



Cambridge International AS & A Level

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COMPUTER SCIENCE

9618/12

Paper 1 Theory Fundamentals

May/June 2023

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 A company has a LAN (local area network).

- (a) Give two benefits of connecting computers to a LAN.

- 1 LAN Allows the sharing of files and data.
 2 LAN Allows sharing of resources like hardware & software.

[2]

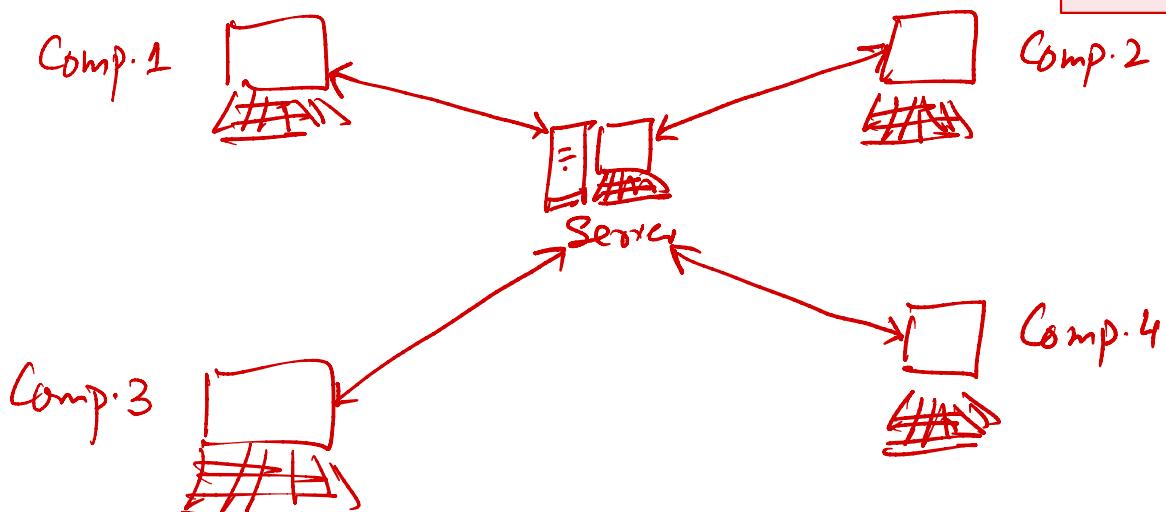
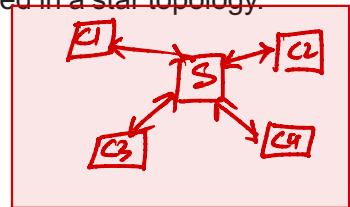
- (b) Give two characteristics of a LAN.

- 1 Covers a small geographical area.
 2 The LAN infrastructure is privately owned.

[2]

- (c) One of the company's offices has one server and four computers connected in a star topology.

Draw a diagram to show the layout of the office's star topology.



[2]

- (d) Computers can be connected using Ethernet.

Describe what is meant by **Ethernet**.

- A protocol for data transmission over wired network.
- It uses CSMA/CD for managing access to the network medium.
- Data is transmitted in frames, each containing source and destination addresses.

[3]

- (e) The network runs as a thick-client model.

Describe what is meant by a **thick-client model**.

1. Processing location: Clients do most of their processing locally.
2. Resource allocation: Most resources are installed locally on clients.

[2]

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- 2 A horse riding school uses a database, Lessons, to store data about lesson bookings.

This database is created and managed using a Database Management System (DBMS).

- (a) The table contains names and descriptions of DBMS features and tools.

Complete the table by writing down the missing names and descriptions.

Name	Description
Data dictionary	Metadata about the database.
Query processor	Executes queries written in SQL.
Logical Schema	A model of a database that is not specific to one DBMS.
Developer Interface	A software tool that allows the user to create items such as tables, forms and reports.

[4]

- (b) Explain the reasons why referential integrity is important in a database.

1. Data consistency

2. Relational rules enforcement

3. Query Accuracy

[3]

- (c) The database Lessons has the following tables:



Dates in this database are stored in the format `#DD/MM/YYYY#`.

The fields RiderLevel and HorseLevel can only have the values: Beginner, Intermediate or Advanced.

- (i) Describe two methods of validating the field RiderLevel.

1. Presence check; to make ^{sure} field is not left blank.

2. Existing check; to make sure data entered is out
of 3 given values.

[2]

- (ii) Write a Structured Query Language (SQL) script to return the names of all the horses that have the horse level intermediate or beginner.

```

SELECT Name
FROM HORSE
WHERE HorseLevel IN ('Intermediate', 'Beginner');
    WHERE HorseLevel = 'Intermediate'
    OR HorseLevel = 'Beginner';
    
```

[4]

COUNT()

- (iii) The following SQL script should return the **number of riders** that have the rider level beginner and have a lesson booked on #09/09/2023 #

```
*   SELECT SUM(STUDENT.RiderLevel) AS NumberOfRiders
      FROM STUDENT, LESSON
 * WHERE STUDENT.1 StudentID = LESSON.1 StudentID
 * AND PK FK
 * OR Date = #09/09/2023#
 * AND STUDENT.RiderLevel = "Beginner";
```

There are **four** errors in the script.

Identify **and** correct each error.

1

.....

2

.....

3

.....

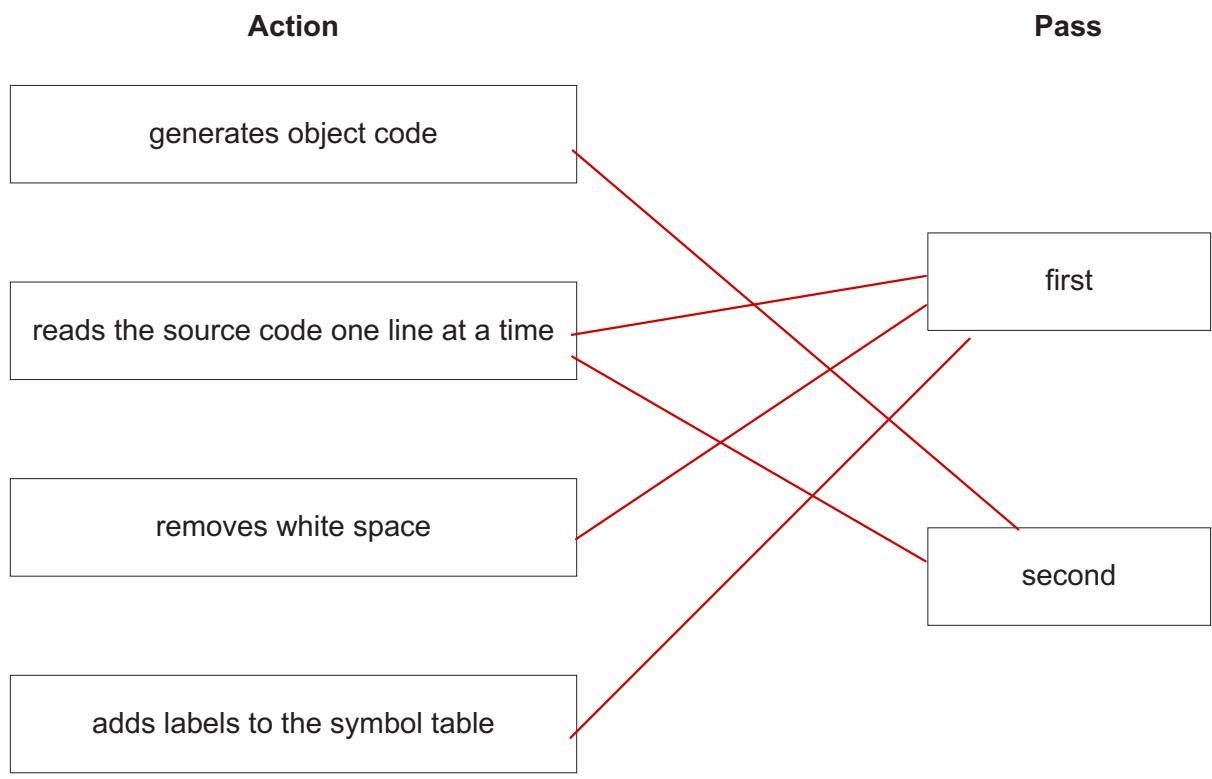
4

[4]

3 A program is written in assembly language.

(a) The program is converted into machine code by a two-pass assembler.

Draw **one or more** lines to identify the pass or passes in which each action takes place.



[3]

(b) Assembly language statements can use different modes of addressing.

Complete the following description of addressing modes.

LDD 205 Direct addressing is when the operand holds the memory address of the data.

LDI 85 Indirect addressing is when the operand holds a memory address that stores the memory address of the data.

LDM #20 Immediate addressing is when the operand is the data.

[3]

B00010100
814

- 4 Data in a computer is stored in binary form.



- (a) State the number of unique binary values that can be represented in 16 bits.

$$\boxed{2^{16}} = \boxed{65536} \quad [1]$$

- (b) Give the 8-bit one's complement representation of the denary number -120.

Show your working.

Working $01111000 \rightarrow$ Inverse all bits
 One's Comp: $10000111 \leftarrow$

Answer 10000111

[2]

- (c) Convert the hexadecimal number A04 into denary.

Show your working.

Working $A \quad 0 \quad 4 \rightarrow$ Hex to Bin
 $1010 \quad 0000 \quad 0100 \leftarrow \rightarrow$ Bin to Den.
 $2048 + 512 + 4 = 2564 \leftarrow$

Answer 2564

[2]

- (d) Show the result of a 2-place left logical shift on the binary number:

$\leftarrow 01001111 \leftarrow$

$00111100 \quad [1]$

- 5 A student has purchased a new laptop.

- (a) The laptop is designed using the Von Neumann model for a computer system.

Identify **two** types of signal that a control bus can transfer.

1	Timing	Read
2	Interrupt	Write

[2]

- (b) Describe **two** ways the hardware of a laptop can be upgraded to improve the performance and explain how each upgrade improves the performance.

- 1 **Increase RAM (Memory Upgrade):**

Allows more programs to run simultaneously without slowing down, as more apps can be kept in the faster RAM

- 2 **Increase the number of cores: More instruction in parallel can be executed.**

[4]

(c) Peripherals are connected to the laptop using ports.

- (i) A printer is connected to a Universal Serial Bus (USB) port.

Describe how data is transmitted through a USB port.

Data is transmitted serially (bit by bit) through USB ports.

[1]

- (ii) A monitor is connected to the laptop using a different type of port.

Identify **one** other type of port that can be used to connect the monitor.

HDMI ✓ (Display port) X

[1]

(d) The laptop has systems software.

- (i) Describe how the Operating System (OS) manages processes in the computer.

Process management Tasks:

1. *Scheduling: Determining the order & time each process runs.*
2. *Resource allocation: Allocates necessary resources, like CPU time, memory, and I/O devices.*
3. *Process isolation: Ensures that processes don't interfere with each other.*
4. *Multitasking: Enables several processes to work simultaneously or it appears like that.*

[5]

- (ii) Describe the purpose of utility software in a computer.

1. System Optimisation

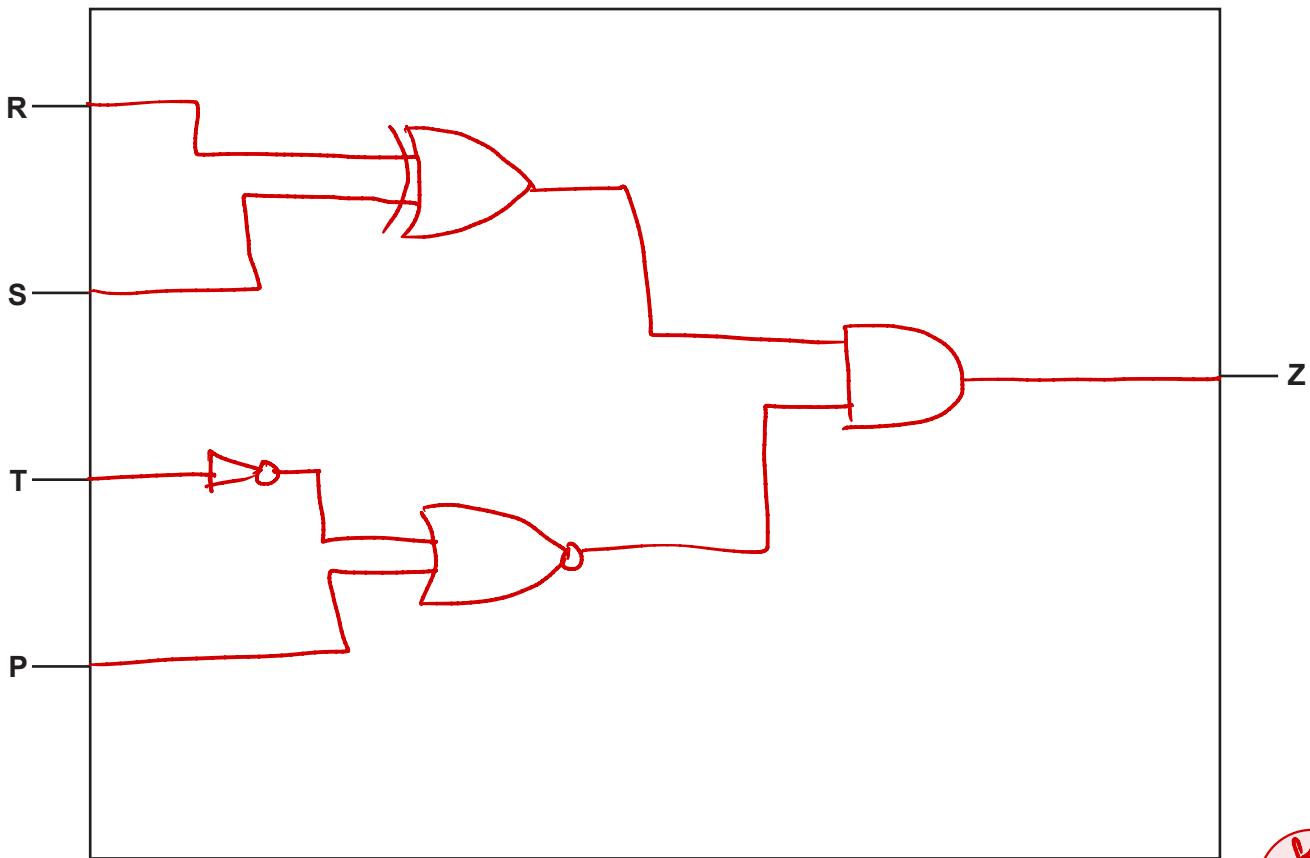
2. System Maintenance

3. Configuration and analysis.

[2]

- 6 (a) Draw the logic circuit for this logic expression:

$$Z = (\underline{R \text{ XOR } S}) \text{ AND } (\underline{\text{NOT } T \text{ NOR } P})$$



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

$$Z = (\underline{\text{NOT } P \text{ OR } Q}) \text{ XOR } (\underline{R \text{ NOR } Q})$$

$P'P$	Q	R	Working space		Z
0 1	0	0	1	1	0
0 1	0	1	1	0	1
0 1	1	0	1	0	1
0 1	1	1	1	0	1
1 0	0	0	0	1	1
1 0	0	1	0	0	0
1 0	1	0	1	0	1
1 0	1	1	1	0	1

[2]

7 A software developer is working in a team writing a program for a client.

(a) The developer is writing a new program library to be used by the other team members.

(i) Define the term **program library**.

A set of pre-written, precompiled, and pre-tested subroutines, which can be 'called in' other programs.

[2]

(ii) Explain **two** benefits to the developer of choosing to create a Dynamic Link Library (DLL).

1. Memory efficiency : Reduces main memory requirements for programs.

2. Smaller Executable Size: The executable file size is smaller.

3. Ease of maintenance

4. Shared use.

[4]

(b) The development team needs to use a translator whilst writing the program for the client.

Identify whether an interpreter or a compiler would be more appropriate at this stage of the program development.

Justify your choice.

Translator *Interpreter*

Justification *1. Realtime testing & debugging
2. Development flexibility.
3. Feedback efficiency.*

[3]

- (c) The development team uses an Integrated Development Environment (IDE).

Complete the table by describing the typical features found in an IDE.

Feature	Description
Breakpoints	Allows pausing the execution of the program at specific points.
Dynamic syntax checks	Automatically checks the code for syntax errors as it is written.
Context-sensitive prompts	Provides code suggestions based on the current context.
Single stepping	Runs/executes the program one line at a time.

[4]

- (d) One section of the program being developed will convert user's speech into commands.

Explain how Artificial Intelligence (AI) can be used in this program.

- * **Speech recognition:** AI interprets spoken words and phrases.
- * **Commands matching:** AI uses learned patterns or databases to translate recognised speech into commands.
- * **Adaptive learning:** AI can adapt and improve its recognition and response capabilities based on user interactions and corrections.

[3]

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