groups or repeating attributes
Second Normal Form (2NF)	All attributes must be fully dependent on the (composite) primary key // No partial dependencies
Third Normal Form (3NF)	All attributes must be fully dependent on the primary key and no other attributes // no non-key dependencies // no transitive dependencies

[3]

7 **(a)** Write the logic expression for the following logic circuit.



X = (A AND B) XOR (NOT C AND B)

..... [3]

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

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

A	B	C	Working space	X
0	0	0		1
0	0	1		1
0	1	0		1
0	1	1		1
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

[2]

8 A company uses cloud computing.

(a) Define cloud computing.

Accessing a service/files/software on a remote server

[1]

(b) State what is meant by a public cloud and a private cloud.

Public cloud Computing services offered by 3rd party provider over the public Internet

Private cloud Computing services offered either over the Internet or a private internal network

[2]

(c) Give **two** benefits and **one** drawback of using cloud computing.

Benefit 1 Can be accessed anywhere with Internet access

Can have multiple people working on the same document

Benefit 2 Can easily share documents

Do not need to install security // security might be better

Drawback You cannot access it if no internet access

Cannot access if server goes down

[3]

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