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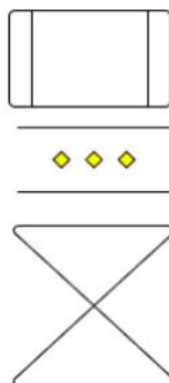


Department of Examinations, Sri Lanka

G.C.E. (A/L) Examination – 2025

20 – ICT

Final Mark Scheme



This document has been prepared for the use of marking examiners. Acceptable changes suggested at the Chief Examiner/Additional Chief examiner meetings are to be included in this document.

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1 Instructions

1.1 General instructions

It is compulsory to adhere to the following standard method in marking answer scripts and entering mark sheets:

1. Each Examiner should use a red colour ball-point pen for marking answer scripts.
2. A purple colour ball-point pen should only be used by Chief/Additional Chief Examiners.
3. Code number of the Examiner should be noted down on front page of each answer script. Enter marks in **clear numerals**.
4. Write off incorrectly written numerals with a clear single line and authenticate the alterations with Examiner's initial.

1.2 Marking MCQ answer scripts

1. Marking templates for G.C.E.(A/L) will be provided by the Department of Examinations. Marking examiners bear the responsibility of using correctly prepared and certified templates.
2. Then, check the answer scripts carefully. If there are more than one or no answers marked to a certain question write off the options with a line. Sometimes candidates may have erased an option marked previously and selected another option. In such occasions, if the erasure is not clear write off those options too.
3. Place the template on the answer script correctly. Mark the right answers with a '✓' and the wrong answers with a '×' against the options column. Write down the number of correct answers inside the cage given under each column. Then, add those numbers and write the number of correct answers in the relevant cage.

1.3 Marking structured essay and essay type answer scripts

1. Cross off any pages left blank by candidates.
2. When marking, **underline wrong or unsuitable answers and write cross mark. Point-out areas by a check mark, where marks can be offered.**
3. Use the right margin of the overland paper to write down the marks.
4. Enter the marks of each subsection of a question as a rational number in the given space of Δ and the final marks of each question should be entered as a total rational number in the given space of $\square$ by denoting respective question number as well. Use the column assigned for the examiners to write marks. See the illustration below.

Example:

Question No. 03

(i)

.....
.....
.....

✓

$\frac{4}{5}$

(ii)

.....
.....
.....

✓

$\frac{3}{5}$

(iii)

.....
.....
.....

✓

$\frac{3}{5}$

03 (i) $\frac{4}{5} +$ (ii) $\frac{3}{5} +$ (iii) $\frac{3}{5} =$

10
15

5. Write down the marks given for each question against the question number in the relevant cage on the front page in **two digits**. Selection of questions should be in accordance with the instructions given in the question paper. Mark all answers and transfer the marks to the front page, and write off answers with lower marks if extra questions have been answered against instructions.
6. Add the total marks carefully and write in the relevant cage on the front page. Turn pages of answer script and add all the marks given for all answers again. Check whether that total tallies with the total marks written on the front page.
7. **Rounding off of 0.5 marks** should only be done to the **final total for Paper II**.

1.4 Preparation of Mark Sheets

1. The final marks of the two papers will **not** be calculated within the Evaluation Board. Therefore add separate mark sheets for each of the question papers. Enter Paper I marks in “Total Marks” column of the mark sheet and write them in words as well. Enter Paper II marks in the “Total Marks” column and include the relevant details.
2. The final marks for Paper I and Paper II should always be rounded up to the nearest whole number and they should never be kept as decimal or half values.
3. Each page of the mark sheet should be compulsorily verified by the Examiner who entered marks to the mark sheet, Examiner who checked the mark sheet, the Verifying Examiner and the Chief Examiner by placing respective code numbers and the signatures.

2 Examination papers



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සියලුම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
 இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்
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 Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
 General Certificate of Education (Adv. Level) Examination, 2025

තොරතුරු හා සන්නිවේදන තාක්ෂණය I
 தகவல், தொடர்பாடல் தொழினுட்பவியல் I
 Information & Communication Technology I

20 E I

පැය දෙකයි
 இரண்டு மணித்தியாலம்
 Two hours

Instructions:

- * Answer *all* the questions.
- * Write your **Index Number** in the space provided in the answer sheet.
- * Instructions are also given on the back of the answer sheet. Follow those carefully.
- * In each of the questions 1 to 50, pick one of the alternatives from (1), (2), (3), (4), (5) which is *correct or most appropriate* and mark your response on the answer sheet with a cross (X) in accordance with the instructions given on the back of the answer sheet.
- * Use of calculators is *not* allowed.

1. Which of the following best represents the typical life cycle of data?
 - (1) collection → processing → usage → archival → deletion
 - (2) collection → usage → processing → deletion → archival
 - (3) processing → collection → usage → deletion → archival
 - (4) processing → archival → collection → usage → deletion
 - (5) usage → archival → collection → deletion → processing
2. Which of the following is a characteristic of open-source software?
 - (1) Limited customizations
 - (2) Reliance on vendor for updates
 - (3) Usage restricted by the owner
 - (4) Source code not being publicly available
 - (5) Being usually free to acquire and use
3. An online examination system is to alert students if they leave any mandatory questions unanswered before submission of their answers. Which data validation techniques are sufficient for this requirement?
 - (1) Data type check only
 - (2) Data type check and presence check only
 - (3) Data type check and range check only
 - (4) Presence check only
 - (5) Range check only
4. Which of the following best describes a pointing device?
 - (1) It is used to control an indicator on the display.
 - (2) It is used to digitize a scene.
 - (3) It is used to identify characters.
 - (4) It is used to read codes.
 - (5) It is used to select images.
5. Which of the following is a secondary storage device in which the data is written to in a sequential manner and can be read from in a random manner?

(1) CD-R	(2) CD-ROM	(3) Magnetic tape
(4) Solid State Drive	(5) USB flash drive	

[See page two]



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- C – Data Bus

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15. Consider the following two statements P and Q:

P – Data is represented as a sequence of discrete values in a digital signal.

Q – Even with some corruption, a digital signal is easier to correctly interpret than an analog signal.

Which of the following is correct regarding the above two statements?

- (1) Both statements P and Q are correct and the point presented in statement P gives the reason for the point presented in statement Q.
 - (2) Both statements P and Q are correct but the points presented in those two statements are not connected.
 - (3) Statement P is correct but statement Q is incorrect.
 - (4) Statement P is incorrect but statement Q is correct.
 - (5) Both statements P and Q are incorrect.
16. What does the term *attenuation* refer to in signal transmission?
- (1) alteration in the properties of the transmitted signal
 - (2) increase in the signal strength
 - (3) loss of signal energy as it travels over a distance
 - (4) time delay in propagation
 - (5) the received signal makes no meaning
17. In which of the following is the frequency of the carrier signal varied according to the message signal?
- (1) in *amplitude modulation*
 - (2) in *amplitude shift keying*
 - (3) in *frequency modulation*
 - (4) in *frequency shift keying*
 - (5) in *pulse code modulation*
18. Which of the following statements are correct regarding the *bus topology*?
- A – It consists of a main cable with terminators at each end.
B – Devices in the topology are directly connected to each other.
C – Problems occur when multiple nodes try to access the medium at the same time.
- (1) A only
 - (2) A and B only
 - (3) A and C only
 - (4) B and C only
 - (5) All A, B and C
19. Which of the following statements best describes the primary function of a *network switch*?
- (1) It amplifies and regenerates signals to travel over long distances.
 - (2) It connects devices within a LAN and forwards frames based on the MAC addresses.
 - (3) It connects multiple networks together and routes data traffic between them.
 - (4) It encrypts data before transmitting them through the network.
 - (5) It maps domain names into IP addresses.
20. Which of the following statements describe the role of the Media Access Control (MAC) protocol?
- A – It ensures orderly access to a shared communication medium.
B – It finds paths and routes data between network hosts.
C – It provides unique addresses to identify network interfaces within a LAN.
- (1) A only
 - (2) A and B only
 - (3) A and C only
 - (4) B and C only
 - (5) All A, B and C
21. Which of the following ISO/OSI layers is responsible for the establishment and maintenance of an end-to-end reliable connection?
- (1) Application Layer
 - (2) Data link Layer
 - (3) Network Layer
 - (4) Physical Layer
 - (5) Transport Layer

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22. Which of the following is true about *open systems*?

- (1) They operate independently without external software or hardware.
- (2) They limit interoperability to maintain internal control.
- (3) They support interoperability, portability and integration using common standards.
- (4) They improve performance by restricting third-party software and using only proprietary programs.
- (5) They are often incompatible with applications from other platforms.

23. Match the **Systems** labelled from **A1** to **A3** to the corresponding **Descriptions** labelled from **B1** to **B3**.

System
A1 - Decision Support System
A2 - Knowledge Management System
A3 - Enterprise Resource Planning System

Description
B1 - A system that stores and distributes organizational information such as best practices and expertise to employees
B2 - A system that helps managers analyze complex data to identify patterns and make business predictions
B3 - A system that integrates various business processes like accounting, procurement and supply chain operations

- (1) A1 – B1, A2 – B2, A3 – B3
- (2) A1 – B1, A2 – B3, A3 – B2
- (3) A1 – B2, A2 – B1, A3 – B3
- (4) A1 – B2, A2 – B3, A3 – B1
- (5) A1 – B3, A2 – B2, A3 – B1

24. Which of the following system development lifecycle models facilitate iterative development and accommodate changing requirements?

- A – Spiral model
B – Agile model
C – Prototyping

- (1) A only
- (2) B only
- (3) A and C only
- (4) B and C only
- (5) All A, B and C

25. Column A lists the phases of the *waterfall model* with labels **A1** to **A5** and column B lists some descriptions with labels **B1** to **B5**:

Column A
A1 - Requirements analysis
A2 - System design
A3 - Implementation
A4 - Testing
A5 - Maintenance

Column B
B1 - Updating the software after deployment
B2 - Writing codes based on detailed system specifications
B3 - Validating whether the system meets user needs and functions correctly
B4 - Identifying what the system should do through discussions with stakeholders
B5 - Creating detailed technical architecture and data flow diagrams

What is the correctly matched phase-description pair?

- (1) A1 – B5
- (2) A2 – B4
- (3) A3 – B2
- (4) A4 – B1
- (5) A5 – B3

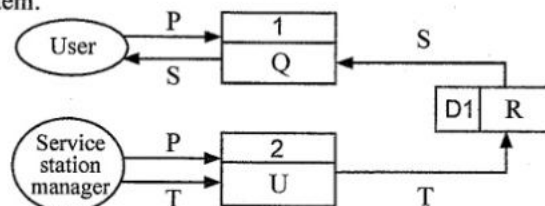
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26. Assume that a project is to be done to computerise the administration of all government schools. The system developers in the project have been advised to use the Structured System Analysis and Design Methodology (SSADM) for it.
What is a key benefit of using SSADM in this project?
- (1) It allows faster development with minimal documentation.
 - (2) It avoids documentation effort completely.
 - (3) It eliminates the need for system analysis.
 - (4) It encourages rapid software deployment.
 - (5) It ensures standardization and consistency of the entire project.
27. Which of the following statements about *system testing* are correct?
- A – It verifies that the complete and integrated system meets the specified requirements.
B – It is normally performed by end-users to validate software functionality.
C – It is performed before *unit testing* in the standard software testing life cycle.
- (1) A only
 - (2) B only
 - (3) A and B only
 - (4) A and C only
 - (5) B and C only
28. A software tester reviews a code part that calculates a discount based on a person's age and purchase history by manually tracing each *if-then-else* condition branch.
What testing is this?
- (1) Acceptance testing
 - (2) Black-box testing
 - (3) Integration testing
 - (4) System testing
 - (5) White-box testing
29. A university replaced its old Learning Management System (LMS) with a new one. However, the new LMS was initially made available only for the first year students. After this successful trial, it was made available for the other students too by stopping using the old LMS completely and starting the new LMS on a specific date.
What type of deployment method is used in this changeover?
- (1) Direct only
 - (2) Phased only
 - (3) Pilot and direct only
 - (4) Pilot and parallel only
 - (5) Pilot and phased only
30. Assume that a vehicle maintenance information system is to be developed. When a vehicle's registration number is input to the system, the system should output the maintenance work records of the vehicle to the user. (e.g., On Aug 19th 2025, the oil of this vehicle was changed.) A service station manager, should also be able to add new work records to the system whenever such work is done to the vehicle.
Shown below is the first-level DFD of the system.



Which of the following gives the correct replacements for P to U in the diagram?

- | | | |
|-----------------------------|--------------------------|------------------------------|
| (1) P – New work record | Q – Display work records | R – Service station managers |
| S – Work history | T – Registration number | U – Add work record |
| (2) P – New work record | Q – Add work record | R – Registration numbers |
| S – Work records | T – Registration number | U – Display work records |
| (3) P – Registration number | Q – Add work record | R – Service station managers |
| S – Work records | T – New work record | U – Display work records |
| (4) P – Registration number | Q – Display work records | R – Work history |
| S – Work records | T – New work record | U – Add work record |
| (5) P – Work history | Q – Display work records | R – Registration numbers |
| S – Work records | T – New work record | U – Add work record |

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31. Consider the following relations from a database at a University. The database is used to keep data about the marks of students taking different courses, the teachers who teach the courses and the department that each teacher is working at:

RESULT(Student_id, Course_id, Mark)

STUDENT(Student_id, Student_name, Student_phone)

COURSE(Course_id, Course_name, Teacher_id)

TEACHER(Teacher_id, Teacher_name, Teacher_phone, Dept_id)

DEPARTMENT(Dept_id, Dept_name, Dept_phone)

Which of the following is **not** a foreign key in this schema?

- (1) Student_id in the RESULT relation
 - (2) Course_id in the RESULT relation
 - (3) Student_id in the STUDENT relation
 - (4) Teacher_id in the COURSE relation
 - (5) Dept_id in the TEACHER relation
32. Consider the following schema of a table that is designed to store data about students:

Name	Type	Null	Key	Extra
Student_id	INT	NO	PRI	AUTO_INCREMENT
Student_name	VARCHAR(100)	NO		
Email	VARCHAR(50)	YES		
Age	INT	YES		

Which of the following statements are true?

- A – Student_name cannot be empty when inserting a record.
 B – The same email address (Email) could be entered for two students.
 C – Inserting a student without specifying the Student_id will result in an error message.
- (1) A only
 - (2) B only
 - (3) C only
 - (4) A and B only
 - (5) All A, B and C
33. Which of these is an advantage of using a compiled language compared to an interpreted language for implementing a program?
- (1) less development time
 - (2) easier debugging
 - (3) faster execution of the developed program
 - (4) portability of the developed program
 - (5) error detection at program run time
34. Which of the following statements are correct?
- A – *Assembler* is a translator for the *Assembly* language.
 B – Compilers detect only logical errors when compiling a program.
 C – Program compilation is a major task of the operating system.
 D – An interpreter converts a program completely to an executable file.
- (1) A only
 - (2) B only
 - (3) A and C only
 - (4) B and D only
 - (5) C and D only
35. Consider the following A, B, C and D variable initializations in Python:
- A = 1.2 B = "True" C = (1,2,3) D = True
- Which of the following gives the correct data types of A, B, C and D respectively?
- (1) float, bool, list, bool
 - (2) float, bool, str, str
 - (3) float, bool, tuple, bool
 - (4) float, str, dict, bool
 - (5) float, str, tuple, bool

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36. What is the execution output of the following Python expression?

```
(1,2,3)[-1]+ 3 * 4
```

- (1) 13 (2) 15 (3) 16 (4) 24 (5) TypeError

37. What is the execution output of the following Python code?

```
x = "01101"
t = 0
p = 0
for i in x:
    if(int(i)):
        t = t + 2 ** p
    p = p + 1
print(t)
```

- (1) 4 (2) 16 (3) 20 (4) 22 (5) 24

38. Following labelled Python code has been written to display all records from the 'Book' table of the 'Books_database':

```
import mysql.connector

mydb = A(host="localhost", user="devi", password="M4PQ#2Ag", database="Books_database")

mycursor = B

mycursor.execute(C)

myresult = mycursor.fetchall()

for x in myresult:
    print(x)

mycursor.close()
mydb.close()
```

Which of the following gives correct replacements for labels **A**, **B** and **C**?

- | | | |
|---------------------------------|-----------------------------|-----------------------------|
| (1) A – mydb.cursor() | B – "SELECT * FROM Book" | C – mysql |
| (2) A – mysql.connector.connect | B – mydb.cursor() | C – "SELECT * FROM Book" |
| (3) A – mysql.connector.connect | B – open('mydb', 'r') | C – "SELECT * FROM Book" |
| (4) A – mysql | B – open('mydb', 'r') | C – mysql.connector.connect |
| (5) A – mysql | B – mysql.connector.connect | C – open('mydb', 'r') |

39. Assume that you have to design the following systems. For which of them will you require the users to login to the system with usernames and passwords in order for them to use those systems?

- A – A learning management system for students to download learning resources and upload assignments
- B – An online banking system to let users transfer funds to other users
- C – A system to let the public know about the services of a Government department and its opening hours

- (1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C



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```
<!DOCTYPE html>
<html>

<h1>Beach</h1>
<body>
<picture>
<source media="(min-width: 1024px)" srcset="beach_large.jpeg" alt="Large beach picture">
<source media="(min-width: 760px)" srcset="beach_medium.jpeg" alt="Beach picture">

</picture>
</body>
</html>
```

3. The `media` attribute specifies what media or device the linked resource is suitable for and the `srcset` attribute specifies the URL of the image to be used.

C – When Nithya emails only the *beach.html* file to Kamala and when Kamala opens it through her smart phone, the ‘Small beach picture’ text is displayed.

- (5) B and C only

Figure 41.2

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Which of the following gives the correct replacements for A to E?

- (1) A – h1, B – p, C – img, D – em, E – href
 (2) A – h1, B – p, C – img, D – em, E – video
 (3) A – h1, B – p, C – href, D – b, E – video
 (4) A – style, B – em, C – img, D – p, E – href
 (5) A – style, B – p, C – body, D – em, E – video

42. Which of the following is the correct way to include the 'shop.css' external CSS file to an HTML file?

- (1) shop.css
 (2) <css src="shop.css">
 (3) <style src="shop.css">
 (4) <stylesheet>shop.css</stylesheet>
 (5) <link rel="stylesheet" href="shop.css">

43. Which of the following technologies is most convenient to make the colour of all the second level (h2) headings of a website to blue?

- (1) Apache (2) CSS (3) HTML (4) MySQL (5) PHP

44. Which of the following statements are true?

- A – Even when analog inputs are given to the digital pins of an Arduino board, they are read as analog values.
 B – The USB port of an Arduino board can also be used to supply DC (direct current) electric power to it.
 C – To input the room temperature to an Arduino board, the V_{out} pin of the LM35 temperature sensor could be used.

- (1) A only (2) A and B only (3) A and C only
 (4) B and C only (5) All A, B and C

- Consider the following code with labels P-S to answer questions 45 and 46. The code has been designed for an Arduino board to switch on/off a motor based on room temperature.

```
const int    sensorPin = A0;
const int    motorPin = 8;

void setup() {
    pinMode(motorPin, P );
}

void loop() {
    int sensorValue = Q (sensorPin);
    float voltage = sensorValue * 5.0 / 1024;
    float temp = voltage * 100;
    if (temp > 40)
        R (S , HIGH);
    else
        R (S , LOW);
}
```

45. Which of the following contains the correct replacements for the labels?

- (1) P – INPUT Q – analogRead R – digitalWrite S – motorPin
 (2) P – INPUT Q – digitalWrite R – analogRead S – motorPin
 (3) P – OUTPUT Q – analogRead R – digitalWrite S – motorPin
 (4) P – OUTPUT Q – analogRead R – digitalWrite S – sensorPin
 (5) P – OUTPUT Q – digitalWrite R – analogRead S – sensorPin

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සියලුම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
 இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரීட்சை, 2025
 General Certificate of Education (Adv. Level) Examination, 2025

තොරතුරු හා සන්නිවේදන තාක්ෂණය II

தகவல், தொடர்பாடல் தொழினுட்பவியல் II

Information & Communication Technology II

20 E II

පැය තුනයි

மூன்று மணித்தியாலம்

Three hours

අමතර කියවීමේ කාලය - මිනිත්තු 10 යි

மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்

Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index No. :

Important:

- * This question paper consists of 14 pages.
- * This question paper comprises of two parts, Part A and Part B. The time allotted for both parts is three hours.
- * Use of calculators is not allowed.

PART A — Structured Essay:
 (pages 2 - 8)

- * Answer **all** the questions **on this paper itself**. Write your answers in the space provided for each question. Note that the space provided is sufficient for your answers and that extensive answers are not expected.

PART B — Essay:
 (pages 9 - 14)

- * This part contains **six** questions, of which, **four** are to be answered. Use the papers supplied for this purpose.
- * At the end of the time allotted for this paper, tie the **two parts together** so that **Part A is on top of Part B** before handing them over to the Supervisor.
- * You are permitted to remove **only Part B** of the question paper from the Examination Hall.

For Examiners' Use Only**For the Second Paper**

Part	Question No.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
	8	
	9	
	10	
Total		

Final Marks

In numbers	
In words	

Code Number

Marking Examiner 1	
Marking Examiner 2	
Marks checked by :	
Supervised by :	

[see page two]

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Part A – Structured Essay
Answer all four questions on this paper itself.

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1. A student is developing a shopping cart website for a bookshop using PHP, MySQL and HTML.

- (a) The student plans to use a table named **Book** in a database named **Books_database** to store data about each book on sale. The table is to consist of the following fields with the data types indicated in parentheses:

id (int), category (char), name (varchar), price (int), publisher (varchar), image (char)

Note: The 'image' field is to contain the filename of the image of the book's cover page.

Assuming that none of the fields are allowed NULL values, write down the SQL statement required to create this **Book** table.

.....

.....

.....

.....

.....

(03 marks)

- (b) Write down the SQL statement required to insert the following record to the **Book** table.

id	category	name	price	publisher	image
1	Art	Painting	800	Rose	a1

.....

.....

.....

.....

(01 mark)

- (c) Assume that the student has created this website and Figure 1.1 shows the output a web user sees when visiting its home page.

Figure 1.2 on page 3 contains an extract from the relevant *index.php* file with four blanks indicated by squares.

[Note: The *index.php* file is linked to *shop.css* to render the display as shown.]

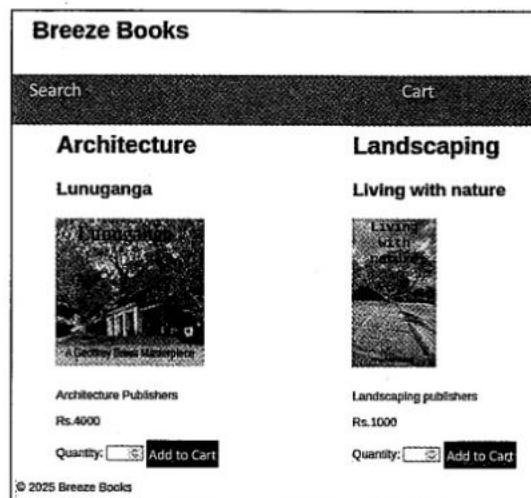


Figure 1.1: The output

[see page three]

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Index No.:

Choosing from the numbered replacements given in the list below the Figure 1.2, write down in each square the number of the relevant replacement.

Do not
write
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column

```
<?php

$conn = new mysqli ('localhost', 'devi', 'C6a#@Q!H', 'Books_database');

if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}

$sql =  ;

$result = $conn->query($sql);

echo"<ul>";

// Loop through items in database to display them

while ($row = mysqli_fetch_assoc($result)) {>
    
    echo"<li>

    <h2>{$row['category']}</h2>
    <h3>{$row['name']}</h3>
    <img src='Images/{"$row['image']}'.jpg'>
    <p>{$row['publisher']}</p>
    <p>Rs.{"$row['price']}</p>";
    ?>

    <form method="POST" action="

```

Figure 1.2: An extract from index.php

List: {1 – <?php 2 – product_id 3 – \$row['id'] 4 – row['price'] 5 – "SELECT * FROM Book"
6 – "SELECT * FROM Books_database" 7 – shop.css 8 – shop.php}

(04 marks)

(d) The word 'Architecture' is displayed in Figure 1.1. Underline the code line in Figure 1.2 that is used to print it. (01 mark)

(e) Assume the price of 'Lunuganga' book is to be reduced to Rs.3,500. Where should this change be done?

(01 mark)

[see page four

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2. (a) *Ceylon Tours* is a mid-sized travel agency that organizes both local and international tours. Currently, the company uses a fully manual system. Due to increased demand and competition, its management plans to develop a computerized Tour Management Information System.

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column

As the Systems Analyst, you are responsible for conducting a preliminary investigation, including identifying problems in the existing system, evaluating feasibility and gathering both functional and non-functional requirements for the new system.

The management has already shared with you a few expectations and observations:

- Customers should be able to book tours and receive the relevant invoices online.
- The system should be secure, available 24/7 and respond within 3 seconds.
- Only authorized staff should be able to update or delete tour details.
- Reports on bookings and payments should be able to be generated.
- Some employees are not competent with using new technology.

Suppose the feasibility study reveals the following:

Finding A: *Ceylon Tours* has a small Local Area Network (LAN), Internet connectivity and modern desktop computers, but the server computer is old and must be upgraded to ensure 24/7 online access.

Finding B: The development and hardware costs are expected to be recovered within two years.

Finding C: Younger staff are positive about the new system, but some senior staff are still uncomfortable with using computers and fear making mistakes.

Finding D: The proposed system is expected to achieve the company's goals of handling increased demand and competing with other agencies.

- (i) Write down the type of feasibility that resulted in each of the findings A, B, C and D.

Finding A:

Finding B:

Finding C:

Finding D:

(01 mark)

- (ii) Based on these feasibility results, would you recommend proceeding with the development of the new system? Write **Yes** or **No** and justify your answer giving **two** reasons.

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(02 marks)

- (iii) Suggest **one** practical step the management can take to reduce the risk identified in **Finding C**.

.....

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(01 mark)

[see page five]

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- (iv) List down **two functional requirements** and **two non-functional requirements** of the above information system.

Functional requirements :

.....

.....

.....

.....

Non-functional requirements :

.....

.....

.....

.....

(02 marks)

- (b) Consider the ER diagram shown in Figure 2.1.

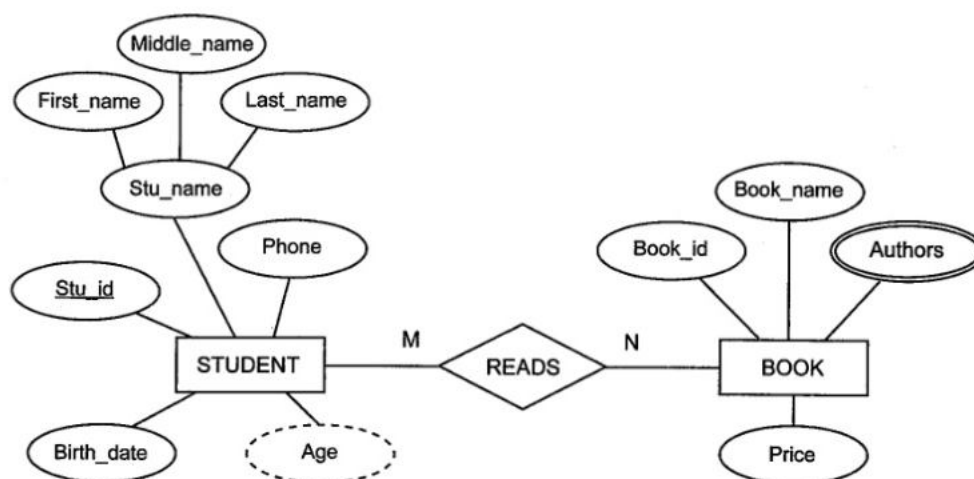


Figure 2.1

Map this ER diagram into a set of relations using only the **Relation name → (Attribute1, Attribute2, ...)** format for each relation. Underline the primary key of each relation.

.....

.....

.....

.....

.....

(04 marks)

[see page six]

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3. (a) Describe the following terms with respect to computer programs.

(i) Syntax errors :

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.....

(01 mark)

(ii) Logical errors :

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(01 mark)

(b) A python program is required to accept a collection of integers from the keyboard and to print the sum of all the even integer values entered thus far when the user enters a negative number.

(i) What should be the output of this program if the five integers 1, 2, 3, 5 and -1 are input separately?

.....

(01 mark)

(ii) Draw a flow chart to show the algorithm needed.

(03 marks)

[see page seven]

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(iii) Write down the required Python program.

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(03 marks)

(iv) What would happen if one gives a floating point value to a Python program that is written to read integers?

.....

(01 mark)

4. (a) On the processor of a computer, the following sequence of execution occurs with respect to two processes P_0 , P_1 and the operating system (OS):

$OS \rightarrow P_0 \rightarrow OS \rightarrow P_1 \rightarrow OS \rightarrow P_0 \rightarrow OS \rightarrow P_1 \dots$

(i) *Running*, *Blocked* and *Ready* are three states of a process. When a context switch occurs from P_0 to P_1 , what is the state transition that occurs in the P_1 process?

.....

(01 mark)

(ii) When P_0 is given the chance to run for the second time, what mechanism helps it to start execution from where it previously stopped?

.....

.....

.....

(02 marks)

(iii) With respect to efficient processor usage, what is the benefit of sending a process to its *blocked* state?

.....

.....

.....

(01 mark)

(b) (i) What is the main reason for 'swapping' a process?

.....

.....

(01 mark)

[see page eight]

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- (ii) A computer uses 16-bit virtual addresses. This computer has a 64 KB physical memory and a 4 KB page size. A user starts two programs (P_0 and P_1) having sizes of 64 KB and 32 KB respectively on this computer. A few selected fields of the first few rows of the *page table* of each process at a particular time are shown in the figure.

Do not write in this column

Page number	Frame	Validity	Page number	Frame	Validity
0	0010	1	0	0100	1
1	0101	1	1	1001	1
2	1110	1	2	1011	1
3	0110	0	3	0110	0
4	1100	0	4	1101	0
A part of the P_0 's page table			A part of the P_1 's page table		

Notes:

- The page number is used as the index into the page table.
- The frame number is indicated in binary. **Validity** bit being 1 indicates that the relevant page is in physical memory.

Assume that in the P_1 process the virtual address 0001 0001 0001 0001 is wanted. Write down the 16-bit physical address that the above address would get mapped to.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(01 mark)

- (iii) Only selecting from the pages shown in its page table in (ii) above, write down **one** virtual address of the P_0 process that will require the operating system to fetch the relevant page to physical memory from secondary storage.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(01 mark)

- (c) (i) The block size of a USB flash drive is 4 KB. A portion of its File Allocation Table (FAT) at a particular time is shown below. The portion shown describes the **complete** blocks of two files as well.

FAT	100	101	102	103	104	105	106	
...	102	103	-1	105	100	106	-1	...

[Note: The last block of a file is indicated by -1.]

The *directory entry* of a file contains the block number of the first block of the file. Write down those numbers of the directory entries for the two files described by the above FAT portion.

--	--

(01 mark)

- (ii) The file allocation block size (e.g., 4 KB) must be carefully chosen. Give **one disadvantage** each of selecting a small block size and a large block size.

Small blocksize :

Large blocksize :

(02 marks)

* *

[see page nine]

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ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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 ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
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කොරකුරු හා සන්නිවේදන තාක්ෂණය II
 தகவல், தொடர்பாடல் தொழினுட்பவியல் II
 Information & Communication Technology II

20 E II

Part B

* Answer any **four** questions only.

5. (a) Prove the following using Boolean algebra:

$$\overline{a}bcd + \overline{a}b\overline{c}d + \overline{a}bcd + ab\overline{c}\overline{d} + abcd\overline{d} + abcd = \overline{a}cd + ab\overline{d} + bc \quad (05 \text{ marks})$$

- (b) A bank vault is secured by a logic circuit with four binary inputs. Three of these inputs come from the keys named k_0 , k_1 and k_2 and the fourth input comes from a timer. The four inputs together form a 4-bit binary number with the timer input as the Most Significant Bit (MSB) and k_0 as the Least Significant Bit (LSB).

The vault unlocks only when the 4-bit binary input (from timer, k_2 , k_1 and k_0 respectively) represents a number that is a multiple of 3 (i.e., 3, 6, 9, 12, 15) or a multiple of 7 (i.e., 7, 14).

Design the most simplified logic circuit that takes these four inputs and gives an output Z which is equal to 1 for the valid input combinations to indicate the unlocking of the vault.

(07 marks)

- (c) Key k_1 is held by the officer-in-charge, while k_0 and k_2 are held by two senior officers. The duration in which the time signal becomes 1 is decided by the bank. State whether the vault can be opened in the absence of the officer-in-charge. Justify your answer. (03 marks)

6. (a) Write down the suitable replacements for the blanks labelled A , B and C of the following paragraph:

User Datagram Protocol (UDP) is a transport layer protocol used by several well-known application layer protocols. ...**A**... and ...**B**... are two such application layer protocols that use the services of the UDP. Although UDP is simple it does not guarantee ...**C**... delivery of data.

(1.5 marks)

- (b) Other than viruses, a number of different types of malware can be accompanying the files downloaded from the Internet. List **three** such types of malware. (1.5 marks)
- (c) Draw a detailed diagram of a network in which three computers, two servers and a network printer are connected in a bus topology. In your diagram show all necessary components that are required. (02 marks)
- (d) Write **one** example for each of the following:
- (i) Class B IP address (0.5 marks)
- (ii) Private IP address (0.5 marks)

[see page ten]

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- (e) Write down the matching of each **TCP/IP layer** labelled from **A** to **D** with the correct **description** labelled from **1** to **4**. (Note: Use only the given labels for your answer.)

TCP/IP layer	Description
A - Application layer	1 - Does routing and path determination for data packets
B - Transport layer	2 - Breaks down data into segments and ensures reliable delivery of data
C - Internet layer	3 - Manages the physical transmission of data
D - Network access layer	4 - Provides network services to user software

(02 marks)

- (f) Write down the purpose of attaching digital signatures to digital documents. (02 marks)
- (g) Suppose that you are given the 192.168.50.0/24 IP address block to allocate it to five departments namely **D1**, **D2**, **D3**, **D4** and **D5** that need 28, 12, 60, 6 and 2 usable hosts respectively.

For each departmental subnet, give the indicated data in a table according to the following table format.

Department Name	Network address	Usable IP address range	First usable IP address	Last usable IP address	Broadcast IP address
-----------------	-----------------	-------------------------	-------------------------	------------------------	----------------------

(05 marks)

7. Saman owns a small shop, 'Ceylon Crafts' in Kandy, which sells wood carvings and batik fabrics mainly to tourists. At the moment it is run entirely as a physical shop, with customers visiting in person and paying in cash.

- (a) While keeping his physical shop, Saman decides to join the digital economy. For this, he creates an online shop to list his products and to accept online payments from customers.
- Previously, the business operated as a *pure brick* organization. After introducing the online shop, what is the new form of the business? (0.5 marks)
 - Saman makes agreements with some nearby tourist hotels to display his products on their websites to direct buyers to his online shop. State the e-commerce transaction type between Saman and the tourist hotels selecting from B2B, B2C, C2C and C2B. (0.5 mark)
 - From the types listed in (ii) above, what is the e-commerce transaction type between Saman and a customer who buys a product online? (0.5 mark)
 - Write down **one** payment method that Saman could provide for customers in his online shop. (0.5 marks)
 - Saman wants to expand his online shop to local suppliers who desire to supply their crafts to Saman. For this purpose, the suppliers are to be given the facility to upload the images of their crafts, submit their prices and the way to contact them. List **four** *digital divide* related problems that Saman could face in this endeavour. (02 marks)
 - For **one** of the problems that you listed in (v) above, explain a solution that Saman could provide. (02 marks)

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(b) Saman has a future plan to include three software agents in this online shop as follows:

Help Agent – interacts with the customer and answers questions about products and delivery times

Price Agent – checks for available discounts and seasonal offers before showing the final price

Delivery Agent – communicates with different delivery services to select the fastest and cheapest option

(i) From these three agents, which one is mainly an *interface agent* and why? (01 mark)

(ii) Draw a simplified agent diagram for the above multi-agent system. Properly label the diagram and show all the interactions clearly. (02 marks)

(iii) Give **one** advantage of using several software agents in Saman's online shop instead of building one single large program to do all the work. (02 marks)

(iv) These agents are expected to work autonomously. Describe **one** situation where the **Delivery Agent** should take an action without being directly instructed by the user. (02 marks)

(v) Describe **one** situation where the **Delivery Agent** may give the customer incorrect information. (02 marks)

8. Your class teacher has requested you to develop a menu-based Python application to manage the examination marks of the students of your class and has provided you with the following requirements of the application.

A) Each student of the class is to be identified by a unique index number such as s01, s02 etc.

B) Each student sits for three papers namely ICT, Physics and Chemistry.

C) The menu should provide the following options:

- 1) Read marks of a student from the keyboard
- 2) Display marks of all students on the screen
- 3) Exit from the application

Where the option 1) allows a user to enter an index number and subject marks of a student, option 2) displays the index numbers and marks of students already entered and option 3) exits from the application.

(a) Write a python function to display the above menu on the screen allowing the user to type a menu option and to return the option the user entered. (03 marks)

(b) If a python list of tuples is used to store the marks of students, write a python function to return a tuple comprising the index number and marks for the three subjects when the index number and the three marks obtained by a student are given.

(For example, if the function is defined as getMarks(indexNumber, mark1, mark2, mark3), it should return a tuple comprising the indexNumber, mark1, mark2 and mark3.) (04 marks)

(c) Write a python function by using the above function to read the marks of multiple students and add them to a list of tuples with the name **classMarks**. Your function should terminate when the user enters -1 as the index number. (04 marks)

(d) Write down a python function to display the marks of a student on the screen given his/her index number. (04 marks)

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9. (a) Your school needs an Event Management System to manage the events of different school clubs such as the Science Club, Sports Club and Literary Association. You have been asked to design a suitable database system for this and are provided with the following information:

- Each student has a unique student number [StuID], a name [StuName], a class [Class] and an e-mail address [Email].
- A student can join [Joins] one or more clubs.
- Each club has a unique number [ClubID], a name [ClubName], a location [Location] and a teacher-in-charge [TeacherID].
- Events are conducted [Conducts] by clubs. Each event has a unique event number [EventID] and a name [EName]. A club can conduct many events, but each event is conducted by only one club. For each event, the system should record the start date [StartDate] and the end date [EndDate].
- A student can participate [Participates] in many events, and in each event, the student can have one of three roles: organizer, volunteer or participant. The system should record the student's role [Role] in each event that he participates.

(i) Draw an Entity-Relationship (ER) Diagram for the above system showing the entities, attributes, relationships and the appropriate cardinalities for each relationship. Underline the primary key attributes.

[Note: Use only the terms given within square brackets in the above description for the attributes and relationships.] (05 marks)

(ii) Write the relational schema for the above ER diagram.

[Note: List only the tables with their attribute names. Underline the primary keys.]

(04 marks)

(b) The table below shows some records of student participation at school events. Each record contains information about the student and the corresponding event. The 'Services' column indicates any additional services the student used during his participation in the event.

Stu_ID	Stu_Name	Phone	Event_ID	Event_Type	Event_Fee	Services	Start_Date	End_Date
S001	Perera	0771234567	E101	ICT Fair	2000	Refreshments	2025-07-01	2025-07-03
S002	Selvan	0777654321	E102	Debate	1500	Refreshments	2025-07-02	2025-07-05
S003	Fernando	0711237890	E101	ICT Fair	2000	Printing	2025-07-01	2025-07-03
S004	Nadaraja	0752341234	E104	Exhibition	2500	Transport	2025-07-03	2025-07-06
S001	Perera	0771234567	E102	Debate	1500	Printing	2025-07-02	2025-07-05

(i) In which normal form does the above table exist? Justify your answer. (02 marks)

(ii) Convert the above table to the next normal form and list the tables obtained after the conversion giving the attributes. Underline the primary key of each table. (04 marks)

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10. A student has developed a system using html, php and MySQL for users to reserve doctor appointment slots at the village hospital. The hospital is open for outpatients from 0800-1700 hrs each day. However, for simplicity, the student has considered only four 15-minute appointment slots per day (i.e., 0800, 0815, 0830 and 0845 hrs). The system uses a database table named **BOOKING** with the following structure to store the time slots already reserved:

BOOKING(Date, Time, Name, Phone)

Note: Date: Date of the appointment
Time: Time of the appointment

Name: Patient's name
Phone: Patient's contact phone number

- (a) A user enters the required appointment date to the system's initial interface shown in Figure 10.1. Without even checking the BOOKING table, what dates should the system **not** allow the user to input? (01 mark)
- (b) The slot availability information for the selected appointment date is shown by the *list.php* file. Two different colours are used to indicate reserved and unreserved slots. A sample output is shown in Figure 10.2.
- (i) An extract of the file *list.php* is shown in Figure 10.3. In it, what is the *result* variable expected to contain? (01 mark)
- (ii) In Figure 10.3, the code part indicated by **A** contains three code lines. Write down its **first** code line. (01 mark)
- (iii) **B** in Figure 10.3 should contain a message to be printed on the screen. What should be stated in it? (01 mark)

Village Hospital Visit date: mm / dd / yyyy Check date © 2025 Village Hospital	Reservation Schedule for 2025-12-23 <table border="1"> <tr> <td>08:00</td> <td>08:15</td> <td>08:30</td> <td>08:45</td> </tr> </table> Select a time: -- : -- : -- Book slot ©2025 Village Hospital	08:00	08:15	08:30	08:45	<pre> echo "<h4>Schedule for \$visit_date</h4>"; // make all slots initially available for booking \$avail = [1, 1, 1, 1]; while (\$row = \$result->fetch_assoc()) { if (\$row['Time'] == '08:00:00') \$avail[0] = 0; A } // end while if (\$avail[0] == 0 and \$avail[1] == 0 and \$avail[2] == 0 and \$avail[3] == 0) { echo "B"; } else { C <?php if (D) echo "E"; else echo "F"; X } </tr> </table> <!--The submit code (not shown)--> <?php } ?> </pre>
08:00	08:15	08:30	08:45			
Figure 10.1	Figure 10.2	Figure 10.3				

- (iv) Write down the suitable replacements for **C**, **D**, **E** and **F** of the code extract shown in figure 10.3, choosing from the following list.

List: `{ $avail[0] == 0, <td style='background-color: green>08:00</td>, <td style='background-color: red>08:00</td>, <hr>, <table>, <tr> }`

Notes: 1. The part **C** requires the use of three of the replacements.

2. The part **X** containing the code for other time slots need **not** be written.

(04 marks)

[see page fourteen]

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- (c) The selected appointment date and the time selected through the interface of Figure 10.2 is directed to the *book.php* file for processing. With respect to this input, what database related test should be done in the *book.php* file? (02 marks)
- (d) Write down an important maintenance task that must be done to the **BOOKING** table at the end of each day in order to increase time slot search efficiency and also to reduce storage requirements of the system. (02 marks)
- (e) After its completion, the student suggests hosting this system using a shared web hosting service available from an Internet Service Provider instead of publishing it on a hospital computer. Write down **one** advantage of this approach. (01 mark)
- (f) The annual cost of this shared web hosting package is Rs.7,500. The student suggests a method for the hospital to recover this cost that will also increase resource utilization. Explain the method and how it improves resource utilization. (02 marks)

3 Paper 1 answers

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
අ.පො.ස. (උ.පෙළ) විභාග/ க.பொ.த. (உயர் தர)ப் பரீட்சை - 2025

විෂය අංකය 20 **විෂයය** ICT
பாட இலக்கம் 20 **பாடம்** ICT

ලකුණු දීමේ පටිපාටිය / புள்ளி வழங்கும் திட்டம்
I පත්‍රය / பத்திரம் I

ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.
01.	1	11.	1	21.	5	31.	3	41.	1
02.	5	12.	2	22.	3	32.	4	42.	5
03.	4	13.	2	23.	3	33.	3	43.	2
04.	1	14.	3	24.	5	34.	1	44.	4
05.	1	15.	1	25.	3	35.	5	45.	3
06.	5	16.	3	26.	5	36.	2	46.	3
07.	5	17.	3	27.	1	37.	4	47.	2
08.	3	18.	3	28.	5	38.	2	48.	4
09.	3	19.	2	29.	3	39.	2	49.	3
10.	5	20.	3	30.	4	40.	3	50.	2

❖ විශේෂ උපදෙස් / விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට / ஒரு சரியான விடைக்கு ලකුණු¹ மதிப்பு / புள்ளி வீதம்
 මුළු ලකුණු / மொத்தப் புள்ளிகள்⁵⁰

4 Paper II mark scheme

Notes

1. $\leftarrow$ A indicates that any credit for the item should be given only if A is correct.
2. Essential keywords sufficient for credit in some answers are underlined.
3. Acceptable alternatives for a given word or set of words are separated by slashes within parentheses.
4. Answers where minor spelling mistakes are acceptable are indicated. A *minor spelling mistake* is where at most one character is either missing, wrong or in excess.
5. **Rounding off of 0.5 marks** should only be done to the **final total** for Paper II.

1. (a) SQL statement to create Book table.

[3]

Any one of the following:

```
CREATE TABLE Book (
    id INT NOT NULL,
    category CHAR(20) NOT NULL,
    name VARCHAR(50) NOT NULL,
    price INT NOT NULL,
    publisher VARCHAR(50) NOT NULL,
    image CHAR(20) NOT NULL
);
```

```
CREATE TABLE Book (
    id INT PRIMARY KEY,
    category CHAR(20) NOT NULL,
    name VARCHAR(50) NOT NULL,
    price INT NOT NULL,
    publisher VARCHAR(50) NOT NULL,
    image CHAR(20) NOT NULL
);
```

```
CREATE TABLE Book (
    id INT,
    category CHAR(20) NOT NULL,
    name VARCHAR(50) NOT NULL,
    price INT NOT NULL,
    publisher VARCHAR(50) NOT NULL,
    image CHAR(20) NOT NULL,
    PRIMARY KEY(id)
);
```

Marks allocated as follows:

A 1 mark: Complete CREATE statement with fields and data types

B 1 mark: Correct syntax ($\leftarrow$ A)

C 1 mark: Suitable char, varchar sizes and NOT NULL or PRIMARY KEY usage ($\leftarrow$ B)

NOTES:

- ▼★ Exact spelling needed for keywords (i.e., CREATE, TABLE, INT, PRIMARY KEY, NOT NULL, CHAR, VARCHAR). However, minor mistakes are permissible for table name and the field names.
- ▼ For mark component C, char and varchar sizes must be at least 5.
- ★ INT can be specified with a size. e.g, INT (5)
- ★ Ignore case.
- ★ Field order is not important.
- ★ Do not check NOT NULL or PRIMARY KEY usage for mark component A.
- ★ If multiple answers given, consider only the first one.

(b) SQL statement to insert given record.

[1]

Any one of the following:

```
INSERT INTO Book
VALUES (1, 'Art', 'Painting', 800, 'Rose', 'a1');
```

```
INSERT INTO Book (id, category, name, price, publisher, image)
VALUES (1, 'Art', 'Painting', 800, 'Rose', 'a1');
```

NOTES:

- ▼ Exact spelling needed for keywords (i.e., INSERT INTO, VALUES). However, minor spelling mistakes are permissible for table name, field names and field values.
- ▼ Only single quotes are allowed for field values. However, the two integer values (1, 800) must be without quotes.
- ★ Ignore case.
- ★ If multiple answers given, consider only the first one.

(c) Write down replacement numbers for the four blanks in the code.

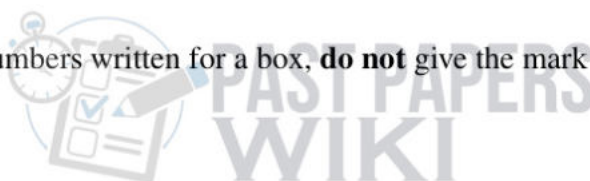
[4]

5 1 8 3

Give **1 mark** for each.

NOTES:

- ▼ If multiple numbers written for a box, **do not** give the mark for **that** box.



- (d) Underline the code line that is used to print 'Architecture'. [1]

```
<h2>{$row['category']}</h2>
```

NOTE:

- ▼ If multiple lines underlined, **do not** give the mark.
- ★ Partial underlines or any method of pointing to the line is acceptable.

- (e) Where should be the change be done when reducing the 'Lunuganga' book's price? [1]

The change should be done to the price field of the relevant record in the Book table.

NOTE:

- ★ The answer: *"The change should be done to the database."* is acceptable.
- ★ If multiple answers given, consider only the first one.

2. (a) (i) Write down the feasibility types that resulted in findings A, B, C and D.

[1]

Finding A: Technical feasibility
 Finding B: Economic feasibility
 Finding C: Operational feasibility
 Finding D: Organizational feasibility

Give **1 mark** if all four correct.

It two or three correct, give a total of only **0.5 marks**.

NOTES:

- ▼ If the same feasibility is repeated for many findings, do not give any credit for the **relevant findings**.
- ★ The word 'feasibility' is not essential.
- ★ If multiple feasibilities given for a finding, **do not** give any credit for that finding.

- (ii) Based on feasibility results do you recommend system development?
 Answer 'yes' or 'no' and justify with two reasons.

[2]

Yes.

Any two of the following reasons:

- Technically feasible as the required hardware is available or the cost can be recovered in two years
- Economically feasible with a payback period of two years
- Operationally feasible as the younger staff are positive about it
- Organizationally feasible as it aligns with business goals

Marks allocated as follows:

A 1 mark: 'Yes' with any correct reason

B 1 mark: Second correct reason (←-- A)

NOTE:

- ★ Reasons with similar meanings are to be accepted.
- ★ Mentioning the specific feasibility name is not essential.

- (iii) Write down one step that management can take to mitigate the risk named in Finding C.

[1]

Provide the required training

NOTE:

- ★ If multiple methods given, consider only the first one.
- ★ Answers with similar meanings are to be accepted.

- (iv) Write down two functional requirements and two non-functional requirements.

[2]

Functional requirements:

Any two of the following:

- Ability to book tours online
- Ability to receive invoices online
- Ability for authorized personnel to update/delete tour details
- Report generation ability

Give **0.5 marks** for each.

NOTE:

▼ If *non-functional requirements* are also written under this, **do not** give any marks.

★ Answers with similar meanings are to be accepted.

Non-functional requirements:

Any two of the following:

- system should be secure
- system should be available 24x7
- system should respond to within three seconds

Give **0.5 marks** for each.

NOTE:

▼ If *functional requirements* are also written under this, **do not** give any marks.

★ Answers with similar meanings are to be accepted.

- (b) Map the given ER diagram into a set of relations. Underline primary keys.

[4]

STUDENT → (Stu_id, First_name, Middle_name,
Last_name, Phone, Birth_date)

BOOK → (Book_id, Book_name, Price)

READS → (Stu_id, Book_id)

AUTHOR → (Book_id, Authors)

Give **1 mark** for each table with a correctly underlined primary key.

NOTES:

- ▼ Exact spelling is required for table and field names. Underscore is also required.
- ▼ Using the required format (excluding arrow) is essential.
- ▼ Reduce **1 mark** for each additional table that is not given here. However, the total mark for 2(b) should not be negative.
- ★ Arrow is not essential.
- ★ READS table can also be named STUDENT_BOOK.
- ★ Student can use a different name for AUTHOR table. But that name should **not** include any spaces.
- ★ Ignore case.

3. (a) (i) Describe the term 'syntax error'.

[1]

Any one of the following:

- Grammar of the program not correct
- Use of incorrect programming language rules

(ii) Describe the term 'logical error'.

[1]

Any one of the following:

- The logic of the program is not correct
- Program gives (incorrect / unexpected / no) output
- Program does not give expected result

(b) (i) What is the expected output for the input: 1,2,3,5 and -1?

[1]

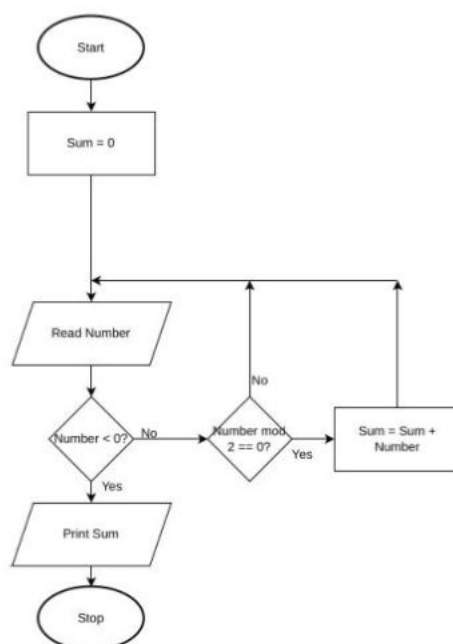
2

NOTE:

▼ Do not give the mark if multiple outputs are given.

(ii) Draw a flow chart to show the algorithm.

[3]



Marks allocated as follows:

- A 1 mark:** Termination for negative value input
B 1 mark: Correct computation (←-- A)
C 1 mark: Completeness (correct shapes, printing sum, important arrows, not using unwanted variables) (←-- B)

NOTES:

- ▼ Consistent use of variable names and their cases are important.
- ★ Ignore the non-use of question marks in the condition boxes.
- ★ Acceptable synonyms for *Start*, *Stop*: Begin, End
- ★ Acceptable synonyms for *Read*: Input, Get
- ★ Acceptable synonyms for *Print*: Write, Output, Display
- ★ 'Number % 2 == 0' or 'Is number even?' are also acceptable.
- ★ Ignore case in text (except in variable names).
- ★ The student can use the Number >= 0 loop to run the computation loop. Then, the relevant part in the flowchart should be changed accordingly.

(iii) Write down the required Python program.

[3]

```
total = 0
while (True):
    i = int(input("Enter an integer ->"))
    if (i < 0):
        break
    if (i%2 == 0):
        total = total + i
print("Sum = ",total)
```

Marks allocated as follows:

- A 1 mark:** Termination for negative value input
B 1 mark: Correct computation (←-- A)
C 1 mark: Printing sum (←-- B)

NOTES:

- ▼ Consistent use of variable names and their cases are important.
- ▼ Correct case is essential for Python keywords.
- ▼ For each of the above A,B and C marking components, correct indentation and syntax is essential.
- ★ 'while (1):' can also be used.

- (iv)

What would happen if one gives a floating point value to a Python program that is designed to read integers?
--

 [1]

(a run-time error / an exception / a ValueError / an error)

NOTES:

- ★ Ignore the case of ValueError.
- ★ If multiple errors given, consider only the first one.

4. (a) (i) When a context switch occurs from P_0 to P_1 what is the state transition that occurs in P_1 ? [1]

Ready $\rightarrow$ Running

NOTES:

- ▼ If more than one transition written, do not give any marks.
- ★ An answer with a similar meaning is acceptable.

- (ii) What mechanism helps P_0 to start from where it previously stopped? [2]

When P_0 stopped the first time, the virtual memory address of its next instruction to execute was stored in its Process Control Block. When it is given the chance to run again, this address is retrieved back from its PCB to execute that instruction.

Marks allocated as follows:

- A 1 mark:** (Process Control Block [PCB] stores the state of the process / address of the next instruction to execute is stored in the PCB)
- B 1 mark:** PCB of P_0

NOTE:

- ★ Give only a total mark of 1 if the answer is just '(Process Control Block / PCB)'.

- (iii) What is the benefit of sending a process to its 'blocked' state? [1]

to allow the CPU to run other ready processes instead of wasting time waiting for slow I/O operations to complete or other resources to become available

A partial mark of 0.5 is to be given for any of the following answers:

- Improve CPU (efficiency / utilization)
- Improve system concurrency
- Leads to a more responsive system
- Prevents the CPU from idling
- Keeps more processes active

NOTE:

- ★ Answers with similar meanings are to be accepted.

- (b) (i) What is the main reason for 'swapping' a process? [1]

(to improve memory utilization by moving inactive processes out of RAM to make space for active ones / to provide memory space for another active process)

A partial mark of 0.5 is to be given for the following answer:

- Leads to a more responsive system

NOTE:

★ Answers with similar meanings are to be accepted.

- (ii) Write down the 16-bit physical address for the given virtual address. [1]

1001 0001 0001 0001

- (iii) Write down one virtual address of the P_0 process that will require the OS to fetch the relevant page. [1]

Any one of the following:

0110 xxxx xxxx xxxx

1100 xxxx xxxx xxxx

where x signifies either 0 or 1.

- (c) (i) Write down block numbers of the directory entries for the two files. [1]

101 104

Give **0.5 marks** for each.

NOTE:

★ Order is not important.

- (ii) Give one disadvantage of selecting a small block size and a large block size.

[2]

Small block size:

Any one of the following:

- increased fragmentation
- larger (allocation table / metadata)
- large file's data being scattered over the media
- (slower performance / slowed down read and write operations, particularly for large files and sequential file access / a disk's read-write head will be forced to move or "seek" more frequently across the disk surface to access all the scattered blocks of a single file / increased file access time)
- Managing a larger allocation table and performing more frequent, individual block allocations for files creates more overhead for the operating system and file system, consuming additional CPU and I/O resources
- old systems may have a maximum number of allocation units allowed for a file → a limit on the maximum file size
- Modern hard drives and SSDs use physical block sizes of 4KB or larger. Using a smaller logical allocation size than the physical block size can lead to inefficient operations, as the drive may have to read a full physical block, update a portion of it, and write the entire block back. This can increase wear on SSDs and slow down mechanical drives.

Give **1 mark**.

NOTE:

- ★ If multiple disadvantages given consider only the first one.
- ★ Answers with similar meanings are to be accepted.

Large block size:

Any one of the following:

- (Internal fragmentation / wasted disk space) if small files used
- (Slower performance for small files / Reading a small file requires the system to process an entire large block)
- In some cases, a very large logical block size can strain the I/O system, as the controller may be forced to break down large blocks for transfer and reassemble them [as the physical block size may be smaller], creating extra overhead

Give **1 mark**.

NOTES:

- ★ If multiple disadvantages given consider only the first one.
- ★ Answers with similar meanings are to be accepted.

5. (a) Prove the given equation using Boolean algebra.

[5]

$$\begin{aligned}
 LHS &= \bar{a}\bar{b}cd + \bar{a}b\bar{c}\bar{d} + \bar{a}bcd + ab\bar{c}\bar{d} + abc\bar{d} + abcd \\
 &= \bar{a}\bar{b}cd + \bar{a}bcd + ab\bar{c}\bar{d} + abc\bar{d} + \bar{a}b\bar{c}\bar{d} + \bar{a}bcd + ab\bar{c}\bar{d} + abcd \\
 &= \bar{a}cd(\bar{b} + b) + ab\bar{d}(\bar{c} + c) + \bar{a}bc(\bar{d} + d) + abc(\bar{d} + d) \\
 &= \bar{a}cd + ab\bar{d} + \bar{a}bc + abc \\
 &= \bar{a}cd + ab\bar{d} + (\bar{a} + a)bc \\
 &= \bar{a}cd + ab\bar{d} + bc
 \end{aligned}$$

Marks allocated as follows:

- A 3 marks:** 1 mark each for each correct line with a simplification
 (←-- The relevant line contains only the correct minterms)
- B 2 marks:** For the remaining simplifications (←-- A)

- (b) Design the most simple logic circuit that takes the four inputs and gives an output Z which is equal to 1 for the valid input combinations.

[7]

Let us assume that the timer signal is represented by T and the activation signal is represented by A.

T	k2	k1	k0	A	Minterms
0	0	0	0	0	
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	1	$T\bar{k}2k1k0$
0	1	0	0	0	
0	1	0	1	0	
0	1	1	0	1	$Tk2k1\bar{k}0$
0	1	1	1	1	$\bar{T}k2k1k0$
1	0	0	0	0	
1	0	0	1	1	$T\bar{k}2\bar{k}1k0$
1	0	1	0	0	
1	0	1	1	0	
1	1	0	0	1	$Tk2\bar{k}1\bar{k}0$
1	1	0	1	0	
1	1	1	0	1	$Tk2k1\bar{k}0$
1	1	1	1	1	$Tk2k1k0$

Then the Karnaugh map becomes:

$k_1 k_0 \backslash T k_2$	00	01	11	10
00	0	0	1	0
01	0	0	0	1
11	1	1	1	0
10	0	1	1	0

Minimal expression is:

$$f = \bar{T}k_1k_0 + T\bar{k}_2\bar{k}_1k_0 + Tk_2\bar{k}_0 + k_2k_1$$

Circuit:

Marks allocated as follows:

- A 4 marks:** Correct truth table OR Karnaugh map
B 2 marks: Minimal correct expression (←-- A)
C 1 mark: Correct circuit (←-- B)

NOTE:

★ If multiple circuits drawn, consider only the first one.

- (c) State whether the vault can be opened in the absence of the officer-in-charge. Justify your answer. [3]

Yes.

The vault opens in two occasions (i.e., the four-bit number is 1001 and 1100) when the officer-in-charge is not in the office.

Marks allocated as follows:

- A 1 marks:** Yes.
B 2 marks: Reason (←-- A)

6. (a) Write down the suitable replacements for the blanks labelled A, B and C in the given paragraph. [1.5]

A and B: (DNS / SNMP / TFTP / DHCP / RTP / RTSP / VOIP / QUIC)

C: (ordered /reliable / guaranteed)

Give **0.5 marks** for each of A, B and C.

NOTES:

▼ If the same correct answer is repeated at A and B, then give the 0.5 mark to only one of them.

★ Answers for A and B can be written in any order.

- (b) List three types of malware that could be accompanying the files downloaded from the Internet. [1.5]

Any three of the following:

- (Trojans / Trojan horses)
- Worms
- Spyware
- Adware
- Ransomware
- Rootkits
- Keyloggers

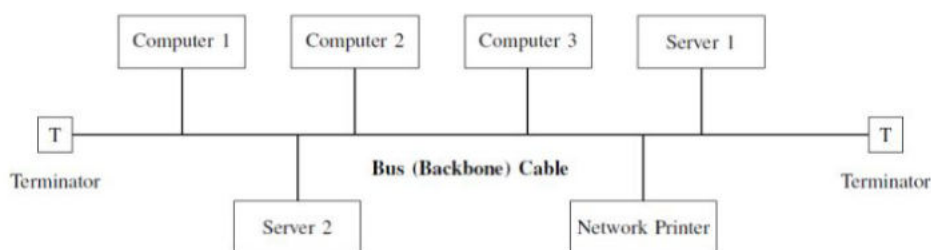
Give **0.5 marks** for each.

NOTE:

★ If more than three written, consider only the first three.

- (c) Draw three computers, two servers and a network printer connected in a bus topology. Show all necessary components that are required.

[2]



Give only **2 or 0 marks**.

NOTES:

- ★ For 'Terminator', the letter T could also be written, or a colored circle could also be drawn. Appropriate Sinhala or Tamil words could also be written.
- ★ For 'Backbone cable', the words 'cable', 'bus' or 'segment' could also be written.
- ★ No need to mention 'T connectors' in the diagram.
- ★ Devices could be connected to the cable in any order.
- ★ If multiple diagrams drawn, consider only the first one.

- (d) (i) Write one example for a Class B IP address

[0.5]

any address between 128.0.xxx.xxx to 191.255.xxx.xxx

NOTE:

- ▼ If multiple examples given, **do not** give any credit if any of the examples is wrong.

- (ii) Give one example for a private IP address.

[0.5]

An example address from the following:

10.0.0.0 { 10.255.255.255 10.0.0.0/8
 172.16.0.0 { 172.31.255.255 172.16.0.0/12
 192.168.0.0 { 192.168.255.255 192.168.0.0/16

NOTE:

- ▼ If multiple examples given, **do not** give any credit if any of the examples is wrong.

- (e) Match the TCP/IP layers labelled from A to D with the correct descriptions labelled from 1-4. [2]

A:4, B:2, C:1, D:3

Give only **0.5 marks** for each.

NOTES:

- ▼ Writing in textual form is not acceptable.
- ▼ If the same number is repeated for multiple TCP/IP layers, then **do not** give credit for the relevant layers.

- (f) Write down the purpose is attaching digital signatures to digital documents. [2]

A description based on any one of the following:

- (Trust / authentication)
- integrity – not altered by someone in the middle
- trust and legal validity (non-repudiation)
- signee cannot deny that he did not sign it

Give **2 or 0 marks**.

- (g) Allocate 192.168.50.0/24 IP address block to departments D1-D5 needing 28,12,60,6 and 2 usable hosts respectively. [5]

Department	Usable Hosts Needed	Required Addresses	Subnet Mask	Prefix
D3	60	64	255.255.255.192	/26
D1	28	32	255.255.255.224	/27
D2	12	16	255.255.255.240	/28
D4	6	8	255.255.255.248	/29
D5	2	4	255.255.255.252	/30

Department ID	Network Address	Usable IP Address Range	First Usable IP	Last Usable IP	Broadcast IP
D3	192.168.50.0/26	192.168.50.1 – 192.168.50.62	192.168.50.1	192.168.50.62	192.168.50.63
D1	192.168.50.64/27	192.168.50.65 – 192.168.50.94	192.168.50.65	192.168.50.94	192.168.50.95
D2	192.168.50.96/28	192.168.50.97 – 192.168.50.110	192.168.50.97	192.168.50.110	192.168.50.111
D4	192.168.50.112/29	192.168.50.113 – 192.168.50.118	192.168.50.113	192.168.50.118	192.168.50.119
D5	192.168.50.120/30	192.168.50.121 – 192.168.50.122	192.168.50.121	192.168.50.122	192.168.50.123

192.168.50.0/24



Mark allocation is as follows:

Give **1 mark** for each correct row. If anything is wrong given in a row, give 0 marks for that row. If '/' is missing from the network address answer, deduct 1 mark from the total marks obtained.

There are a few more alternative answers:

Possible alternative answer 1:

Department ID	Network address	Usable IP address range	First usable IP address	Last usable IP address	Broadcast IP address
D3	192.168.50.0/25	192.168.50.1 to 192.168.50.126	192.168.50.1	192.168.50.126	192.168.50.127
D1	192.168.50.128/26	192.168.50.129 to 192.168.50.190	192.168.50.129	192.168.50.190	192.168.50.191
D2	192.168.50.192/27	192.168.50.193 to 192.168.50.222	192.168.50.193	192.168.50.222	192.168.50.223
D4	192.168.50.224/28	192.168.50.225 to 192.168.50.238	192.168.50.225	192.168.50.238	192.168.50.239
D5	192.168.50.240/28	192.168.50.241 to 192.168.50.254	192.168.50.241	192.168.50.254	192.168.50.255

Possible alternative answer 2:

Department ID	Network address	Usable IP address range	First usable IP address	Last usable IP address	Broadcast IP address
D3	192.168.50.0/25	192.168.50.1 to 192.168.50.126	192.168.50.1	192.168.50.126	192.168.50.127
D1	192.168.50.128/27	192.168.50.129 to 192.168.50.158	192.168.50.129	192.168.50.158	192.168.50.159
D2	192.168.50.160/27	192.168.50.161 to 192.168.50.190	192.168.50.161	192.168.50.190	192.168.50.191
D4	192.168.50.192/27	192.168.50.193 to 192.168.50.222	192.168.50.193	192.168.50.222	192.168.50.223
D5	192.168.50.224/27	192.168.50.225 to 192.168.50.254	192.168.50.225	192.168.50.254	192.168.50.255

7. (a) (i) Earlier, the business operated as 'pure-brick'. After introducing the online shop, what is the new form of the business? [0.5]

(bricks and clicks / clicks and mortar / brick-and-click)

NOTE:

▼ If other incorrect forms also written, **do not** give any credit.

- (ii) Saman makes agreements with tourist hotels to display his products on their websites. State the e-commerce transaction type between Saman and the tourist hotels selecting from B2B, B2C, C2C and C2B. [0.5]

B2B

NOTE:

▼ Exact case and spelling needed.

▼ If multiple answers given, **do not** give any credit.

- (iii) From the types listed, what is the e-commerce transaction type between Saman and a customer who buys a product online. [0.5]

B2C

NOTE:

▼ Exact case and spelling needed.

▼ If multiple answers given, **do not** give any credit.

- (iv) Write down one payment method that Saman could provide for customers in his online shop. [0.5]

(credit cards / debit cards / online transfer / cash on delivery / card payment on delivery / third party payment service / mobile wallet /QR code based payments)

NOTE:

▼ Trade names not accepted.

★ If student gives multiple methods, consider only the first one.

- (v) List four digital divide related problems that Saman could face when giving the product detail upload facility to his customers. [2]

Any four of the following:

- Limited access to devices
- Limited access to the Internet
- Lack of digital literacy
- Language barrier
- Reluctance to use technology
- Not having access to electricity

Give **0.5 marks** for each for a maximum mark of 2.

NOTE:

★ If more than four problems given, consider only the first four.

- (vi) For one of the problems listed in (v), explain a solution that Saman could provide. [2]

Problem	Solution
Limited access to devices	1. Request authorities and related firms to facilitate the suppliers to obtain devices 2. Instruct the suppliers to use communication centers.
Limited access to the Internet	1. Request authorities and related firms to facilitate Internet connectivity 2. Instruct the suppliers to use communication centers. 3. Instruct the suppliers on how to use mobile hotspots using their mobile devices.
Lack of digital literacy	1. (Facilitate/conduct) awareness programs 2. Have simple user interfaces 3. Supply instructional videos
Language barrier	1. Multi-lingual user interfaces 2. Supply instructional videos in Sinhala/Tamil
Reluctance to use technology	1. Have motivational sessions 2. Have simple user interfaces 3. Supply instructional videos
Not having access to electricity	1. Request authorities and related firms to facilitate the suppliers to have electricity 2. Promote alternative energy usage 3. Instruct the suppliers to use communication centers.

Give either **2 or 0** marks.

NOTE:

▼ **Do not** give marks if the solution does not match a problem given in (v).

★ Any other correct solution method that **Saman could be involved in** is acceptable.

- (b) (i) From the three given agents, which one is the *interface agent* and why?

[1]

Help agent; Because it interacts with the customer

Marks allocated as follows:

A 0.5 marks: Help agent

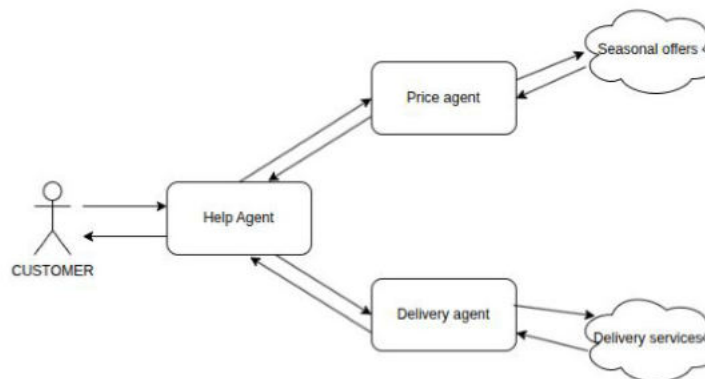
B 0.5 marks: reason (←-- A)

NOTE:

▼ Do not give marks if multiple agents are written.

- (ii) Draw simplified agent diagram. Label the diagram and show all interactions.

[2]



Marks allocated as follows:

A 1 mark: Correctly connected CUSTOMER and the three agents as shown

B 1 mark: Proper arrow directions AND
indicating 'Seasonal offers' and 'Delivery services' (←-- A)

NOTES:

★ Ignore the shapes used in the diagram.

★ If multiple diagrams drawn, consider only the first one.

- (iii) Give one advantage of using several software agents instead of using one large program to do all the work. [2]

Any one of the following:

- easy maintenance
- modularity
- (parallel processing / higher execution speed / division of workload)
- fault tolerance
- scalability
- higher speed due to specialization

Give **2 or 0 marks** only.

NOTE:

★ If multiple advantages given, consider only the first one.

- (iv) Describe one situation where the *Delivery agent* should take an action without being directly instructed by the user. [2]

Any one of the following:

- if the expected courier service is not available, then automatically select the next best service
- report courier delays to the CUSTOMER through the Help Agent
- handle address validation problems

Give **2 or 0 marks** only.

NOTE:

★ If multiple examples given, consider only the first one.

- (v) Describe one situation where the Delivery Agent may give incorrect information to the customer. [2]

Any one of the following:

- Wrong delivery cost due to the incorrect information in the delivery service databases
- Incorrect delivery times due to unforeseen circumstances
- Wrong information due to the stale databases that the Delivery Agent may use

Give **2 or 0 marks** only.

NOTE:

★ If multiple situations given, consider only the first one.

8. (a) Write a Python function to display the menu, allow the user to type a menu option and return the option the user entered.

[3]

```
def menu():
    print("1) Read a student's mark")
    print("2) Display marks")
    print("3) Exit")
    i = int(input("Enter your option ->"))
    return i
```

Marks allocated as follows:

- A 1 mark:** 'def' line with function name and colon
B 1 mark: Correct display of options (←-- A)
C 1 mark: input and return (←-- B)

NOTES:

- ▼ Correct indentation and syntax is essential for each of the mark components.
- ▼ Python keywords (i.e., def, print, int, input, return) must be in lowercase.
- ★ If multiple codes given, consider only the first one.

- (b) Write a Python function to return a tuple comprising the index number and marks for the three subjects when the index number and marks for the three subjects are given.

[4]

```
def getMarks(indexNumber, mark1, mark2, mark3):
    return indexNumber, mark1, mark2, mark3
```

Marks allocated as follows:

- A 2 marks:** 'def' line with function name, four parameters and colon
B 2 marks: return tuple (←-- A)

NOTES:

- ▼ Correct indentation and syntax is essential for each of the mark components.
- ▼ Python keywords (i.e., def, return) must be in lowercase.
- ★, ▼ Student can use his/her name for 'getMarks'. But it must be meaningful. If not, reduce **0.5 marks** from the earned total for this question.
- ★ If multiple codes given, consider only the first one.
- ★ Codes with the same functionality are acceptable.

- (c) Write a Python function by using the above function to read the marks of multiple students and add them to a list of tuples named **classMarks**. The function should terminate when the user enters -1 as the index number. [4]

```
classMarks=[]

def getStudentMark():
    index = input("Enter student index no -> ")
    while index != "-1":
        mark1 = int(input("Marks for ICT ->"))
        mark2 = int(input("Marks for Physics ->"))
        mark3 = int(input("Marks for Chemistry ->"))
        classMarks.append(getMarks(index,mark1,mark2,mark3))
        index = input("Enter student index no -> ")
```

Marks allocated as follows:

- A 1 mark:** Definition of 'classMarks' list as global or local
B 2 marks: Function definition and getting all values in a loop
C 1 mark: Append to list (←-- A, B)

NOTES:

- ▼ Correct indentation and syntax is essential for each of the mark components.
- ▼ Python keywords (i.e., def, input, while, int, append) must be in lowercase.
- ★▼ Ignore case defects in 'classMarks'. However, the student must consistently use whatever the case that s/he uses.
- ★, ▼ Student can use his/her name for 'getStudentMark'. But it must be meaningful. If not, reduce **0.5 marks** from the earned total for this question.
- ★ If multiple codes given, consider only the first one.
- ★ Codes with the same functionality are acceptable.

- (d) Write down a Python function to display the marks of a student given his/her index number. [4]

```
def printAMark(index):
    for mark in classMarks:
        if index == mark[0]:
            print(mark[0],mark[1],mark[2],mark[3])
```

Marks allocated as follows:

- A 1 mark:** Function definition
B 1 mark: for (←-- A)
C 1 mark: if (←-- B)
D 1 mark: print (←-- C)

NOTES:

- ▼ Correct indentation and syntax is essential for each of the mark components.
- ▼ Python keywords (i.e., def, for, in, if, print) must be in lowercase.
- ★▼ Ignore case defects in 'classMarks'. But it must be consistent with student's use of it for part (c).
- ★ If multiple codes given, consider only the first one.
- ★ Codes with the same functionality are acceptable.

9. (a) (i)

Draw an ER diagram for the above system showing entities, attributes, relationships and cardinalities. Underline the primary keys. (Use only the given terms for attributes and relationships.)

[5]

Two diagrams are possible:

Diagram 1:

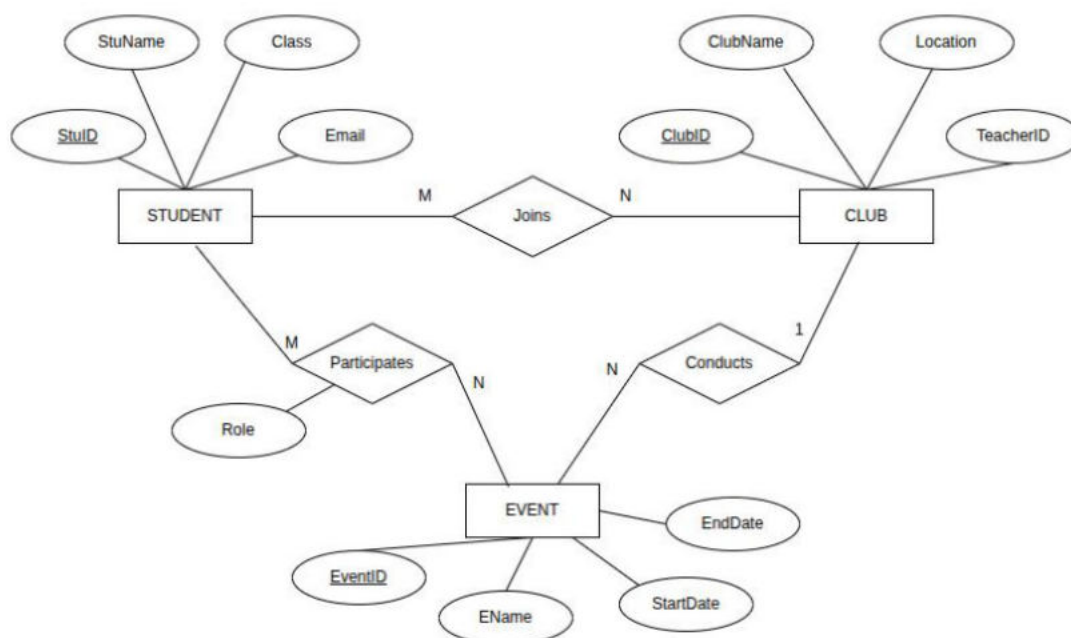
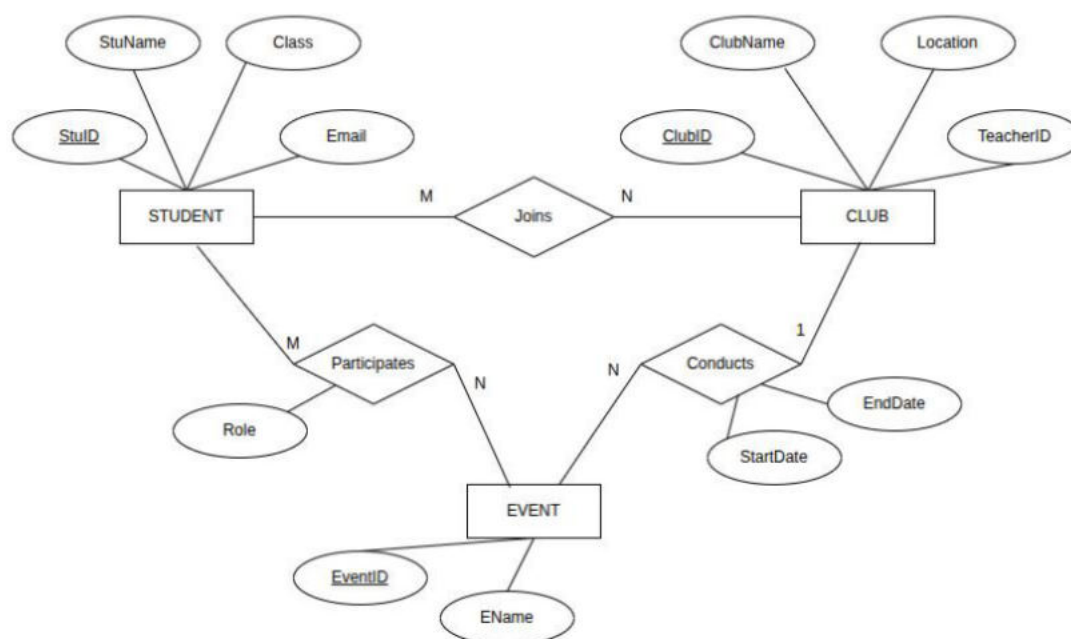


Diagram 2:



Marks allocated for Diagram 1 as follows:

- A 1 mark:** STUDENT entity with all attributes listed and the primary key underlined
B 1 mark: CLUB entity with all attributes listed and the primary key underlined
C 1 mark: EVENT entity with all attributes listed and the primary key underlined
D 0.5 marks: 'Joins' relationship with M:N cardinality ($\leftarrow\leftarrow A, B$)
E 0.5 marks: 'Conducts' relationship with 1:N cardinality ($\leftarrow\leftarrow B, C$)
F 0.5 marks: 'Participates' relationship with M:N cardinality ($\leftarrow\leftarrow A, C$)
G 0.5 marks: Descriptive attribute 'Role' ($\leftarrow\leftarrow F$)

Marks allocated for Diagram 2 as follows:

- A 1 mark:** STUDENT entity with all attributes listed and the primary key underlined
B 1 mark: CLUB entity with all attributes listed and the primary key underlined
C 1 mark: EVENT entity with all attributes listed and the primary key underlined
D 0.5 marks: 'Joins' relationship with M:N cardinality ($\leftarrow\leftarrow A, B$)
E 0.5 marks: 'Conducts' relationship with 1:N cardinality and the two descriptive attributes ($\leftarrow\leftarrow B, C$)
F 0.5 marks: 'Participates' relationship with M:N cardinality ($\leftarrow\leftarrow A, C$)
G 0.5 marks: Descriptive attribute 'Role' ($\leftarrow\leftarrow F$)

NOTES:

- ▼ Exact case is essential for attributes and relationships.
- ▼ Entity names must be singular.
- ★ For entities, the Sinhala medium students can use Sinhala names and the Tamil medium students Tamil names.
- ★ If multiple diagrams drawn, consider only the first one.

- (ii) Write the relational schema for the above ER diagram. (List only the tables with their attribute names. Underline primary keys.)

[4]

STUDENT(StuID, StuName, Class, Email)
 CLUB(ClubID, ClubName, Location, TeacherID)
 EVENT(EventID, EName, ClubID, StartDate, EndDate)
 JOINS(StuID, ClubID)
 PARTICIPATES(StuID, EventID, Role)

Marks allocation is as follows:

- Give **4 marks** if all five tables correct
- Give **3 marks** if only four tables are correct
- Give **2 marks** if only three tables are correct

NOTES:

- ▼ For credit to be given to a table, in addition to the correct attributes, the primary key must be underlined.
- ★ Ignore the use of any arrows by the student to separate the table names from attributes.
- ★ Ideally, the table names must be as shown. However, this year, ignore case and spelling defects in them. Please note that this may change in the future years.
- ★ This year, minor spelling mistakes are allowed for attribute names. However, it may not be allowed in future years.
- ★ If multiple diagrams drawn, consider only the first one.

- (b) (i) In which normal form does the given table exist? Justify your answer.

[2]

Normal form:

(1 NF / First Normal Form)

Justification:

This table has a number of partial dependencies and (no repeating groups / each field contains atomic values).

Marks allocated for Diagram 1 as follows:

A 1 mark: First normal form

B 1 mark: Justification (both sides of the above 'and' compulsory)

NOTE:

- ★ An answer with a similar meaning is acceptable.

- (ii) Convert the above table to the next normal form and list the tables obtained after the conversion giving the attributes. Underline the primary key of each table.

[4]

STUDENT(Stu_ID, Stu_Name, Phone)

EVENT(Event_ID, Event_Type, Event_Fee, Start_Date, End_Date)

STUDENT_EVENT(Stu_ID, Event_ID, Services)

Marks allocated as follows:

A 1 mark: STUDENT table with correct attributes

B 1 mark: EVENT table with correct attributes

C 1 mark: STUDENT_EVENT table with correct attributes

D 1 mark: Underlining all four primary keys

NOTES:

- ▼ Listing the tables in any other form is not acceptable.
- ★ Ignore the use of any arrows by the student to separate the table names from attributes.
- ★ Student can use any appropriate name for STUDENT_EVENT. But that name should **not** include any spaces.
- ★ Ignore case and spelling defects in table names.
- ★ This year, minor spelling mistakes are allowed for attribute names. However, it may not be allowed in future years.

- 10. (a)** Without even checking the BOOKING table, what dates should the system not allow the user to input? [1]

(Any date earlier than the current date / a date with an invalid format / an invalid date)

NOTE:

★ If multiple answers given, consider only the first one.

- (b) (i)** In the 'list.php' code of Fig.10.3, what is the 'result' variable expected to contain? [1]

It should contain all 'Booking' table rows [if any] that contains (\$visit_date / visit_date / entered appointment date)

Marks allocated as follows:

A 0.5 marks: BOOKING table rows

B 0.5 marks: that contains (\$visit_date / visit_date / entered appointment date) (←-- A)

- (ii)** Write down the first code line in Part A of Fig.10.3. [1]

```
if ($row['Time'] == '08:15:00') $avail[1] = 0;
```

Give a total of just **0.5 marks** for any of the following answers:

- if (\$row['Time'] == '08:30:00') \$avail[2] = 0;
- if (\$row['Time'] == '08:45:00') \$avail[3] = 0;

NOTES:

▼ Exact syntax and case are essential.

★ If multiple code lines written, consider only the first one.

- (iii)** What message should be stated in B of Fig.10.3? [1]

All appointment slots for this date are reserved. Kindly select a different date.

Marks allocated as follows:

A 0.5 marks: All booked

B 0.5 marks: for this date (←-- A)

NOTES:

★ Any appropriate message containing the above two components is acceptable.

★ Ignore the use of any quotes by the student.

(iv) Write down suitable replacements for C,D,E and F of Fig.10.3.

[4]

```
C: <hr>
      <table>
        <tr>
D: $avail[0] == 0
E: <td style='background-color: red'>08:00</td>
F: <td style='background-color: green'>08:00</td>
```

Give **1 mark** each for correct C,D,E and F.

NOTES:

- ▼ If more than the required number of replacements are given for any one of the labels C, D, E and F, then **do not** give the mark for that label.
- ▼ Exact syntax is required.
- ★ Ignore case.
- ★ Use of double quotes acceptable.
- ★ Although not ideal, the <hr> tag can occur anywhere within C.

(c) With respect to the selected date and time, what database related test should be done in the book.php file?

[2]

The selected appointment slot on the selected date should not be already reserved.

NOTES:

- ▼ No partial marks.
- ★ Answers with similar meanings are acceptable.

(d) Write down an important maintenance task that must be done to the BOOKING table at the end of each day to increase time slot search efficiency and to reduce storage requirements of the system.

[2]

(Any rows relating to that day should be removed / Deleting old reservation records)

NOTES:

- ▼ No partial marks.
- ★ Answers with similar meanings are acceptable.
- ★ If multiple maintenance tasks given, consider only the first one.

- (e) Write down one advantage of hosting this system using a shared web hosting service instead of publishing it on a hospital computer. [1]

Any one of the following:

- Cost-Effectiveness: Any one of the following:
 - This is cheaper than local publishing as the high costs for infrastructure, hardware and software are not required.
 - Furthermore, the cost of the server is split among many users, making it a very affordable option.
- Technical skills to handle server maintenance, updates and hardware issues are not required.
- It is easy and less time consuming to setup.
- (Managing the website is comparatively easy due to the user-friendly interfaces provided by the provider / Ease of use)
- Scalability: If needed, can upgrade hosting plan or switch to a different type of hosting.
- 24/7 customer support team for immediate technical assistance usually available
- No need to spend time on server maintenance, security monitoring and troubleshooting
- Improved reliability
- (Better uptime / helps website remain more accessible and functional)
- May support more simultaneous access by users
- Reduces need for hardware and software
- Reduces space and infrastructure requirement for (hardware / server)

NOTES:

- ★ Answers with similar meanings are acceptable.
- ★ If multiple advantages given, then consider only the first one.

- (f) Explain the method to recover the web hosting cost and how it improves resource utilization. [2]

Method:

Charge a fee from a patient when s/he makes a reservation

- Estimate the expected number of patients that will use this system per year
- Divide Rs.7500 from that number to find the amount that each patient will have to pay when making a booking

Benefit:

This will prevent patients from making reservations that they do not use

Marks allocated as follows:

A 1 mark: method

B 1 mark: how it increases resource utilization (←-- A)

NOTES:

- ★ The details of the method (as given above) are not essential.
- ★ If multiple methods given, consider only the first one.

AL 2025 ICT Paper Mark scheme amendments made after the Chief Examiner/Ad-Chief meeting held on 31st Jan and 1st Feb 202t at the Royal College, Colombo.

Important:

- The *printed and distributed mark scheme* along with *these amendments* must be strictly complied with.
- This document contains **only the amendments** to the printed mark scheme. Thus for each sub-question, the printed mark scheme should be referred to whatever is not amended through this document.

Amendments

Paper I

None

Paper II

Qn	Amendment
1(a)	<i>Marks allocated as follows:</i> A 1 mark: Complete CREATE statement with fields and data types B 1 mark: Correct syntax (←-- A) C 1 mark: Suitable char, varchar sizes and NOT NULL or PRIMARY KEY usage as shown above (←-- B) NOTES: ★ Spelling and case: Exact spelling needed for all. Ignore case for SQL keywords (i.e., CREATE, TABLE, INT, PRIMARY KEY, NOT NULL, CHAR, VARCHAR). All field names must be in lower-case. ★ For mark component C, char and varchar sizes must be defined. ★ INT can be specified with a size. e.g, INT (5) ★ Field order is not important. ★ Do not check NOT NULL or PRIMARY KEY usage for mark component A. ★ If multiple answers given, consider only the first one.

1(b)	NOTES: ★ Spelling and case: Exact spelling needed for all. Ignore case for SQL keywords (i.e., INSERT INTO, VALUES). Field names and values must have exact case. ★ For this year's marking, the double quotes also are allowed for field values. Note that the two integer values (1, 800) must be without quotes. ★ If multiple answers given, consider only the first one.
1(d)	NOTE: ★ If multiple lines underlined, do not give the mark. ★ Partial underlines or any method of pointing to the line is are acceptable.
1(e)	NOTE: ★ The answer: "The change should be done to the (database / Book table)." or any answer conveying the same meaning is acceptable. ★ If multiple answers given, consider only the first one. Do not give the mark for any other erroneous answer.
2(b)	NOTES: ★ Table names: READS table can also be named STUDENT_BOOK. The candidate can use a different name for the AUTHOR table. But that name should not include any spaces. ★ Spelling and case: Exact spelling is required for the STUDENT, BOOK and READS/STUDENT_BOOK table names and all field names. Underscore is also required where it is used. For this year, ignore case of table names. However, exact case is required for field names. ★ Format: Using the required format (excluding arrow) is essential. Arrow is not essential. ★ Reduce 1 mark for each additional table that is not given here. However, the total mark for 2(b) should not be negative.

3(b) (ii)	NOTES: ★ Consistent use of variable names and their cases are important. ★ Ignore the non-use of question marks in the condition boxes. ★ Acceptable synonyms: • <i>Start, Stop:</i> Begin, End • <i>Read:</i> Input, Get • <i>Print:</i> Write, Output, Display ★ 'Number % 2 ==0', 'Number % 2 =0' or 'Is number even?' are also acceptable. ★ Ignore case in text (except in variable names). ★ The student can use the Number>=0 loop to run the computation loop. Then, the relevant part in the flowchart should be changed accordingly.
3(b) (iii)	NOTES: ★ Spelling and case: Exact spelling and case is essential for Python keywords. Consistent use of variable names and their cases are important. ★ For each of the above A,B and C marking components, correct indentation and syntax is essential. ★ 'while (1):' can also be used.
3(b) (iv)	(a run-time error / an exception / a ValueError / an error / execution error) NOTES: ★ Ignore the case of ValueError. ★ If multiple errors given, consider only the first one.Do not give the mark for an erroneous answer.
4(b) (iii)	Any one of the following: 0110 xxxx xxxx xxxx 1100 xxxx xxxx xxxx 0011 xxxx xxxx xxxx 0100 xxxx xxxx xxxx where x signifies either 0 or 1.
5	Please see attachment

6(a)	A and B: (DNS / SNMP / TFTP / DHCP / RTP / RTCP / VOIP / QUIC / NTP) C: (ordered /reliable / guaranteed) Give 0.5 marks for each of A, B and C. NOTES: ★ Spelling and case: Writing the full name is acceptable. If abbreviations used, then spelling must be exact. For this year's marking, ignore case. ★ If the same correct answer is repeated at A and B, then give the 0.5 mark to only one of them. ★ Answers for A and B can be written in any order. ★ If multiple answers are written for each of A and B, take only the first one of each.
6(b)	Any three of the following: • (Trojans / Trojan horses) • Worms • Spyware • Adware • Ransomware • Rootkits • Keyloggers • Bots Give 0.5 marks for each. NOTE: ★ Spelling and case: The marks are to be given <u>only</u> if the examiner can understand what the student is meaning. Ignore case. ★ If more than three written, consider only the first three.

6(c)	NOTES: ★ For 'Terminator', the letter T could also be written, or a colored circle could also be drawn. Appropriate Sinhala or Tamil words could also be written. ★ For 'Bus (Backbone) cable', the words 'cable' or 'bus' could also be written. ★ The student can use suitable shapes to indicate the computers, the servers and the network printer or they may use boxes for all as shown above. ★ No need to mention 'T connectors' in the diagram. ★ Devices could be connected to the cable in any order. ★ If multiple diagrams drawn, consider only the first one.
6(d) (i)	any address between 128.xxx.xxx.xxx to 191.xxx.xxx.xxx NOTE: ▼ If multiple examples given, do not give any credit if any of the examples is wrong.
6(d) (ii)	<i>An example address from the following:</i> 10.0.0.0 – 10.255.255.255 172.16.0.0 – 172.31.255.255 192.168.0.0 – 192.168.255.255 NOTE: ▼ If multiple examples given, do not give any credit if any of the examples is wrong.
6(g)	<i>Mark allocation is as follows:</i> Give 1 mark for each correct row. If anything is wrong given in a row, give 0 marks for that row. If <u>none</u> of the network address answers do not contain the '/', then deduct 1 mark from the total marks obtained.

7(b) (ii)	<i>Marks allocated as follows:</i> A 1 mark: Correctly connected CUSTOMER and the three agents as shown B 1 mark: Proper arrow directions AND indicating 'Seasonal offers' and 'Delivery services' (←-- A, correct use of shapes) NOTES: ★ Shapes: Ignore the types of shapes used by the student in the diagram. For 'seasonal offers' and 'delivery services', either no shape or a shape different to the one that was used for the agents must be used. If not, do not give the mark for component B. ★ Arrows: • Arrows are not needed for mark component A; just connecting the agents and the customer with the relevant lines is sufficient. • The dataflows indicated by the arrows are not needed. However, if given, then they must be correct in order for the mark for component B to be given. • Two-ways arrows are also acceptable. ★ If multiple diagrams drawn, consider only the first one. ★ Instead of the word 'CUSTOMER', the student can use the word 'USER'.
8(c)	NOTES: ▼ Correct indentation and syntax is essential for each of the mark components. ▼ Python keywords (i.e., def, input, while, int, append) must be in lowercase. ★▼ Ignore case defects in 'classMarks'. However, the student must consistently use whatever the case that s/he uses. ★, ▼ Student can use his/her name for 'getStudentMark'. But it must be meaningful. If not, reduce 0.5 marks from the earned total for this question. ★ If multiple codes given, consider only the first one. ★ Codes with the same functionality are acceptable. ★ If classMarks is defined as a local variable, then at the end of the function, this variable has to be returned: e.g., return classMarks.
8(d)	NOTES: ▼ Correct indentation and syntax is essential for each of the mark components. ▼ Python keywords (i.e., def, for, in, if, print) must be in lowercase. ★▼ Ignore case defects in 'classMarks'. But it must be consistent with student's use of it for part (c). ★ If multiple codes given, consider only the first one. ★ Codes with the same functionality are acceptable. ★ If classMarks was defined as a local variable, then it must be passed to this function: e.g., def printAMark(index, classMarks):

9(a) (i)	NOTES: ▼ Spelling and case: Exact spelling and case is essential for attributes and relationships. ▼ Entity names: For the entities, the Sinhala medium students can use Sinhala names and the Tamil medium students Tamil names. But all English, Sinhala and Tamil entity names must be singular. ★ If multiple diagrams drawn, consider only the first one.
9(a) (ii)	<i>Marks allocation is as follows:</i> • Give 4 marks if all five tables correct • Give 3 marks if only four tables are correct • Give 2 marks if only three tables are correct • Give 1 mark if only two tables are correct NOTES: ▼ Spelling and case: Exact spelling and case is essential for attributes. ▼ Table names: • The JOINS table can also be named STUDENT_CLUB and the PARTICIPATES table can also be named STUDENT_EVENT. • The table names should match the relevant entities/relationships in the diagram. ▼ For credit to be given to a table, in addition to the correct attributes, the primary key must be underlined. ★ Ignore the use of any arrows by the student to separate the table names from attributes. ★ If multiple diagrams drawn, consider only the first one.
9(b) (ii)	NOTES: ▼ Spelling and case: Exact spelling and case is essential for attributes. Ignore case and minor spelling defects in table names. Student can use any appropriate name for STUDENT_EVENT. But that name should not include any spaces. ▼ Listing the tables in any other form is acceptable. ★ Ignore the use of any arrows by the student to separate the table names from attributes.

10(b) (iii)	NOTES: ★ Any appropriate message containing the above two components is acceptable. [★] Ignore the use of any quotes by the student.
10(b) (iv)	NOTES: ▼ If more than the required number of replacements are given for any one of the labels C, D, E and F, then do not give the mark for that label. ▼ Exact syntax is required. ★ Ignore case. [★] Use of double quotes acceptable. ★ Although not ideal, the <hr> tag can occur anywhere within C.

5. (a) Prove the given equation using Boolean algebra.

[5]

There are multiple ways to prove this. The following is one method:

$$\begin{aligned}
 LHS &= \bar{a}\bar{b}cd + \bar{a}bc\bar{d} + \bar{a}bcd + ab\bar{c}\bar{d} + abc\bar{d} + abcd \\
 &= \bar{a}\bar{b}cd + \bar{a}bcd + ab\bar{c}\bar{d} + abc\bar{d} + \bar{a}bc\bar{d} + \bar{a}bcd + abc\bar{d} + abcd \\
 &= \bar{a}cd(\bar{b} + b) + ab\bar{d}(\bar{c} + c) + \bar{a}bc(\bar{d} + d) + abc(\bar{d} + d) \\
 &= \bar{a}cd + ab\bar{d} + \bar{a}bc + abc \\
 &= \bar{a}cd + ab\bar{d} + (\bar{a} + a)bc \\
 &= \bar{a}cd + ab\bar{d} + bc \\
 &= RHS
 \end{aligned}$$

Marks allocated as follows:

A 3 marks: 1 mark each for each correct line with a simplification
(←-- The relevant line contains only the correct minterms)

B 2 marks: For the remaining simplifications (←-- A)

NOTE:

- ★ The student can prove as expected from LHS to RHS or from RHS to LHS as well. When proving from the LHS to the RHS, stating the laws used is not required. However, if the proof is from RHS to LHS, then stating the laws used are required.

- (b) Design the most simple logic circuit that takes the four inputs and gives an output Z which is equal to 1 for the valid input combinations.

[7]

Let us assume that the timer signal is represented by T.

Method 1:

T	k2	k1	k0	Z	Minterms
0	0	0	0	0	
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	1	$\bar{T}\bar{k}2k1k0$
0	1	0	0	0	
0	1	0	1	0	
0	1	1	0	1	$\bar{T}k2k1\bar{k}0$
0	1	1	1	1	$\bar{T}k2k1k0$
1	0	0	0	0	
1	0	0	1	1	$Tk2\bar{k}1k0$
1	0	1	0	0	
1	0	1	1	0	
1	1	0	0	1	$Tk2\bar{k}1\bar{k}0$
1	1	0	1	0	
1	1	1	0	1	$Tk2k1\bar{k}0$
1	1	1	1	1	$Tk2k1k0$

The Boolean expression for the circuit is:

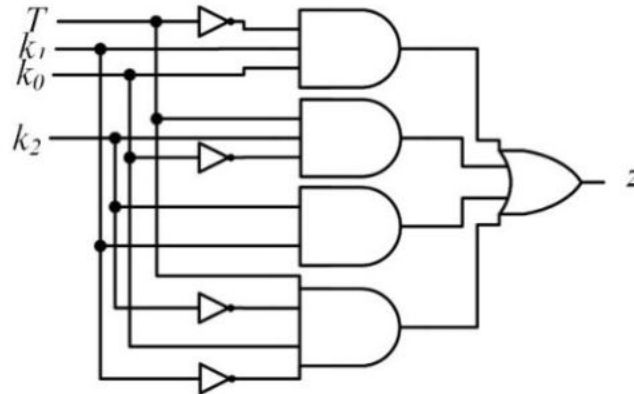
$$Z = \bar{T}\bar{k}_2k_1k_0 + \bar{T}k_2k_1\bar{k}_0 + \bar{T}k_2k_1k_0 + T\bar{k}_2\bar{k}_1k_0 + Tk_2\bar{k}_1\bar{k}_0 + Tk_2k_1\bar{k}_0 + Tk_2k_1k_0$$

By rearranging the terms

$$Z = \bar{T}\bar{k}_2k_1k_0 + \bar{T}k_2k_1\bar{k}_0 + \bar{T}k_2k_1k_0 + Tk_2\bar{k}_1\bar{k}_0 + Tk_2k_1\bar{k}_0 + Tk_2k_1k_0 + T\bar{k}_2\bar{k}_1k_0$$

Using the proof in (a):

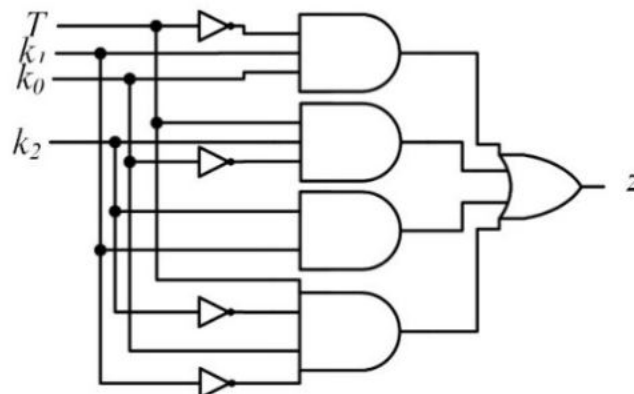
$$Z = \bar{T}k_1k_0 + Tk_2\bar{k}_0 + k_2k_1 + T\bar{k}_2\bar{k}_1k_0$$



Method 2:

The Karnaugh map:

		T K ₂			
		00	01	11	10
K ₁ K ₀	00	0	0	1	0
	01	0	0	0	1
	11	1	1	1	0
	10	0	1	1	0



Marks allocated as follows:

- A 4 marks:** Correct truth table (←-- All 0s and 1s marked)
OR Karnaugh map (←-- All 0s and 1s marked)
- B 2 marks:** Minimal correct expression
(←-- Truth table or Karnaugh Map with at least the 1s correctly marked)
- C 1 mark:** Correct circuit (←-- B)

NOTE:

- ★ If multiple circuits drawn, consider only the first one.
- ★ If Z is not written for the minimal correct expression, give only 1 mark for the mark component B.
- ★ An equivalent universal form circuit (i.e., a circuit containing NAND or NOR gates) is acceptable. But it has to be optimal.

- (c) State whether the vault can be opened in the absence of the officer-in-charge. Justify your answer. [3]

Yes.

The vault opens in two occasions (i.e., the four-bit number is 1001 and 1100) when the officer-in-charge is not in the office.

Marks allocated as follows:

- A 1 marks:** Yes.
- B 2 marks:** Reason (←-- A)

NOTE:

- ★ No partial marks for mark component B.



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