Computer Science Paper 1
Short Answer and Data Response
Model Paper 2025

Time Allowed: 2 hours 20 minutes
Total Marks: 90

You must answer on the question paper.

You must bring a soft pencil (preferably type B or HB), a clean eraser, and a dark blue or black pen. You may use a simple calculator if needed.

Before attempting the paper, write your name, candidate number, centre name, and centre number clearly in the designated spaces.

Instructions for Candidates

- Answer all questions.
- Write your answer to each question in the space provided.
- You must show all necessary working clearly.
- Do not use an erasable pen or correction fluid.
- Avoid writing over any bar codes printed on the paper.

Information for Candidates

- This paper consists of a total of **90 marks**.
- The number of marks assigned for every question or its parts is indicated within brackets [ ].

Please read all questions carefully and follow the instructions exactly to ensure your responses are properly evaluated.

Q1.

a. A PNG image is compressed before uploading to a website.

Explain how lossless compression works and give one advantage of using it over lossy compression. [3]

b. An image has a resolution of 800 × 600 pixels and a color depth of 24 bits.

Calculate the file size in kilobytes (KB), and megabytes (MB). [4]

File size: _____ KB File size: _____ MB

c. Convert the hexadecimal number B7F into:

i. Binary

ii. Denary [4]

d. What is meant by the term overflow in binary addition? Show it using two 8-bit numbers. [4]

Q1 TOTAL MARKS: 15

Q2. Consider a logic statement.

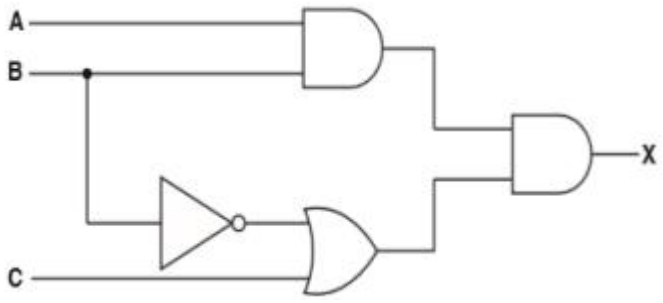
X = 1 (A is NOT 1AND B is 1) OR (A is NOT 1 AND C is NOT 1)OR (B is 1 AND C is 1)

a. Draw a logic circuit to represent the given logic statement. [4]

b. Fill out the truth table for the provided logic statement. [4]

A	B	C	WORKING SPACE	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

c. Write the logical statement of the given logic circuit. [2]



Q2 TOTAL MARKS: 10

Q3. A city government is exploring how to incorporate AI technologies to improve urban living, including traffic management, public safety, and citizen services. [8]

a. Identify and describe four real-world applications of AI that can be used in daily urban life.
Focus on areas like smart assistants, traffic systems, healthcare, or shopping platforms.

	AI Application	**How it is used in daily life**
1.		
2.		
3.		
4.		

b. Complete the following tasks:

i. Explain how a simple rule-based AI system works. Use an example like *IF temperature > 30 THEN turn on fan*. [2]

_____
_____
_____
_____

ii. State two key differences between automation and AI. [2]

_____
_____
_____
_____

iii. Give one example each of human intelligence and machine intelligence in solving the same type of task. [2]

_____
_____
_____
_____

Q3 TOTAL MARKS: 14

Q4. A company that manufactures medical devices has deployed robotic systems to carry out delicate assembly and inspection tasks. These robots are integrated with sensors, microprocessors, and actuators, and work in real-time using feedback to improve accuracy.

a. Identify and describe four key characteristics of these robots that enable them to perform complex, repetitive tasks with speed and precision in a high-tech manufacturing environment. [8]

	Robot Feature	**Description and Role in Manufacturing**
1.		
2.		

3.		
4.		

b. A team of engineers is designing a communication system for a smart city. As part of the design, they must decide which data transmission mode**,** Simplex**,** Half-Duplex**,** or Full-Duplex is most suitable for different applications like traffic sensors, public safety devices, and two-way communication systems.
The table below lists several statements related to these data transmission modes.
Place a ✓ tick **i**n the appropriate column to show whether each statement applies to Simplex**,** Half-Duplex**,** or Full-Duplex communication. [5]

Statement	**Simplex**	**Half-Duplex**	**Full-Duplex**
Communication occurs in one direction only.			
Both devices can send and receive, but not at the same time.			
Supports simultaneous two-way communication.			
Used in walkie-talkie and push-to-talk systems.			
Commonly used in modern telecommunication systems like mobile phones			

Q4 TOTAL MARKS: 13

Q5. A team of students is preparing a presentation about how various components of a computer system work together , from memory to storage to processing.
a. The performance of a CPU is affected by multiple technical factors.
(i) Name **two** such factors.
(ii) Explain how each one impacts performance. [4]

	Factor	**Impact on Performance**
1.		
2.		

b. Consider the types of computer memory. Complete the table below by identifying the memory type described in each case. [3]

Description	**Memory Type**
Stores instructions permanently and is not lost when power is off.	
Temporarily holds data currently being processed.	
Extends RAM using storage when RAM is full.	

c. Match each storage type with its main feature or use. [3]

Storage Type	Main Characteristic
1. Optical Storage	a. Durable and fast, no moving parts
2. Magnetic Storage	b. Uses lasers to read/write data
3. Solid-State Drive	c. Common in hard drives, with spinning disks

d. List three examples of embedded systems used in daily life and briefly describe their use. [3]

1. _____
2. _____
3. _____

Q5 TOTAL MARKS: 13

Q6.A teacher gave students a list of programming terms related to algorithm design and asked them to match the correct term to its definition.

a. Choose the correct term from this list: [6]

Selection	Counting Pattern	Decomposition
Boolean Operator	Sequence	Abstraction

i. Breaking a complex problem into smaller, manageable parts.
Term: _____
ii. Removing unnecessary details to focus on what's relevant.
Term: _____
iii. Instructions that are executed in the order they appear.
Term: _____
iv. A programming structure used to make decisions in code.
Term: _____
v. A logical condition such as AND, OR, or NOT.
Term: _____
vi. A common algorithmic structure used to keep track of repetitions.
Term: _____

b. A pseudo code segment is written to input 20 numbers, count how many are even, and display the result. However, it contains 4 logical or syntax errors:

```
01 EvenCount ← 0
02 FOR x FROM 1 TO 20
03     OUTPUT "Enter a number:"
04     INPUT Num[x]
05     IF Num MOD 2 = 0 THEN
06         EvenCount = EvenCount + 1
07     END IF
08 NEXT x
09 OUTPUT "Total even numbers is" EvenCount
```

Identify the line numbers with the errors and suggest a correction for each: [4]

- Error 1 – Line number: _____

Correction: _____

- Error 2 – Line number: _____

Correction: _____

- Error 3 – Line number: _____

Correction: _____

- Error 4 – Line number: _____

Correction: _____

Q6 TOTAL MARKS: 10

Q7a. Describe three different types of malware and explain how each one can affect a computer system. Include the method of attack and its impact. [6]

_____
_____
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_____
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_____
_____
_____
_____

b. Match each of the following protocols with its correct function: [3]

Protocols	Functions
HTTP	Retrieves emails from a server
SMTP	Transfers email messages between servers
POP	Transfers unsecured web pages

c. Discuss one advantage and one disadvantage of a star topology and a mesh topology. [4]

_____
_____
_____
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d. Define what is meant by an embedded system and provide two real-world examples of embedded systems. [2]

_____
_____
_____
_____

Q7 TOTAL MARKS: 15

Computer Science Paper 1
Marking Scheme and Answer key
Short Answer and Data Response
Model Paper 2025

Q1a. Explain how lossless compression works and give one advantage of using it over lossy compression. **[3]**

Answer:

Lossless compression reduces file size without losing any data.
The original file can be perfectly reconstructed from the compressed file.
Advantage: No data is lost, which is important for images where quality matters (e.g., medical images).

Marking scheme:

2 marks for explaining the working of lossless compression. (at least two points required)
1 mark for its advantage

b. An image has a resolution of 800 × 600 pixels and a color depth of 24 bits.
Calculate the file size in kilobytes (KB), and megabytes (MB). **[4]**

Answer:

Total pixels = 800 × 600 = 480,000
Total bits = 480,000 × 24 = 11,520,000 bits
Convert to bytes: 11,520,000 ÷ 8 = 1,440,000 bytes
Convert to KB: 1,440,000 ÷ 1024 = 1406.25 KB
Convert to MB: 1406.25 ÷ 1024 ≈ 1.37 MB

Marking scheme:

1 mark for converting into bits
1 mark for converting into bytes
1 mark for converting into KB
1 mark for converting into MB

c. Convert the hexadecimal number B7F into: **[4]**
i. Binary
ii. Denary

Answer:

Binary: B = 1011, 7 = 0111, F = 1111 → 101101111111
Denary: $(11\times16^2) + (7\times16^1) + (15\times16^0) = 2816 + 112 + 15 = 2943$

Marking scheme:

2 marks for converting hexadecimal into Binary
2 marks for converting hexadecimal into Denary

d. What is meant by the term overflow in binary addition? Show it using two 8-bit numbers. **[4]**

Answer:

Overflow occurs when the result of a binary addition exceeds the maximum value the register can hold.
Example:
11110000 (240)
+ 11110000 (240)
= 111000000 (480) → 9 bits, overflow since only 8 bits are allowed

Marking scheme:

2 marks for defining term overflow
2 marks for showing it through example

Q1 TOTAL MARKS: 15

Q2. Consider a logic statement.

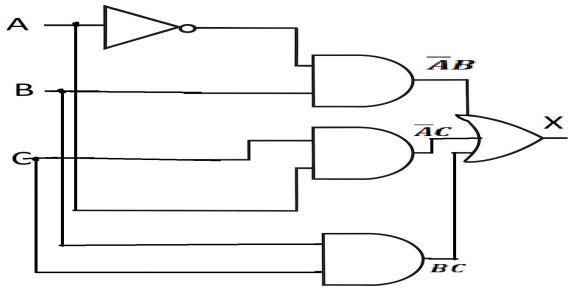
X = 1 (A *is NOT* 1 *AND* B *is* 1) *OR* (A *is NOT* 1 *AND* C *is NOT* 1) OR (B *is* 1 *AND* C *is* 1)

a. Draw a logic circuit to represent the given logic statement. [4]

Answer:

$X = \overline{A}B + \overline{A}C + BC$

Logic gates used: NOT, AND, OR



Marking scheme:

1 mark for correctly using NOT gate
1 mark for correctly using AND gates (all three required)
1 mark for correctly using OR gate(s) (at least one required)
1 mark for correct connections of the inputs and gates

b. Fill out the truth table for the provided logic statement. [4]

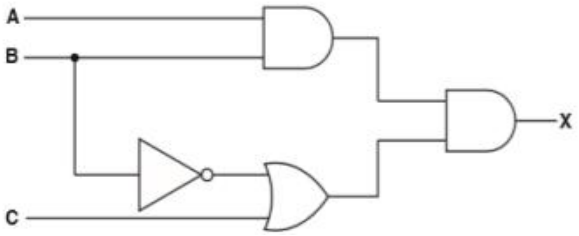
Answer:

A	B	C	$\overline{A}B$	$\overline{A}C$	BC	X
0	0	0	0	0	0	0
0	0	1	0	1	0	1
0	1	0	1	0	0	1
0	1	1	1	1	1	1
1	0	0	0	0	0	0
1	0	1	0	0	0	0
1	1	0	0	0	0	0
1	1	1	0	0	1	1

Marking scheme:

1 mark for correctly completing the column for $\overline{A}B$
1 mark for correctly completing the column for $\overline{A}C$
1 mark for correctly completing the column for BC
1 mark for correctly completing the output column for X

c. Write the logical statement of the given logic circuit. [2]



Answer:

$X = AB.(\overline{B} + C)$

Marking scheme:

1 mark for correctly writing the terms for AND gates
1 mark for correctly writing the term for OR gate

Q2 TOTAL MARKS: 10

Q3. A city government is exploring how to incorporate AI technologies **to improve urban living, including traffic management, public safety, and citizen services.**

a. Identify and describe four real-world applications of AI that can be used in daily urban life.[8]
Focus on areas like smart assistants, traffic systems, healthcare, or shopping platforms.
Answer:
1. Smart Assistants: Used for voice commands, reminders, and automation at home.
2. AI in Traffic Systems: Adaptive traffic lights, congestion prediction, and smart routing.
3. Healthcare AI: Predictive diagnostics, medical imaging analysis.
4. Shopping Platforms: Personalized recommendations, chatbots for customer service.

Marking scheme:
1 mark each for identifying AI application (four required)
1 mark each for describing AI application (four required)

b. Complete the following tasks: [2]
i. Explain how a simple rule-based AI system works. Use an example like *IF temperature > 30 THEN turn on fan*.
Answer:
Rule: IF motion_detected = true THEN turn on lights.
Explanation:
The system checks for motion using a sensor.
If motion is detected (i.e., someone enters the room), the system automatically turns on the lights.
Marking scheme:
1 mark for defining rule
1 mark for its explanation

ii. State two key differences between automation and AI. **[2]**
Answer:
1. Automation follows pre-programmed rules but AI can learn and adapt.
2. AI handles unstructured problems but automation is task-specific.

Marking scheme:
1 mark for each difference (two required)

iii. Give one example each of human intelligence and machine intelligence in solving the same type of task. [2]
Answer:
Task: Translating a document.
Human: Uses context and culture.
Machine: Uses trained data patterns.
Marking scheme:
1 mark for human intelligence
1 mark for machine intelligence

Q3 TOTAL MARKS: 14

Q4. A company that manufactures medical devices has deployed robotic systems to carry out delicate assembly and inspection tasks. These robots are integrated with sensors, microprocessors, and actuators, and work in real-time using feedback to improve accuracy.

a. Identify and describe four key characteristics of these robots that enable them to perform complex, repetitive tasks with speed and precision in a high-tech manufacturing environment. [8]

Answer:

1. Sensors: detect environment, improve precision.
2. Microprocessors: control logic and processing.
3. Actuators: enable movement and task performance.
4. Feedback Systems: adjust in real-time for accuracy.

Marking scheme:

1 mark each for identifying robot feature (four required)
1 mark each for describing its characteristics (four required)

b. A team of engineers is designing a communication system for a smart city. As part of the design, they must decide which data transmission mode, Simplex, Half-Duplex, or Full-Duplex is most suitable for different applications like traffic sensors, public safety devices, and two-way communication systems.

The table below lists several statements related to these data transmission modes.

Place a ✓ tick in the appropriate column to show whether each statement applies to Simplex, Half-Duplex, or Full-Duplex communication.

[5]

Answer:

Statement	Simplex	Half-Duplex	Full-Duplex
Communication occurs in one direction only.	✔		
Both devices can send and receive, but not at the same time.		✔	
Supports simultaneous two-way communication.			✔
Used in walkie-talkies and push-to-talk systems.		✔	
Commonly used in modern telecommunication systems like mobile phones			✔

Marking scheme:

1 mark each for correctly marking tick in the correct box (all five required)

Q4 TOTAL MARKS: 13

Q5a. A team of students is preparing a presentation about how various components of a computer system work together, from memory to storage to processing.

The performance of a CPU is affected by multiple technical factors.

(i) Name two such factors.

(ii) Explain how each one impacts performance. [4]

Answer:

1. Clock Speed: Higher speed means more instructions per second.
2. Number of Cores: More cores allow parallel processing.

Marking scheme:

1 mark each for naming factor (two required)
1 mark each for explaining its impact (two required)

b. Consider the types of computer memory. Complete the table below by identifying the memory type described in each case. [3]

Answer:

Description	Memory Type
Stores instructions permanently and is not lost when power is off.	ROM
Temporarily holds data currently being processed.	RAM
Extends RAM using storage when RAM is full.	Cache

Marking scheme:

1 mark each for identifying correct memory (three required)

c. Match each storage type with its main feature or use. [3]

Answer:

Storage Type	Main Characteristic
1. Optical Storage	b. Uses lasers to read/write data
2. Magnetic Storage	c. Common in hard drives, with spinning disks
3. Solid-State Drive	a. Durable and fast, no moving parts

Marking scheme:

1 mark each for correct matchin (three required)

d. List three examples of embedded systems used in daily life and briefly describe their use. [3]

Answer:

1. Microwave – Controls timing and heating
2. Washing Machine – Manages wash cycle
3. Smartwatch – Tracks health and notifications

Marking scheme:

1 mark each for correct example of embedded systems (three required)

Q5 TOTAL MARKS: 13

Q6.A teacher gave students a list of programming terms related to algorithm design and asked them to match the correct term to its definition.

a. Choose the correct term from this list: [6]

Selection	Counting Pattern	Decomposition
Boolean Operator	Sequence	Abstraction

Answer:

i. Breaking a complex problem into smaller, manageable parts.
Term: Decomposition
ii. Removing unnecessary details to focus on what's relevant.
Term: Abstraction
iii. Instructions that are executed in the order they appear.
Term: Sequence
iv. A programming structure used to make decisions in code.
Term: Selection

v. A logical condition such as AND, OR, or NOT.
Term: Boolean Operator
vi. A common algorithmic structure used to keep track of repetitions.
Term: Counting Pattern
Marking scheme:
1 mark each for writing correct term (six required)

b. A pseudo code segment is written to input 20 numbers, count how many are even, and display the result. However, it contains 4 logical or syntax errors:

```
01 EvenCount ← 0
02 FOR x FROM 1 TO 20
03    OUTPUT "Enter a number:"
04    INPUT Num[x]
05    IF Num MOD 2 = 0 THEN
06       EvenCount = EvenCount + 1
07    END IF
08 NEXT x
09 OUTPUT "Total even numbers is" EvenCount
```

Identify the line numbers with the errors and suggest a correction for each: [4]
Answer:

- Error 1 – Line number: 4

Correction: Num[x] → Num (indexing not needed)

- Error 2 – Line number: 5

Correction: Num MOD 2 = 0 → Num MOD 2 = 0 THEN (syntax)

- Error 3 – Line number: 6

Correction: EvenCount = EvenCount + 1 → Use ← instead of =

- Error 4 – Line number: 9

Correction: String concatenation missing → '...is ' & EvenCount
Marking scheme:
1 mark each for identifying and correcting an error (four required)

Q6 TOTAL MARKS: 10

Q7a. Describe three different types of malware and explain how each one can affect a computer system. Include the method of attack and its impact. [6]
Answer:
1. Virus
Method of Attack:
A virus attaches itself to legitimate files or programs. It spreads when the infected file is opened or executed.
Impact:
It can corrupt or delete files, slow down system performance, or crash the entire system. It may also spread to other computers via email or USB drives.
2. Trojan Horse
Method of Attack:
A Trojan disguises itself as a harmless or useful program (like a fake game or software installer). Users are tricked into downloading and running it.
Impact:
It gives attackers remote access to the system, allowing them to steal data, install more malware, or control the computer without the user knowing.

3. Ransomware

Method of Attack:

Ransomware typically spreads through malicious email attachments or links. Once opened, it encrypts the user's files.

Impact:

The victim is locked out of their data and asked to pay a ransom (usually in cryptocurrency) to regain access. Even after payment, recovery is not guaranteed.

Marking scheme:

1 mark each for describing malware's attack (three required)

1 mark each for describing malware's impact (three required)

b. Match each of the following protocols with its correct function: [3]

Answer:

Protocols	Functions
HTTP	Transfers unsecured web pages
SMTP	Transfers email messages between servers
POP	Retrieves emails from a server

Marking scheme:

1 mark each for correct matching (three required)

c. Discuss one advantage and one disadvantage of a star topology and a mesh topology. [4]

Answer:

Star Advantage: Easy to troubleshoot

Star Disadvantage: Hub failure affects all

Mesh Advantage: Redundancy and reliability

Mesh Disadvantage: Expensive and complex

Marking scheme:

1 mark for correctly writing advantage of star topology

1 mark for correctly writing disadvantage of star topology

1 mark for correctly writing advantage of mesh topology

1 mark for correctly writing disadvantage of mesh topology

d. Define what is meant by an embedded system and provide two real-world examples of embedded systems. [2]

Answer:

A specialized computer system within a larger device.

Examples: ATM machine, Smart Refrigerator

Marking scheme:

1 mark for correctly defining embedded system

1 mark for correctly giving two examples

Q7 TOTAL MARKS: 15

Ziauddin Examination Board SSC (Advanced Level)

Computer Science Paper 1

Table of Specification (ToS)

No.	TOPICS	Question No. in model paper	AO	Total Marks
1	SYSTEMS ARCHITECTURE	3a	AO3	8
		3b	AO1	6
		4a	AO3	8
		5a	AO1	4
		5b	AO1	3
		5c	AO1	3
		5d	AO1	3
		7a	AO1	6
		7b	AO1	3
		7c	AO2	4
		7d	AO3	2
2	ALGORITHMS, PROGRAMMING AND LOGIC	2a	AO2	4
		2b	AO3	4
		2c	AO2	2
		6a	AO1	6
		6b	AO3	4
3	DATA REPRESENTATION	1a	AO1	3
		1b	AO2	4
		1c	AO2	4
		1d	AO1	4
		4b	AO1	5
Total Marks				**90**

ZUEB Criteria (Revised)			
AO	**Assessment Objectives**	**%**	**Marks**
AO1	Knowledge & Understanding	50%	45
AO2	Application	20%	18
AO3	Analysis & Evaluation	30%	27
Total			**90**

Model paper evaluation	
AO1	46
AO2	18
AO3	26
Total	**90**