

13511

AL/2025/20/E-II

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
 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
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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 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.

Do not write in this column

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.]

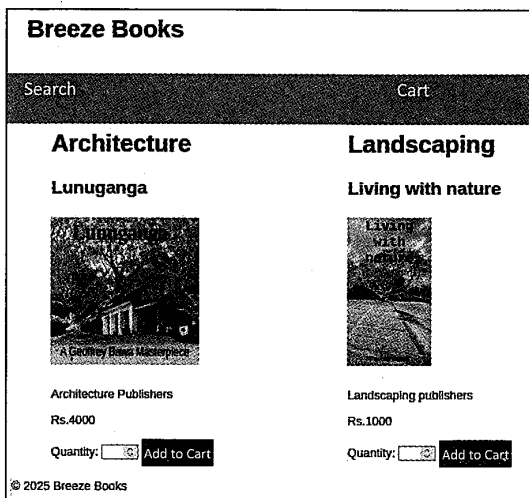


Figure 1.1: The output

[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 in this 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="<input type="checkbox"/>">
        <input type="hidden"
            name="product_id"
            id="product_id" value="<?php echo{"<input type="checkbox"/>";?>">

        <label for="product_quantity"> Quantity: </label>
        <input type="number" id="product_quantity" name="product_quantity"
            value="" min="0" max="10">

        <button type="submit" name="add_to_cart"> Add to Cart </button>
    </form>
    </li>
<?php
}??>
</ul>
    
```

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)

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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.

Do not write in this 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.

.....

.....

.....

(02 marks)

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

.....

.....

.....

(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.

Do not write in this column

Functional requirements :

.....

.....

.....

.....

Non-functional requirements :

.....

.....

.....

.....

(02 marks)

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

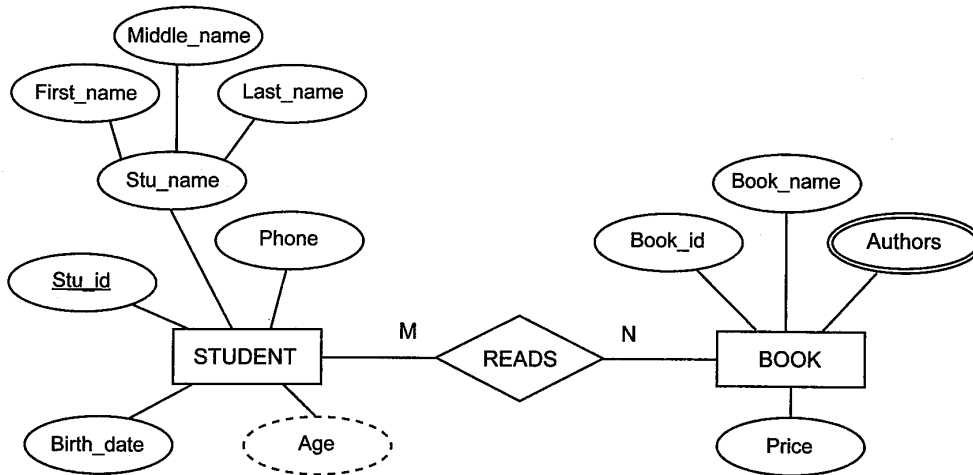


Figure 2.1

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.

Do not write in this column

(i) Syntax errors :

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

(01 mark)

(ii) Logical errors :

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

(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)

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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)

**

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 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
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කොරකුරු හා සන්නිවේදන තාක්ෂණය	II	20 E II
தகவல், தொடர்பாடல் தொழினுட்பவியல்	II	
Information & Communication Technology	II	

Part B

* Answer any four questions only.

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

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

(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)

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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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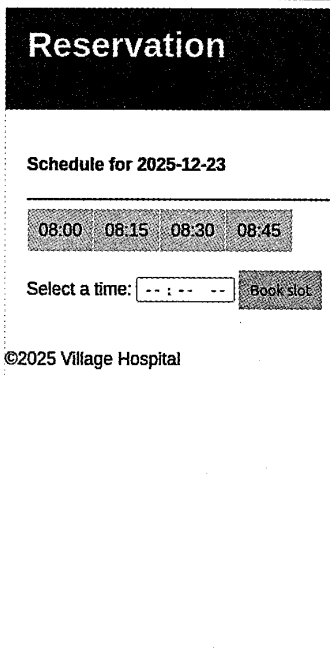
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10. A student has developed a system using html, php and mySQL for users to reserve doctor appointment slots at the village hospital. The hospital is open for outpatients from 0800-1700 hrs each day. However, for simplicity, the student has considered 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 *Name:* Patient's name
Time: Time of the appointment *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)

 <p style="text-align: center;">Figure 10.1</p>	 <p style="text-align: center;">Figure 10.2</p>	<pre> echo "<h4>Schedule for \$visit_date</h4>"; // make all slots initially available for booking Savail = [1, 1, 1, 1]; while (\$row = \$result->fetch_assoc()) { if (\$row['Time'] == '08:00:00') \$Savail[0] = 0; A } // end while if (\$Savail[0] == 0 and \$Savail[1] == 0 and \$Savail[2] == 0 and \$Savail[3] == 0) { echo "B"; } else { ?> C <?php if (D) echo "E"; else echo "F"; X ?> </tr> </table> <!The'submit' code (not shown)--> <?php } ?> </pre> <p style="text-align: center;">Figure 10.3</p>
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(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: `{$Savail[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)

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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)
