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Confidential

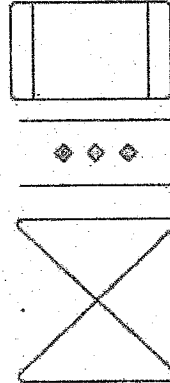


Department of Examinations, Sri Lanka

G.C.E. (A/L) Examination – 2024

**20 – ICT**

**Mark Scheme**



This document has been prepared for the use of marking examiners. Some changes would be made according to the views presented at the Chief Examiner's Meeting.

Amendments are to be included.

# 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  $\Delta$  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)	$\frac{3}{5}$	=	$\frac{10}{15}$
----	-----	---------------	---	------	---------------	---	-------	---------------	---	-----------------

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.

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව  
இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය / க.பொ.த. (உயர் தர)ப் பரீட்சை - 2024

විෂය අංකය  
பாட இலக்கம்

20

විෂයය  
பாடம்

Information and Communication  
Technology

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

❖ විශේෂ උපදෙස් / விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට / ஒரு சரியான விடைக்கு ලකුණු 01 බැගින් / புள்ளி வீதம்

මුළු ලකුණු / மொத்தப் புள்ளிகள் 01 × 50

### 3 Paper II mark scheme

#### Notes:

1. Essential keywords sufficient for credit in some answers are underlined.
2. Acceptable alternatives for a given word or set of words are separated by slashes.
3. <--A indicates that any credit for the item should be given only if A is correct.
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.

Qn	Answer	Marks
1(a)(i)	action select /select radio radio submit Submit  <b>Notes:</b> <ol style="list-style-type: none"> <li>1. Ignore case defects.</li> <li>2. Exact spelling needed.</li> <li>3. No partial marks.</li> <li>4. Order is important.</li> </ol>	1 1 1 1
1(ii)	<b>Any one of the following:</b> <ul style="list-style-type: none"> <li>• the action_page.php file/script/code is executed</li> <li>• run/execute php file/script/code</li> <li>• collected data is submitted to action_page.php for processing</li> <li>• The form data is validated and sent to the specified page (action_page.php) for processing</li> </ul> <b>Notes:</b> <ol style="list-style-type: none"> <li>1. 'stored in the action_page.php file' not accepted.</li> </ol>	1
1(iii)	<b>Any one of the following:</b> <ul style="list-style-type: none"> <li>• It will validate the email address.</li> <li>• It will check whether the email address is in proper form.</li> </ul>	1

1(iv)	<p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>• It will check whether the input contains only 10 digits</li> <li>• It will check whether the input contains only 0 to 9</li> </ul> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. 0-9 accepted.</li> </ol>	1
1(v)	<p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>• To display '10, Hill street, Kandy' when the cursor is moved over the hyperlink</li> <li>• To display additional information when the cursor is moved over the hyperlink</li> </ul> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Due to the error in the code line reference in the exam paper, the mark allocated for this question <b>is to be given to all who have attempted any part of Question 1.</b></li> </ol>	1
1(b)	<p>It prints the student_id, first_name and last_name of the records from the 'students' ('stu-dents') table of the 'studentDB' database</p> <p><b>Marks allocation:</b></p> <p><b>A:</b> records of the 'students' ('stu-dents') table of the 'studentDB' database</p> <p><b>B:</b> printing student_id, first_name and last_name</p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Ignore case and space defects.</li> <li>2. The underscore ( ) essential for field names.</li> </ol> <p><b>Alternative:</b></p> <p><b>A:</b> Gets the database connection</p> <p><b>B:</b> Displays the indicated data</p>	<p>1</p> <p>1</p> <p>(0.5)</p> <p>(0.5)</p>

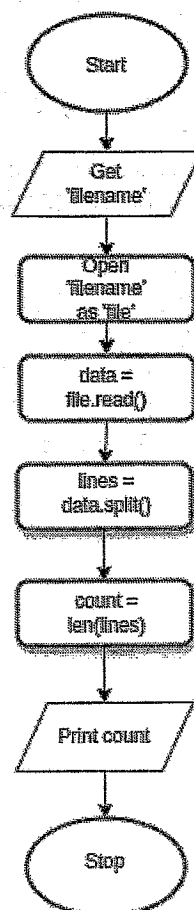
Qn	Answer	Marks
2(a)(i)	A: input/data B: process/processing C: output/information  <b>Notes:</b> 1. No partial marks.	1
2(a)(ii)	<p><b>Activity 1:</b></p> <p><b>Input:</b> username, password / username / email / user login details  <b>Process:</b> checking whether input valid / user validation (authentication)  <b>Output:</b> letting user in / display home page (welcome message)</p> <p><b>Notes:</b> 1. For <b>input</b>, student writing just 'password', is NOT acceptable.</p> <p><b>Activity 2:</b></p> <p><b>Input:</b> item(s) to purchase / selecting the items to purchase  <b>Process:</b>  compute total cost for the (selected items / items in the trolley);  searching the selected items and putting them to trolley  <b>Output:</b> total cost / display total cost</p> <p><b>Activity 3:</b></p> <p><b>Input:</b> (debit) card information  <b>Process:</b> Do the payment process to do the fund transfer for the amount that has to be paid / debit card validation / bank processing / accessing the payment gateway  <b>Output:</b> confirmation of payment ; initiate the stationery delivery process ; showing the details relating to the payment</p>	<p>1 (If only two correct: 0.5 marks)</p> <p>1 (If only two correct: 0.5 marks)</p> <p>1 (If only two correct: 0.5 marks)</p>

2(a)(iii)	<b>Activity 2:</b>  <b>Input:</b> last order reference / last order details / selecting 'Repeat previous order' option <b>Process:</b> get items of previous order and compute total cost for the selected items; check the availability of previous order items and compute new total cost for the selected items <b>Output:</b> display item details with total cost	<b>1</b>  (If only two correct: <b>0.5 marks</b> )
2(b)	<b>Any one of the following:</b> <ul style="list-style-type: none"> <li>• <u>vendor must provide</u> the setting up and configuration support</li> </ul>	<b>1</b>
2(c)	<b>Any one of the following:</b> <ul style="list-style-type: none"> <li>• With ICT it is easier to get information and publish other's material as one's own</li> <li>• Using plagiarism removal tools/ paraphrasing tools can be used to publish other's contents as one's own</li> </ul>	<b>1</b>
2(d)	<b>Any one of the following:</b> <ul style="list-style-type: none"> <li>• The ICT sector has a high energy demand. Production of electronic devices and their use requires energy. Most energy production in the world still results in CO<sub>2</sub> emissions, adding to global warming. Thus there is a significant contribution of ICT to global warming.</li> </ul>	<b>1</b>
2(e)	<b>Any one of the following:</b> <ul style="list-style-type: none"> <li>• Privacy violation/ breach</li> <li>• Collected data could be used for targeted advertising / given to third parties</li> </ul>	<b>1</b>
2(f)	sellers, lowest  <b>Notes:</b> <ol style="list-style-type: none"> <li>1. No partial marks.</li> <li>2. Other synonyms for 'lowest' acceptable.</li> </ol>	<b>1</b>



Qn	Answer	Marks
3(a)	<p><b>Alternative 1:</b></p> <pre> graph TD     Start([Start]) --&gt; Init[count = 0, inWord = 0]     Init --&gt; GetFilename[/Get filename/]     GetFilename --&gt; OpenFile[Open file]     OpenFile --&gt; ReadChar[/Read character/]     ReadChar --&gt; EOF{EOF?}     EOF -- Yes --&gt; PrintCount[/Print count/]     PrintCount --&gt; Stop([Stop])     EOF -- No --&gt; Space{Space or newline?}     Space -- Yes --&gt; InWord0[inWord = 0]     InWord0 --&gt; ReadChar     Space -- No --&gt; InWord0Eq{inWord = 0?}     InWord0Eq -- Yes --&gt; InWord1[inWord = 1]     InWord1 --&gt; CountInc[count = count + 1]     CountInc --&gt; ReadChar     InWord0Eq -- No --&gt; ReadChar   </pre>	

	<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Other synonyms could be accepted for 'inWord' values. e.g., for 0: false, no for 1: true, yes</li> <li>2. If 'inequality' checks are being used, then the 'yes', 'no' labels need to interchange.</li> <li>3. For the conditions, the question mark symbol (?) is essential.</li> <li>4. Synonyms for 'Get', 'Print' acceptable.</li> </ol> <p><b>Marks allocation for Alternative 1:</b></p> <p><b>A:</b> initial flow-chart segment containing 'count' initialization, opening filename (&lt;- correct flow-chart symbols) <b>1</b></p> <p><b>B:</b> flow-chart segment containing character reading loop until EOF (&lt;- <b>A</b>, correct flow-chart symbols) <b>1</b></p> <p><b>C:</b> word counting loop (&lt;- <b>B</b>, correct flow-chart symbols) <b>1</b></p>	
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**Alternative 2:****Notes:**

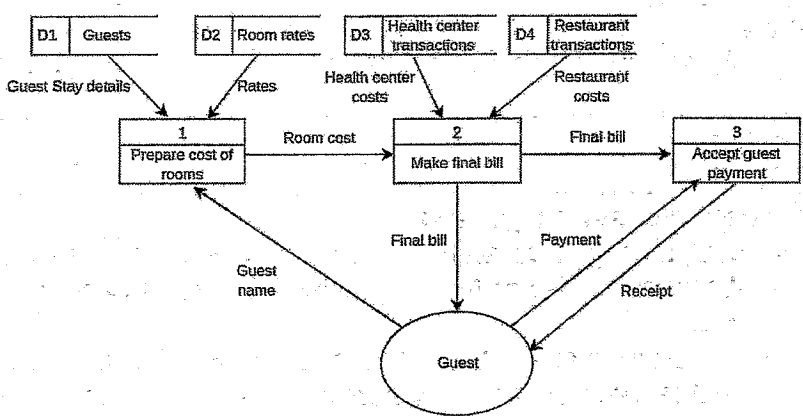
1. Synonyms for 'Get', 'Print' acceptable.

**Marks allocation for Alternative 2:**

<b>A:</b> initial flow-chart segment containing opening filename (← correct flow-chart symbols)	<b>0.5</b>
<b>B:</b> flow-chart segment for reading 'file' into a variable ('data') (← <b>A</b> , correct flow-chart symbols)	<b>0.5</b>
<b>C:</b> splitting 'data' into 'lines' (← <b>B</b> , correct flow-chart symbols)	<b>0.5</b>
<b>D:</b> Getting the length of 'lines' and printing it (← <b>C</b> , correct flow-chart symbols)	<b>0.5</b>

3(b)	<p>[6, 12]</p> <p><b>Notes:</b></p> <p>1. Ignore space defects.</p> <p><b>Marks allocation:</b></p> <p>A: correct list content ..... 1.5</p> <p>B: [ ] and comma (- A) ..... 0.5</p>	
3(c)	<p><b>Marks allocation:</b></p> <p>A: int 1</p> <p>B: upper + 1 1</p> <p>C: num 1</p> <p>D: num % i 1</p> <p>E: break 1</p> <p><b>Notes:</b></p> <p>1. Ignore space defects.</p> <p>2. Exact spelling, case needed.</p>	

Qn	Answer	Marks
4(a)	<ol style="list-style-type: none"> <li>1. Feasibility study</li> <li>2. System analysis</li> <li>3. System design</li> </ol> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Order important.</li> <li>2. No partial marks.</li> </ol>	1
4(b)	<p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>• Helps getting feedback and approval from clients</li> <li>• Provides early visualization for clients</li> <li>• Helps in properly designing the system / Helps in finding missing functionality / Helps in refining requirements / Helps the developers understand the user requirements better</li> <li>• Helps in early discovery of design problems / errors</li> <li>• Helps in cost / resource estimation</li> <li>• Ensures greater level of client satisfaction</li> <li>• Makes users actively involved in the development process</li> <li>• Helps developers and users both understand the system better</li> <li>• Bridges the communication gap between developers and users</li> <li>• Could be reused by the developer for other similar projects</li> <li>• Reduces risks of project failure</li> </ul>	1

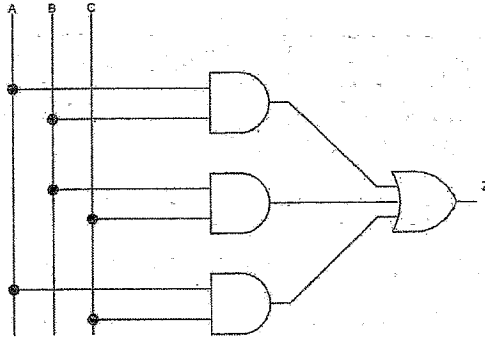
4(c)(i)	 <p><b>Marks allocation:</b></p> <p><b>A:</b> Complete diagram part for '1.Prepare cost of rooms' with two data stores <b>1</b></p> <p><b>B:</b> Complete diagram part for '2.Make final bill' with two data stores <b>1</b></p> <p><b>C:</b> Complete diagram part for '3.Accept guest payment' <b>1</b></p> <p><b>Notes:</b></p> <p>1. The names chosen by the student for the data flows and data stores could be different to the above, but must convey a similar meaning.</p>	
4(c)(ii)	<p><b>2. Make final bill</b></p> <p>Total cost = room cost of guest</p> <p>DO WHILE there are restaurant transactions by guests  Total cost = Total cost + restaurant cost  END WHILE</p> <p>DO WHILE there are health center transactions by guests  Total cost = Total cost + health center cost cost  END WHILE</p> <p>Total cost = Total cost + (Total cost * 0.1)</p> <p><b>Notes:</b></p> <p>1. Giving the answer in a descriptive/tabular form is also acceptable.</p> <p>2. Total cost = Total cost * 1.1 is also acceptable.</p> <p><b>Marks allocation:</b></p> <p><b>A:</b> Considering room cost <b>0.5</b></p> <p><b>B:</b> Considering restaurant costs <b>0.5</b></p> <p><b>C:</b> Considering health center costs <b>0.5</b></p> <p><b>D:</b> Service charge addition (&lt;-A, B, C) <b>0.5</b></p>	

4(d)	use  <b>Notes:</b> 1. Synonyms for 'use' also acceptable. (e.g., navigate, interact with etc.)	1
4(e)	small / low	1
4(f)	<p>A method that the manager can use:</p> <ul style="list-style-type: none"> <li>Assign weights to each feature (F1 and F2) based on their importance. Also assign weights to the acquiring and usage costs.</li> <li>For each option (A, B, and C), evaluate how well it meets each feature and assign marks. Assign marks to the costs of the systems too (lower the cost, the higher the assigned mark).</li> <li>Multiply the marks by the weights for each criterion and sum them up to get the total score for each option.</li> <li>The option with the highest total weighted score is the most suitable choice.</li> </ul> <p><b>Marks allocation:</b></p> <p><b>A:</b> Giving marks to each option based on how much they satisfy F1 and F2</p> <p><b>B:</b> Giving marks to the costs <b>and</b> finally choosing the best option</p>	<p>0.5</p> <p>0.5</p>

Qn	Answer	Marks																																														
5(a)	<table><tr><th>A</th><th>B</th><th>C</th><th>Z</th></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></table> <p>The total mark is decided as follows:</p> <table><tr><th>Maximum no. of Rows correct</th><th>Marks</th></tr><tr><td>8</td><td>2</td></tr><tr><td>5,6,7</td><td>1.5</td></tr><tr><td>3,4</td><td>1</td></tr><tr><td>1,2</td><td>0.5</td></tr></table> <p><b>Notes:</b></p> <ol style="list-style-type: none"><li>Having 'output' as the Z column title is acceptable.</li><li>If the Z column is not labeled, or is different from 'Z/output', then reduce 0.5 marks from the earned total.</li></ol>	A	B	C	Z	0	0	0	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1	1	0	1	0	1	1	0	1	1	1	1	0	Maximum no. of Rows correct	Marks	8	2	5,6,7	1.5	3,4	1	1,2	0.5	2
A	B	C	Z																																													
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8	2																																															
5,6,7	1.5																																															
3,4	1																																															
1,2	0.5																																															
5(b)	A <p><b>Notes:</b></p> <ol style="list-style-type: none"><li>Derivation is not required.</li></ol>	1																																														
5(c)(i)	<table><tr><th>A</th><th>B</th><th>C</th><th>Z</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>The total mark is decided as follows:</p> <table><tr><th>Maximum no. of Rows correct</th><th>Marks</th></tr><tr><td>8</td><td>2</td></tr><tr><td>5,6,7</td><td>1.5</td></tr><tr><td>3,4</td><td>1</td></tr><tr><td>1,2</td><td>0.5</td></tr></table> <p><b>Notes:</b></p> <ol style="list-style-type: none"><li>Having 'output' as the Z column title is acceptable.</li><li>If the Z column is not labeled, or is different from 'Z/output', then reduce 0.5 marks from the earned total.</li></ol>	A	B	C	Z	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	Maximum no. of Rows correct	Marks	8	2	5,6,7	1.5	3,4	1	1,2	0.5	2
A	B	C	Z																																													
0	0	0	0																																													
0	0	1	0																																													
0	1	0	0																																													
0	1	1	1																																													
1	0	0	0																																													
1	0	1	1																																													
1	1	0	1																																													
1	1	1	1																																													
Maximum no. of Rows correct	Marks																																															
8	2																																															
5,6,7	1.5																																															
3,4	1																																															
1,2	0.5																																															



5(c)(ii)	<div style="text-align: center;"> <math display="block">  \begin{array}{c cccc}  &amp; \text{AB} &amp; &amp; &amp; \\  &amp; 00 &amp; 01 &amp; 11 &amp; 10 \\  \hline  C &amp; &amp; &amp; &amp; \\  0 &amp; 0 &amp; 0 &amp; 1 &amp; 0 \\  1 &amp; 0 &amp; 1 &amp; 1 &amp; 1  \end{array}  </math> </div> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Indicating all 1's and 0's are compulsory.</li> </ol> <p>Give <b>one</b> mark for each correct row.</p>	<b>2</b>
5(c)(iii)	<div style="text-align: center;"> <math display="block">  \begin{array}{c cccc}  &amp; \text{AB} &amp; &amp; &amp; \\  &amp; 00 &amp; 01 &amp; 11 &amp; 10 \\  \hline  C &amp; &amp; &amp; &amp; \\  0 &amp; 0 &amp; 0 &amp; 1 &amp; 0 \\  1 &amp; 0 &amp; 1 &amp; 1 &amp; 1  \end{array}  </math> </div> <p style="text-align: right;"><math>AB + BC + AC</math></p> <p style="text-align: right;"><b>Marks allocation:</b></p> <p style="text-align: right;"><b>A:</b> marking all three loops on the correct Karnaugh map      <b>1</b></p> <p style="text-align: right;"><b>B:</b> final expression (<math>\leftarrow A</math>)      <b>1</b></p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. For mark component B, the term Z is not compulsory.</li> <li>2. Cells containing 0's not being indicated on the Karnaugh map is permissible for this part.</li> </ol>	<b>1</b> <b>1</b>

5(c)(iv)	 <p><b>Marks allocation:</b>  <b>A:</b> first set of AND gates  <b>B:</b> final OR gate (<math>\leftarrow A</math>)</p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. If the wire connections are not clearly indicated on a correct circuit, then give only a maximum of <b>0.5 marks</b>. The student can either indicate the wire connections using the dark dots (as shown in the diagram) or use half-circles to indicate non-connecting wires.</li> <li>2. The Z term is not compulsory.</li> </ol>	0.5 0.5
5(d)(i)	<p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>• to add two bits together</li> <li>• to add two single-bit binary numbers to produce a 'sum' and a 'carry' output</li> <li>• to add the two least significant digits in a binary sum</li> <li>• used as a fundamental building block in digital circuits; used in ALU chips</li> </ul>	1
5(d)(ii)	<p><b>Description:</b></p> <p>A flip-flop can store a bit of information and maintain it over time. Once a bit is stored, it retains its value until it is changed. Thus it works as a memory element in digital circuits.</p>	

<b>How it differs from combinational logic gates:</b>		
<b>Flip-flops</b>	<b>Combinational logic gates</b>	
sequential circuit / output depends on time and past states	combinational circuit / output depends only on inputs	
stores data / works as a memory element	no memory / outputs are based solely on current inputs	
synchronized with clock pulses	No clock; outputs change instantly with inputs	
used to store and transfer data / used in memory elements	performs logic operations	
<p style="text-align: right;"><b>Marks allocation:</b></p> <p><b>A:</b> description (how a FF works as a memory element) <b>1</b></p> <p><b>B:</b> any one of the comparisons <b>1</b></p> <p><b>Notes:</b></p> <p>1. For mark component B, a comparison should include both sides of the table; if only one side given, give only <b>0.5 marks</b> for B.</p>		

5(d)(iii)

2

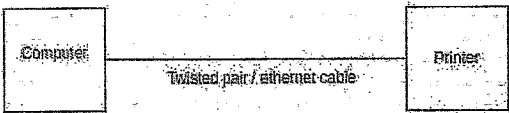
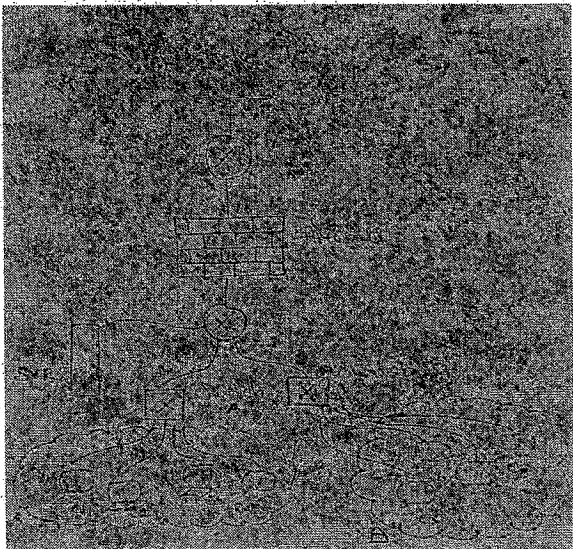
INPUT			OUTPUT	
A	B	C-IN	C-OUT	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

The total mark is decided as follows:

Maximum no. of Rows correct	Marks
8	2
5,6,7	1.5
3,4	1
1,2	0.5

**Notes:**

1. 'Input', 'Output' titles could be ignored.

Qn.	Answer	Marks
6(a)		1
6(b)(i)	 <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>The 'firewall' is optional.</li> </ol> <p><b>Marks allocation:</b></p> <p><b>A:</b> Department A and B LANs with correct placement of two switches (marked A,B) <span style="float: right;">0.5</span></p> <p><b>B:</b> Correct SVR, router and Internet connectivity <span style="float: right;">0.5</span></p>	
6(b)(ii)	<p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>switches: to provide each LAN's connectivity to the Router</li> <li>switches: to give a connection to each computer of each LAN</li> <li>router: to provide the connection to the internet</li> <li>router: to provide the connectivity between the LANs</li> <li>firewall: to filter out the unwanted traffic</li> </ul> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>To get this mark, the relevant device must be correctly placed on the student's diagram for 6(b)(i).</li> <li>The SVR can be placed in one of the LANs as well.</li> </ol>	1

6(b)(iii)

1

**Notes:**

1. To get this mark, the C1 → switch → router → switch → C6 path must be available on the student's diagram for 6(b)(i).

6(c)(i)

255.255.255.0

1

6(c)(ii)

Subnet	Network address	first usable IP address	Last usable IP address	Broadcast address
S1	192.168.100.0	192.168.100.1	192.168.100.30	192.168.100.31
S2	192.168.100.32	192.168.100.33	192.168.100.62	192.168.100.63
S3	192.168.100.64	192.168.100.65	192.168.100.94	192.168.100.95
S4	192.168.100.96	192.168.100.97	192.168.100.126	192.168.100.127
S5	192.168.100.128	192.168.100.129	192.168.100.158	192.168.100.159
S6	192.168.100.160	192.168.100.161	192.168.100.190	192.168.100.191

0.5  
0.5  
0.5  
0.5  
0.5  
0.5

**Two other alternatives:**

	192.168.100.192	192.168.100.193	192.168.100.222	192.168.100.223
	192.168.100.224	192.168.100.225	192.168.100.254	192.168.100.255

(0.5)  
(0.5)

**Notes:**

1. 0.5 marks for each correct row (for a maximum mark of 3)

6(d)(i)	Provide a look-up service to provide the corresponding ip address(es) relevant to the given URL  <b>Notes:</b> 1. Give the mark if the student gives a similar answer.	1
6(d)(ii)	<b>Hierarchical:</b> The DNS hierarchy consists of <u>multiple levels of servers</u> to direct Internet traffic efficiently.  <b>Distributed:</b> There are many servers having the portions of the DNS records in a distributed manner in multiple locations in the internet	1.5  0.5
6(e)(i)	application layer	0.5
(ii)	network access layer	0.5
(iii)	internet layer	0.5
(iv)	internet layer	0.5
6(f)(i) (ii)	<b>Note:</b> In the question, CFF has been erroneously printed as CEE.  Thus, the <b>two</b> marks of this question are to be awarded to all who have attempted <u>6(f)</u> .	2



Qn	Answer	Marks
7(a)(i)	<p>Sensor used in this circuit is a Reed switch. It is sensitive to a magnetic field and acts as a switch accordingly. When the door is closed (applied with a magnetic field), the Reed switch acts as closed and when the door is open (without the magnetic field) the Reed switch acts as an open switch.</p> <p>Essential points - Identify the switch operation of (Reed switch) - (Switch on and off) due to the Magnetic Field application.</p> <p><b>Marks allocation:</b>  <b>A:</b> identifying the switch operation of the Reed switch  <b>B:</b> switching on/off due to magnetic field</p>	<p>1 1</p>
7(a)(ii)	<p><b>ANY TWO of the following corrections for a total mark of 2:</b></p> <p>Correction 1: if (senState == LOW)  Correction 2: tone(BuzzerP, 262);  Correction 3: noTone(BuzzerP);</p>	<p>1 1 (1)</p>
7(a)(iii)	<p><b>Marks allocation:</b>  <b>A:</b> LDR (or light sensor) <b>and</b> a Resistor (10K<math>\Omega</math>)  <b>B:</b> LDR (or light sensor) to be connected to A0 (or any Analog input pin of the Arduino board).</p>	<p>1 1</p>
7(b)(i)	<p>B2B, B2C, and C2B</p> <p><b>Notes:</b>  1. No partial marks.</p>	<p>1</p>

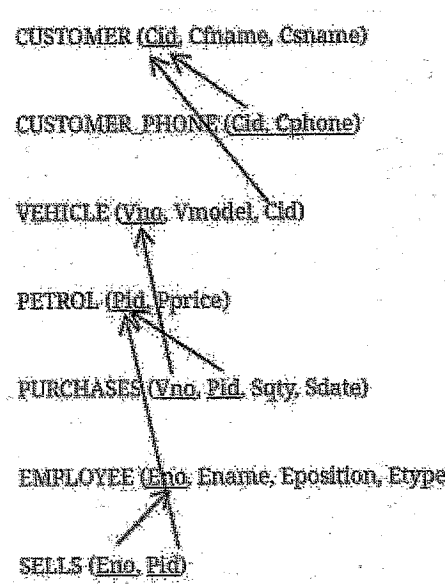


7(b)(ii)	<p><b>For</b> – SuperMobile can benefit financially by making the profits made by DeliverToday service to themselves and as the sales volumes grow there can be increasing gains.</p> <p><b>Against</b> –</p> <p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>• Initial setup cost (vehicles, salaries, fuel, insurance, etc.),</li> <li>• SuperMobile can experience cost overheads per each sale they make and the losses can be large to keep dedicated delivery service if the sales volumes drop.</li> </ul> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Student must clearly relate the reason with financial relevance and justify</li> </ol>	<p>1</p> <p>1</p>
7(b)(iii)	<p><b>Any one of the following:</b></p> <ul style="list-style-type: none"> <li>• Mobile Phones often have End of Life (EoL) and End of Support (EoS) defined by the manufacturer which marks the practical end dates for their sales</li> <li>• Mobile phone versions rapidly outdate with the technology and customer preferential features making them difficult to sell after a certain period</li> <li>• Certain internal parts (battery, etc) may not be safe to use after a certain period due to health and safety risks</li> <li>• Older models may no longer receive software updates, reducing their functionality over time.</li> </ul>	1
7(b)(iv)	<p>Allowing customers to give back their old phones for a discount when they purchase a new phone.</p> <p><b>Marks allocation:</b></p> <p><b>A:</b> Collect old phones</p> <p><b>B:</b> Discount for new purchase</p>	<p>1</p> <p>1</p>

7(c)(i)	<p>Agent programs demonstrate autonomous, proactive, reactive, cooperative, learnability and social-ability characteristics which standard software programs are usually not designed with.</p> <p><b>Give the mark if the student has included any ONE of the following characteristics in his/her answer:</b></p> <ul style="list-style-type: none"> <li>• autonomous</li> <li>• proactive</li> <li>• reactive</li> <li>• cooperative</li> <li>• learnability</li> <li>• social-ability / cooperation with other agents</li> </ul>	1
7(c)(ii)	<p><b>Positive</b> – Generally, any consideration that when followed, will help to produce an optimum outcome of agent decisions.</p> <p>Allocate the mark to <b>any ONE</b> of the following:</p> <ul style="list-style-type: none"> <li>• avoiding collisions between agents and other objects</li> <li>• reducing power consumption</li> <li>• following shortest path</li> <li>• following least congested path</li> </ul> <p><b>Negative</b> – Generally, any consideration that, when avoided, will help to produce an optimum outcome of agent decisions.</p> <p>Allocate the mark to <b>any ONE</b> of the following:</p> <ul style="list-style-type: none"> <li>• collisions</li> <li>• taking more time to deliver goods than the given time (or average time)</li> </ul>	1

Qn	Answer	Marks																		
8(a)	35  <b>Notes:</b> 1. No partial marks.	2																		
8(b)	<table><tr><td>P</td><td>0</td></tr><tr><td>Q</td><td>int</td></tr><tr><td>R</td><td>str</td></tr><tr><td>S</td><td>n % 2</td></tr><tr><td>T</td><td>n // 2</td></tr><tr><td>U</td><td>reversed_binary</td></tr></table> <b>Notes:</b> 1. Ignore space defects. 2. Exact spelling, case needed.	P	0	Q	int	R	str	S	n % 2	T	n // 2	U	reversed_binary	0.5 0.5 0.5 0.5 0.5 0.5						
P	0																			
Q	int																			
R	str																			
S	n % 2																			
T	n // 2																			
U	reversed_binary																			
8(c)(i)	<table><tr><td>A</td><td>n</td></tr><tr><td>B</td><td>weights</td></tr><tr><td>C</td><td>res</td></tr><tr><td>D</td><td>res</td></tr><tr><td>E</td><td>remainder</td></tr><tr><td>F</td><td>remainder</td></tr><tr><td>G</td><td>weight</td></tr><tr><td>H</td><td>item_selector</td></tr><tr><td>I</td><td>selected</td></tr></table> <b>Notes:</b> 1. For B, either <b>values</b> or <b>names</b> is also acceptable. 2. Exact spelling, case needed.	A	n	B	weights	C	res	D	res	E	remainder	F	remainder	G	weight	H	item_selector	I	selected	1 1 1 1 1 1 1 1 1
A	n																			
B	weights																			
C	res																			
D	res																			
E	remainder																			
F	remainder																			
G	weight																			
H	item_selector																			
I	selected																			
8(c)(ii)	<b>Any one of the following:</b> • Add two more items each to 'weights', 'values' and 'names arrays' • Update the arrays to include the new item details <b>Notes:</b> 1. If the answer is just 'update arrays', then only give <b>0.5 marks</b> .	1																		

Qn	Answer	Marks
9(a)(i)	<p><b>Marks allocation:</b></p> <p><b>A:</b> Four entities with all attributes correctly listed, key attributes underlined (0.5 marks for each entity) <b>2</b></p> <p><b>B:</b> Three relationships with correct cardinality (0.5 marks for each relationship) <b>1.5</b></p> <p><b>C:</b> Two attributes of 'purchases' and 'Cphone' multi-valued attribute <b>0.5</b></p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Ignore case defects.</li> <li>2. Exact spelling needed.</li> </ol>	

9(a)(ii)	 <p><b>Marks allocation:</b></p> <p><b>A:</b> Seven tables with all attributes correctly listed, primary key underlined (<b>0.5 marks</b> for each entity) <b>3.5</b></p> <p><b>B:</b> Correctly drawn arrows <b>0.5</b></p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Ignore case defects.</li> <li>2. Exact spelling needed.</li> </ol>	
9(b)(i)	<p>1NF / First normal form</p> <p><b>Justification:</b> Result table has a number of partial dependencies and no repeating groups. Each field contains atomic values.</p> <p><b>Marks allocation:</b></p> <p><b>A:</b> First normal form <b>1</b></p> <p><b>B:</b> Justification <b>1</b></p>	

9(b)(ii)	<p>Remove partial dependencies as follows:</p> <p>STUDENT (<u>Student_ID</u>, Student_Name)</p> <p>SUBJECT (<u>Subject_ID</u>, Subject_Name, Teacher_ID, Teacher_Name, Exam_Date)</p> <p>RESULTS (<u>Student_ID</u>, <u>Subject_ID</u>, Mark)</p> <p><b>Allocate the two marks to ANY TWO from the following (with 1 mark for each):</b></p> <ul style="list-style-type: none"><li>• Describing how the new STUDENT table can be made</li><li>• Describing how the new SUBJECT table can be made</li><li>• Describing how the new RESULTS table can be made</li></ul>	2				
9(c)(i)	<table border="1"><thead><tr><th>Product_Name</th><th>Wholesale_Price</th></tr></thead><tbody><tr><td>Sugar</td><td>800.00</td></tr></tbody></table>	Product_Name	Wholesale_Price	Sugar	800.00	1
Product_Name	Wholesale_Price					
Sugar	800.00					
9(c)(ii)	<p><b>Any one from:</b></p> <ul style="list-style-type: none"><li>• INSERT INTO Product (Product_No, Product_Type, Product_Name, Retail_Price, Wholesale_Price) VALUES ('P6', 'Stationery', 'Bag', 755.00, 750.00);</li><li>• INSERT INTO Product VALUES ('P6','Stationary','Bag',755.00,750.00);</li></ul> <p><b>Notes:</b></p> <ol style="list-style-type: none"><li>1. The semicolon, exact spelling and case of table name and the field names are required.</li><li>2. Ignore minor spelling mistakes of the inserted data values.</li></ol>	1				
9(c)(iii)	<p>SELECT Product_Type, Product_Name, Wholesale_Price FROM Product WHERE Product_Name &lt;&gt; 'Bag';</p> <p><b>Notes:</b></p> <ol style="list-style-type: none"><li>1. The semicolon, exact spelling and case of table name and the field names are required.</li><li>2. != can be used Instead of &lt;&gt; .</li><li>3. WHERE not Product_Name= 'bag'; is also acceptable.</li></ol>	1				

Qn	Answer	Marks
10(a)	<p><b>second:</b> load value of variable 'width' into a register</p> <p><b>third:</b> <u>add the values</u> in the two registers</p> <p><b>Notes:</b></p> <p>1. Order important.</p>	<p>1</p> <p>1</p>
10(b)	<p><b>Mark allocation:</b></p> <p><b>A:</b> result of subtraction is 0010</p> <p><b>B:</b> 2's complement of 1100 is 0110</p> <p><b>C:</b> result of binary addition and ignoring the carry is 0010</p>	<p>1</p> <p>1</p> <p>1</p>
10(c)(i)	READY	1
10(c)(ii)	RUNNING -> BLOCKED	1
10(c)(iii)	<p>The address of the next instruction to execute in the 'web browser' process is stored in the 'Program Counter' of the PCB of that process</p> <p>The address of the next instruction to execute in the 'spreadsheet' process is got from the 'Program Counter' of the PCB of that process</p> <p><b>Mark allocation:</b></p> <p><b>A:</b> The address of the next instruction to execute in the 'web browser' process</p> <p><b>B:</b> stored in the 'Program Counter' of the PCB of that process</p> <p><b>C:</b> The address of the next instruction to execute in the 'spreadsheet' process</p> <p><b>D:</b> is got from the 'Program Counter' of the PCB of that process</p>	<p>0.5</p> <p>0.5</p> <p>0.5</p> <p>0.5</p>
10(d)(i)	8	1
10(d)(ii)	110 0000 0000 0100	1

10(d)(iii)	That frame is occupied by another page	1
10(d)(iv)	It informs the operating system that the contents of that page has to be written to secondary storage when that page is evicted from memory	1
10(e)(i)	The block number of the 'index block'	1
10(e)(ii)	contiguous allocation	1



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