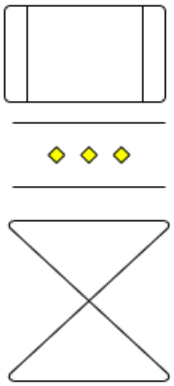
Confidential

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.

Contents

1 Instructions

1.1 General instructions

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

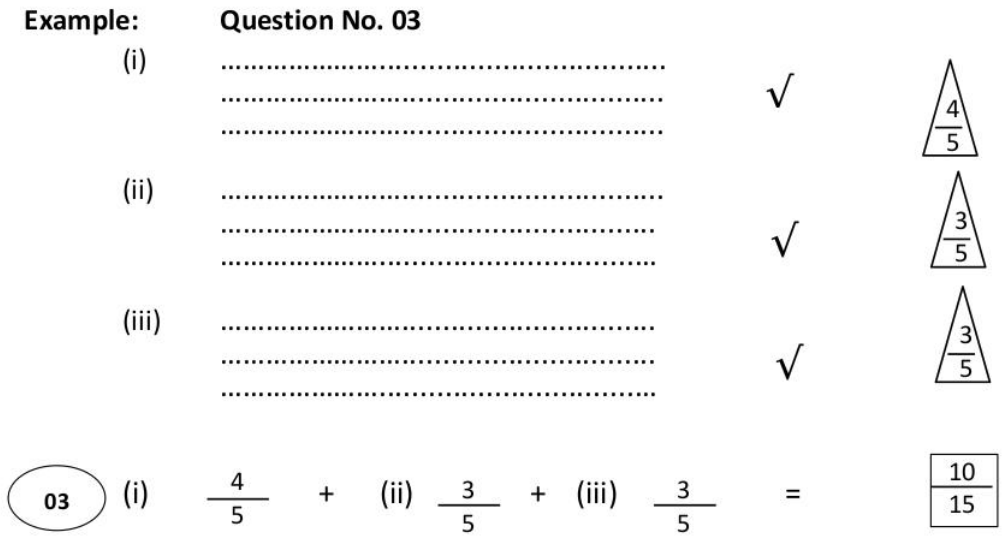
1. Each Examiner should use a red colour ball-point pen for marking answer scripts.
2. A purple colour ball-point pen should only be used by Chief/Additional Chiief Examiners.
3. Code number of the Examiner should be noted down on front page of each answer script. Enter marks in **clear numerals**.
4. 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.



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

3 Paper 1 answers

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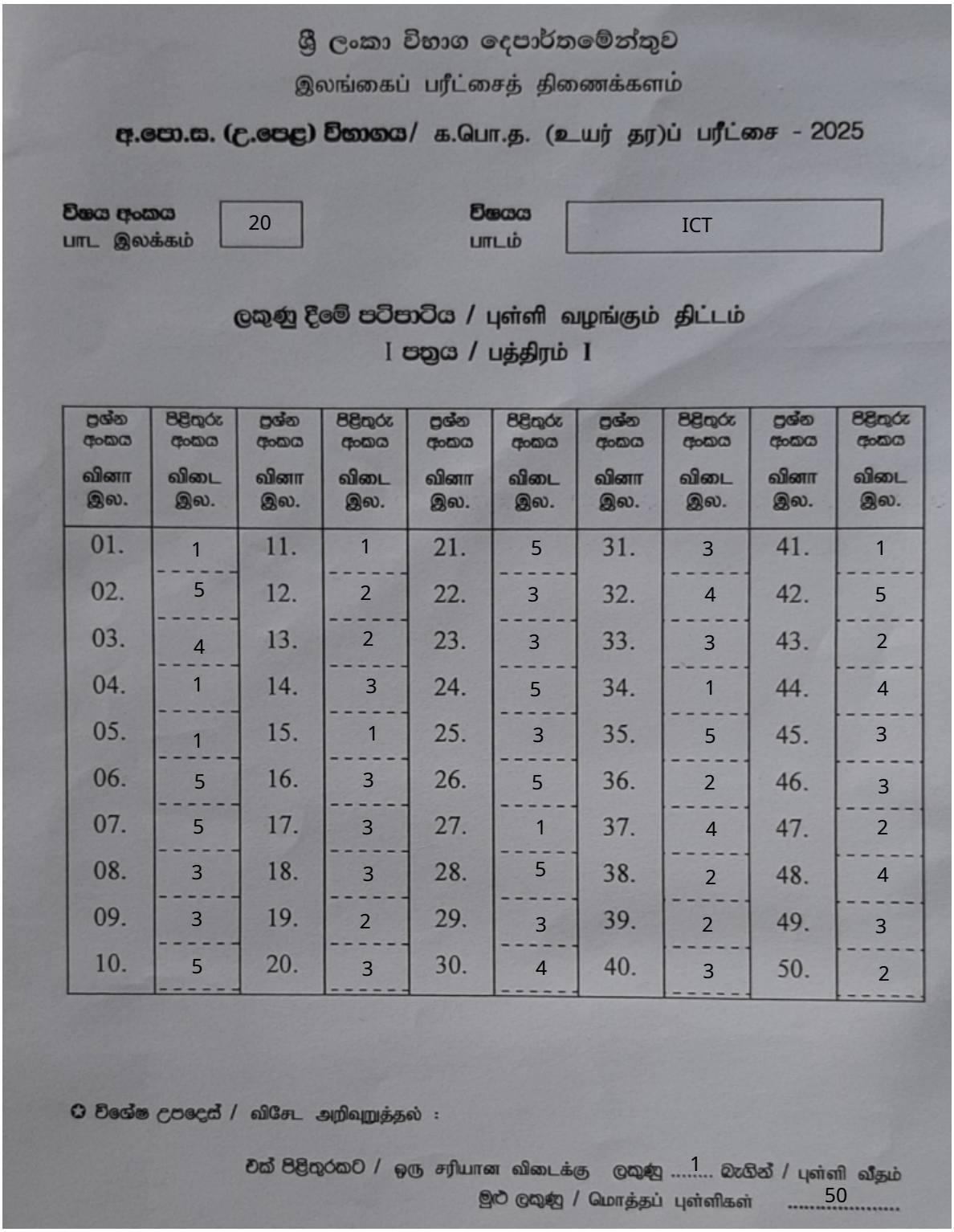

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இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය/ க.பொ.த. (உயர் தர)ப் பரீட்சை - 2025

විෂය අංකය / பாட இலக்கம் 20

විෂයය / 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 ලකුණු ..... 1 ..... බැගින් / புள்ளி வீதம்

මුළු ලකුණු / மொத்தப் புள்ளிகள் ..... 50 .....

4 Paper II mark scheme

Notes
1. ←-- 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 (←-- A)
C 1 mark: Suitable char, varchar sizes and NOT NULL or PRIMARY KEY usage (←-- 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 feasiblity 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 ($\leftarrow\!\!-$ 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

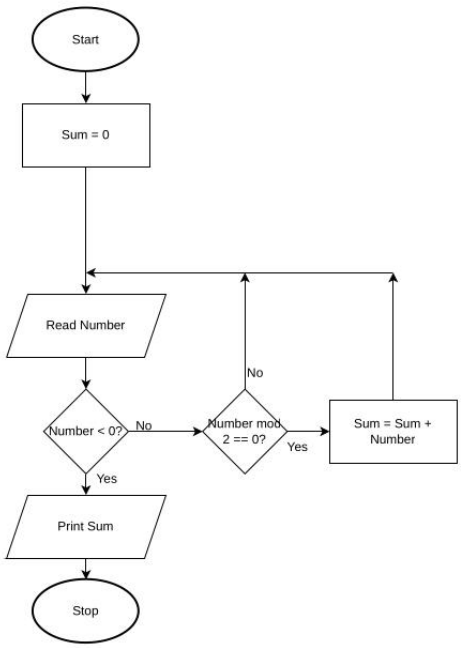
(b) **(i)** What is the expected output for the input: 1,2,3,5 and -1? **[1]**

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 intergers? **[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 → 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]**

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

Marks allocated as follows:

A 3 marks: **1 mark** each for each correct line with a simpification
(←-- 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	$T\overline{k2}k1k0$
0	1	0	0	0	
0	1	0	1	0	
0	1	1	0	1	$\overline{T}k2k1\overline{k0}$
0	1	1	1	1	$\overline{T}k2k1k0$
1	0	0	0	0	
1	0	0	1	1	$T\overline{k2}\ \overline{k1}k0$
1	0	1	0	0	
1	0	1	1	0	
1	1	0	0	1	$Tk2\ \overline{k1}\ \overline{k0}$
1	1	0	1	0	
1	1	1	0	1	$Tk2k1\overline{k0}$
1	1	1	1	1	$Tk2k1k0$

Then the Karnaugh map becomes:

k1 k0 \ Tk2	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:

$$f = \bar{T}k1k0 + T\overline{k2}\,\overline{k1}k0 + Tk2\overline{k0} + k2k1$$

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:

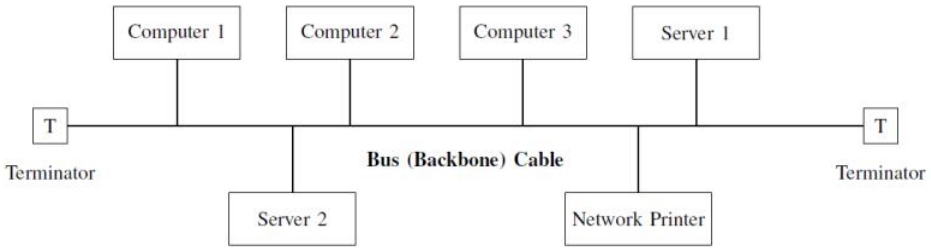
- (Trojans / Trojan horses)
- Worms
- Spyware
- Adware
- Ransomware
- Rootkits
- Keyloggers

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 adderss. **[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:

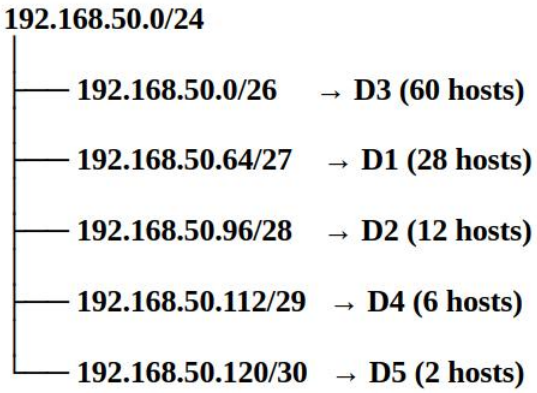
- (Trust / authentication)
- integrity – not altered by someone in the middle
- trust and legal validity (non-repudiation)
- signee cannot deny that he did not sign it

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



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

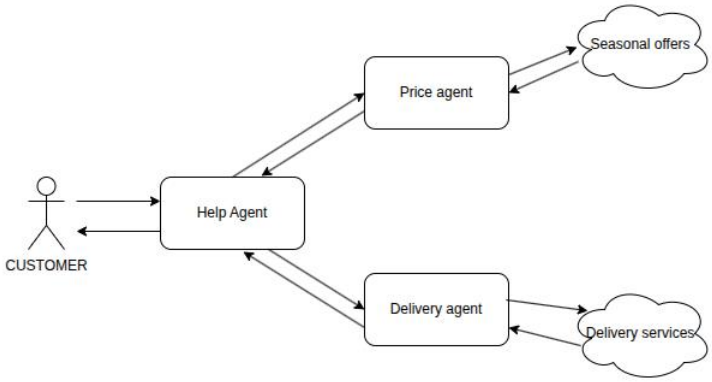
Marks allocated as follows:

A 0.5 marks: Help agent
B 0.5 marks: reason ($\leftarrow\!\!-$ 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' ($\leftarrow\!\!-$ 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 instruted 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:

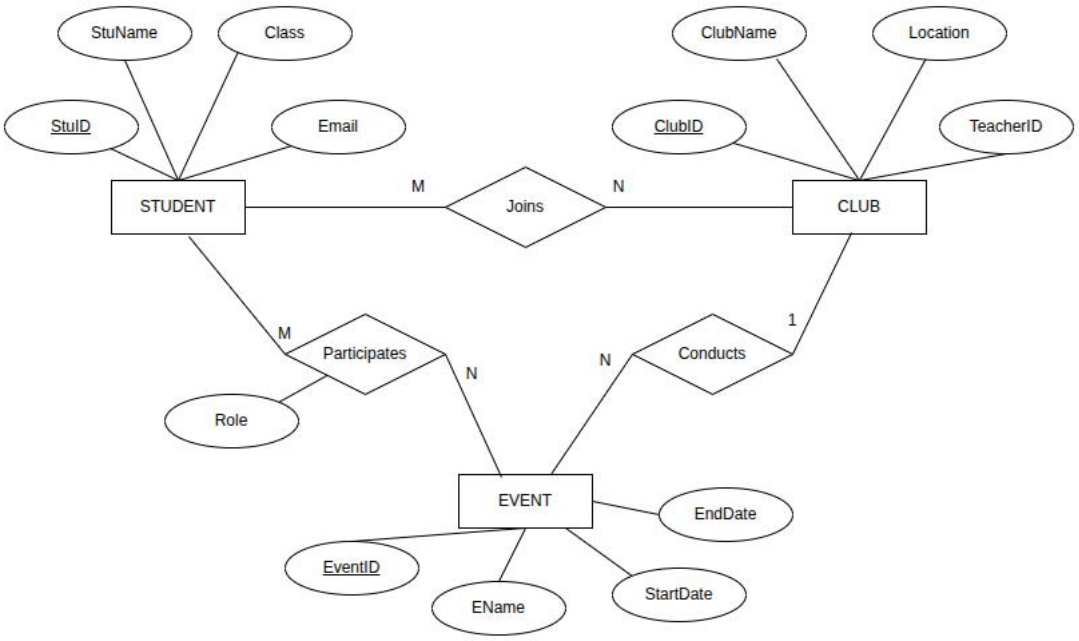
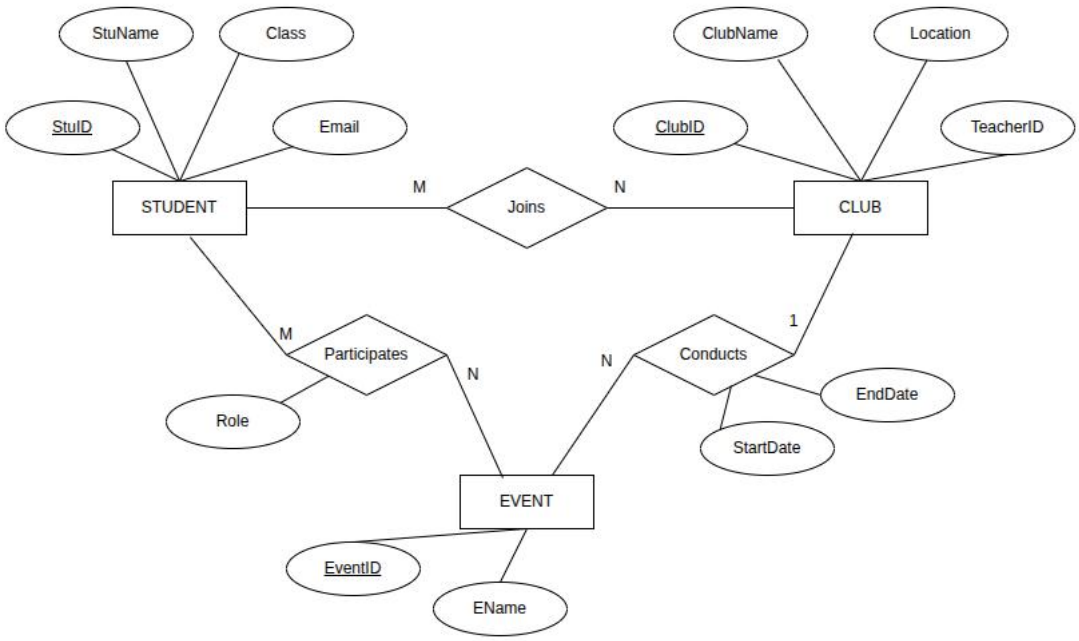


Diagram 2:



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 1mark:	EVENT entity with all attributes listed and the primary key underlined
D 0.5 marks:	'Joins' relationship with M:N cardinality (⇠ A, B)
E 0.5 marks:	'Conducts' relationship with 1:N cardinality (⇠ B, C)
F 0.5 marks:	'Participates' relationship with M:N cardinality (⇠ A, C)
G 0.5 marks:	Descriptive attribute 'Role' (⇠ 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 1mark:	EVENT entity with all attributes listed and the primary key underlined
D 0.5 marks:	'Joins' relationship with M:N cardinality (⇠ A, B)
E 0.5 marks:	'Conducts' relationship with 1:N cardinality and the two descriptive attributes (⇠ B, C)
F 0.5 marks:	'Participates' relationship with M:N cardinality (⇠ A, C)
G 0.5 marks:	Descriptive attribute 'Role' (⇠ 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(<u>StuID</u>, StuName, Class, Email)
CLUB(<u>ClubID</u>, ClubName, Location, TeacherID)
EVENT(<u>EventID</u>, EName, ClubID, StartDate, EndDate)
JOINS(<u>StuID</u>, <u>ClubID</u>)
PARTICIPATES(<u>StuID</u>, <u>EventID</u>, 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 ($\leftarrow\!\!-\!\!-\ A$)

NOTES:

★ The details of the method (as given above) are not essential.

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