සියලුම හිමිකම් ඇවිරිණි./All Rights Reserved.

බස්නාහිර පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව
மேல் மாகாண கல்வித் திணைக்களம்
Western Province Education Department

බස්නාහිර පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2026
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தரப் பரீடசை, 2026
General Certificate of Education (Atv. Level) Examination, 2026

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

20 E II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීම් කාලය	- මිනිත්තු 10 යි
மேலதிக வாசிப்பு நேரம்	- 10 நிமிடங்கள்
Additional Reading Time	**- 10 minutes**

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

Index No: .....

Important:

- *This question paper consists of* **16** *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 2-10)

- *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 11-16)

- *This part consists* ***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 Examiner's 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 :	

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

Do not write in this column

1. (a). Draw the expected output of the following HTML code segment when rendered by a web browser.

```
<u>Available Courses</u>
<ol>
<li>Information Technology</li>
<li>Engineering</li>
<li>Business Management
<ul><li>Accounting</li>
<li>Marketing</li></ul></li>
<li>Law</li>
</ol>
```

Note: Consider the following dotted line box as the display area of the browser.

(b) Write the correct external CSS code to apply the following formatting to the above HTML list.

(i). Display all list items in Times New Roman font.

(ii). Change the ordered list text color to dark green.

(iii). Set the unordered sub-list items to italic style.

(iv). Add a 1-pixel solid black border around the entire list section.

(v). Set the background color of the page to light gray.

(i).....

(ii).....

(iii).....

(iv).....

(v).....

(c). Consider the HTML form given in Figure 1 rendered by a web browser.



Figure 1

The relevant HTML code (incomplete) is given below. Fill in the blanks to obtain the output shown in Figure 1.

```
<html>
<head>
<title>Library Membership Form</title>
</head>
<body>
<h3>Library Membership Form</h3>
<form ____________="register.php" ___________________="post">
<div>Member Name :<input type = __________    __________="mname"></div>
<p><div>Enter Membership Type :
<input type= __________ _________________="memtype" _______="10">
<ol><li>Student</li><li>Teacher</li></ol>
</div>
<br>
<div>
Preferred Notification Method :
<input type =__________   __________="notify"      __________="Email">Email
<input type =__________   __________="notify"      __________="SMS">SMS
</div>
<br><div>
Select Library Branch :
<__________ name="branch">
<option __________="Colombo">Colombo</option>
<option __________="Kalutara">Kalutara</option>
<option __________="Gampaha">Gampaha</option>
</__________></div><br>
<input type=_________________  value=_______________>
</form>
</body>
</html>
```

(d). The details entered through the HTML form are to be stored in a database table named member.

The following PHP code segment is incomplete. Fill in the blanks to insert the submitted form data into the member table.

```
<?php
$connection = new mysqli("localhost","root","","libraryDB");
if ($connection -> connect_errno) {
  echo "Failed to connect to MySQL: " . $connection -> connect_error;
  exit();
}

$mname = $_POST [__________];

$memtype = $_POST [__________];

$notify=$_POST [__________];

$branch = $_POST [__________];
$sql = "INSERT INTO member
       (memberName, membershipType, notificationMethod, branch)

        VALUES

 (_____________,  _____________,  _____________, _____________)";

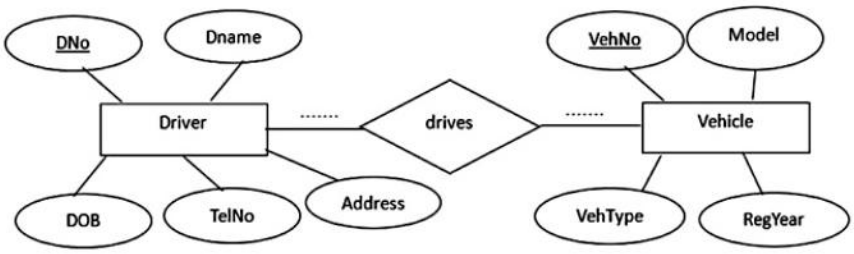
if ($connection->query($sql) === TRUE) {
  echo "New record created successfully";}

else {
  echo "Error: " . $sql . "<br>" . $connection->error;}

$connection -> close();
?>
```

2. (a). Consider the following ER diagram designed for a company that provides car rental services.

- Drivers register with the organization along with their vehicle, where they are assigned a unique number. The driver is not allowed to drive any other vehicle except their own.



(i). Indicate the cardinality between the driver and the vehicle entities in the blanks provided in the above ER diagram.

(ii). The number of years a vehicle has been driven by a driver should be recorded. Draw the attribute NoOfYears in the relevant position of the ER diagram above.

(iii). Only drivers registered with the company are entitled to a special interest-free insurance policy (InsurancePolicy). They are entitled to the insurance only during the period of their service to the company. Drivers can obtain several insurance policies according to their needs, and the relevant insurance policy is unique to that driver only. Each insurance policy has the attributes InsName, TimePeriod, Benefits. Show this case in the ER diagram above.

(b). Below are some tables related to the database created for a School Library System

Book

BookId	BookName	NoOfCopies
A001	Madolduwa	5
A002	Pin Lamaya	2
A003	Gamperaliya	3
B002	Famous Five	3

Student

StuId	StuName	Class
S001	Smanthi	10A
S002	Kamal	10A
S003	Sanjeewa	10A
S018	Sanduni	11B
S020	Nehan	11B

BorrowBook

BookId	**StuId**	BorrowDate	ReturnDate
A001	S001	2025-03-01	2025-03-08
A001	S002	2025-03-10	2025-03-17
A002	S001	2025-03-01	2025-03-08
A003	S018	2025-05-13	2025-05-21
B002	S018	2025-05-21	2025-05-28
B002	S002	2025-05-21	2025-05-28

(i). State the correct SQL query to create the Book table. No field should allow NULL values, and the primary key must be specified.

……...

……...

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……...

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(ii). The number of copies of the book *Gamperaliya* has been increased to 5. State the correct SQL query for this.

……...

……...

……...

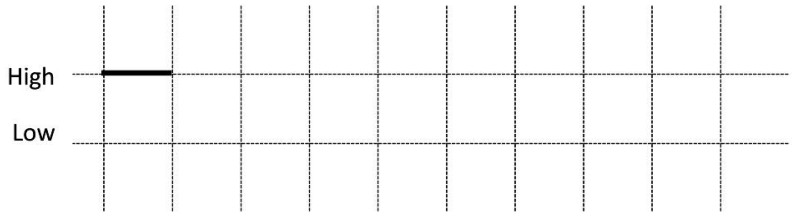
(iii). Write the output of the following SQL query based on the above tables.

```
SELECT StuName, Class
FROM Student,BorrowBook
WHERE  BorrowDate='2025-05-21' AND
Student.StuId=BorrowBook.StuId;
```

(c) The following bit stream is transmitted over a digital channel.

0110111001

The left-most bit is sent first and it has already been plotted for you. Plot the remaining bits using NRZ-I (Non-Return to Zero Inverted) encoding method.



(d).Draw a schematic diagram to show the connection between two computers via a PSTN.

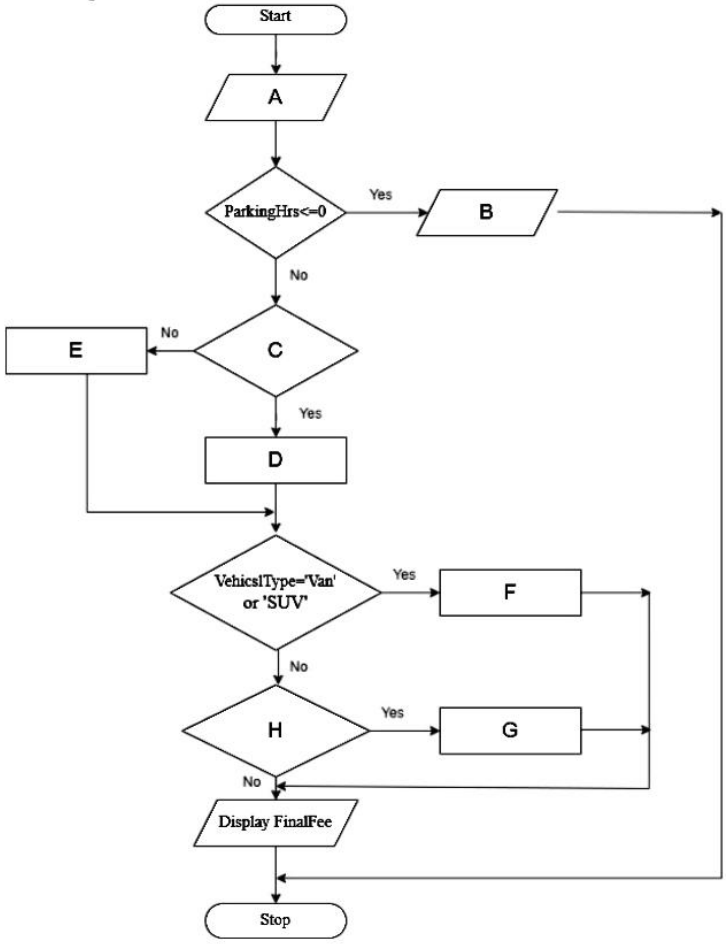
3. (a) A flowchart is to be drawn for an algorithm used in a smart parking system to calculate and display the parking fee of a vehicle.

The number of parking hours and the vehicle type are given as inputs.

Note:

- The first 2 hours are charged at Rs. 100 per hour.
- Additional hours are charged at Rs. 150 per hour.
- If the vehicle type is **"Van"** or **"SUV**(Sport Utility Vehicle)**"**, an additional fixed charge of Rs. 500 should be added.
- If the number of parking hours is less than or equal to 0, the algorithm should display **"Invalid Parking Duration"** and should not calculate the fee.
- If the total parking fee exceeds Rs. 5000, a discount of 5% should be deducted from the final amount.

Write down the most suitable replacements for labels A to H in the following flowchart which is drawn for the above problem.



A - ……..…… E - ……..……..……

B - …… F - ……..……..……

C - …… G - ……..……..……

D - …… H - ……

(b)The Python code given below is written to display all odd numbers from a first given number to a second given number.

The program always checks whether the first number is less than the second number. If the first number is greater than or equal to the second number, the user is requested to re-enter both numbers.

Complete the program by filling the blanks.

```
while True:
    fnum= int(input("Enter the first number: "))
    snum= int(input("Enter the second number: "))
    if _____________________:
        _____________________
    else:
        print("Invalid input. Please re-enter the numbers.")
while _____________________:
    if _____________________:
        print( _____________________)
    _____________________
```

(c). Write down the replacements for the labels in the following Python program which has been coded to write student names and marks stored in two lists named student_names and student_marks to a new file named 'students.txt'.

```
def write_student_data(names, marks):
    file = open("students.txt", ____A____)
    for i in range( ___B_____(names)):
        file.write(names[i] + " " +____C_____(marks[i]) + "\n")
    file.___D____
student_names = ["Kamal", "Nimal", "Sunil"]
student_marks = [75, 82, 90]
write_student_data(student_names, student_marks)
```

A - .....

B- .....

C- .....

D- .....

4. (a) The CPU of a computer is currently executing process P1. A high-priority process, P3, arrives, and the scheduler immediately selects P3 for execution. To make room for P3 in main memory, process P2, which was waiting to write data to the disk, was moved from main memory to secondary storage.

(i).Write the state transitions of processes P1 and P2.

……..……..

……..……..

(ii).Write two tasks carried out by the operating system for each of the processes P1 and P3 during their context switch.

……..……..

……..……..

(b). For each allocation method below, write the data items kept in the directory by the operating system to locate files.

(i). Contiguous allocation ……

(ii). Linked allocation ……

(iii). Indexed allocation ……

(c). Consider a disk that uses the File Allocation Table (FAT) file system for managing its storage. The cluster size is 4 KB. A file named DataFile.txt of size 125 KB needs to be stored on this disk. Calculate the amount of internal fragmentation. Show your workings clearly.

……..……..

……..……..

……..……..

……..……..

……..……..

……..……..

(d). A system with byte addressable memory uses 1 GB of physical memory and the virtual memory of 4 GB. The size of a page is 4 KB.

A few selected fields of the page table used by a process at a particular time are given below.

	Frame number	Absent/ Present
0	0	0
1	2	1
2	0	0
3	12	1
:	:	:
8	9	1
9	0	0
:	:	:

Notes:

- The page number is used as the index to the page table.
- The frame numbers are in decimal.

(i). Calculate the number of pages of the above system.

……..……..

……..……..

(ii). Each entry of the page table consists of frame number bits(18 bits), an absent/present bit and 8 more bits. The maximum size of the page table is m x 2^n bits.
What are the values of m and n?

……..……..

……..……

(iii). What is the function of the modified (dirty) bit in a page table entry?

……..……..……..

……..……..……..

……..……..……..

……..……

(iv). Assume that a virtual address in page number 2 is requested by the CPU. List the main tasks performed by the operating system in order to fulfill the request.

……..……

……..……

……..……

……..……

****

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மேல் மாகாணக் கல்வித் திணைக்களம்
Department of Education - Western Province

තෙවන වාර පරීක්ෂණය
மூன்றாம் தவணைப் பரீட்சை - 2026
Third Term Test

ශ්‍රේණිය தரம் Grade	13	විෂයය பாடம் Subject	Information & Communication Technology	පත්‍රය வினாத்தாள் Paper	II	පැය மணித்தியாலம் Hours	3

* Answer any **four** questions only.

5.(a). Simplify the following Boolean expression using Boolean algebra and prove that

$$\bar{A}.B+(B\oplus C)+(\overline{B+C}).\overline{AB}=\overline{ABC}$$

(b). Consider the following three cases of a digital system with three inputs X,Y,Z.

$P = \bar{X}$

$Q = \bar{Y} + Z$

$R = \overline{(X + Y)}$

Three intermediate conditions P, Q, and R are generated from the inputs X, Y, and Z. The output F becomes TRUE (1) only when both P and Q are TRUE simultaneously, or when R is TRUE. For all other combinations, the output becomes FALSE (0).

A student intends to implement this logic circuit using minimum number of gates.

For this purpose, he derives both the Standard Sum of Products (SOP) expression and the Standard Product of Sums (POS) expression for the output F.

Answer the following questions.

(i). Draw the truth table representing the above logic condition. Clearly indicate the values of X, Y,Z, and P, Q, R, and F.

(ii). Write the Standard SOP expression, and the Standard POS expression for the output F.

(iii). Using Karnaugh maps (K-Maps), simplify the POS expression obtained in part (ii).

(iv). Draw the circuit for the simplified expression using minimum number of gates.

6. (a) Gayan and Hiran communicate over the internet using public key encryption. Gayan wants to send a confidential and trustworthy message to Hiran. He considers the following two methods:

Method A : Gayan encrypts the message using Hiran's public key, and Hiran decrypts it using his private key.

Method B : Gayan encrypts the message using his own private key, and Hiran decrypts it using Gayan's public key.

(i). State the main purpose of each method (A and B) in the communication process.

(ii). Gayan decides to use both Method A and Method B together when sending a message. Explain how this combination improves overall security.

(b) A university has three faculties and all three faculties are in the same premises. The following table shows the devices available in each faculty.

Faculty	Devices
Engineering	58 Computers, 2 Network Printers
Science	28 Computers, 1 Printer
Arts	18 Computers, 1 Network Printer

The network administrator of the university has received the IP address block 172.30.54.0 /25 to be used for the university network. The network administrator has to design a subnetwork for each faculty considering the following requirements.

- It is necessary to interconnect all the LANs together to make the communication easy and to connect all the subnets to the Internet through a Proxy server.
- Computers of engineering faculty are provided IP addresses dynamically.
- The entire network is to be protected through a firewall.

(i). Write down the network address, broadcast address, subnet mask and usable IP address range of each subnet. Use the following table to present your answer.

Faculty	Network Address	Broadcast Address	Subnet Mask	Usable IP Address Range
Engineering				
Science				
Arts				

(ii). Draw a network diagram to show the logical arrangement of the university's computer network identifying all required devices.

(iii). The university is organizing an online academic event where multiple services are running simultaneously.

A - A live video streaming session for lectures

B - A file download portal for course materials

C - A real-time online quiz system for assessments

Identify the most suitable protocol (TCP or UDP) for each of the above services and justify your answer.

7.(a). An IoT-based patient monitoring system is used in a smart hospital ward. Nurses can monitor patients using a mobile application. The setup includes a controller, a microcontroller board with a communication module and a heart-rate sensor.

The system diagram contains components labeled **A, B, and C** and an arrow **M** connecting the mobile device to the system, as shown in figure 1.

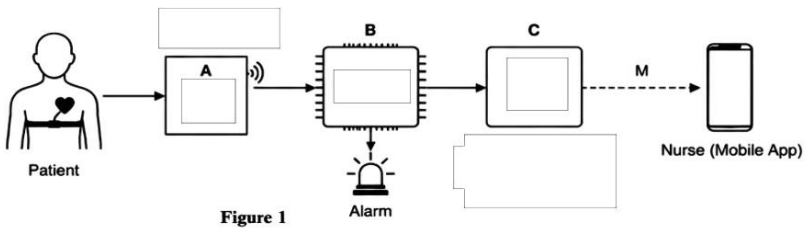


Figure 1

(i). Match the IoT components labeled **A, B, and C** with the following:
- Controller
- Heart-rate Sensor
- Arduino Board with Communication Module

(ii). Explain why the arrow **M** is shown in a single direction .

(b). The above setup is connected to an emergency alarm system. The following is the algorithm used to automate the emergency alarm system.

The heart-rate sensor provides readings from 1 to 10, where:

```
While (true) {
    Read Heart Rate as H_R
    If [X]
        If Alarm Off
            Then [Y]
        End if
    Else
        If Not Alarm Off
            Then [Z]
                End if
            End if
        }
```

- 1 = Very low heart rate
- 10 = Very high heart rate

The normal level to maintain is between 4 and 6 inclusive.

Write the most suitable entries for **X, Y,** and **Z**.

(c). What could be monitored in the hospital ward using a temperature sensor?

(d). A multi-agent system is introduced for the hospital. A Simplified diagram of this system is given in figure 2.

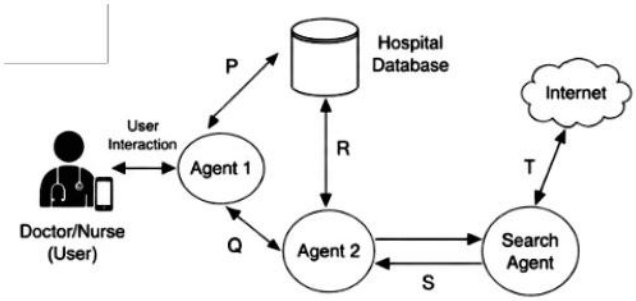


Figure 2

- Patient reports and scan images are stored in the hospital database.
- **Agent 1** handles communication with doctors and nurses and triggers Agent 2.
- **Agent 2** analyzes patient reports, detects possible medical issues, and triggers Search Agent if needed.
- **Search Agent** searches the Internet for treatment guidelines and sends the information to Agent 2.
- **Agent 2** updates the database and notifies **Agent 1** if urgent attention is required.

(i). In this scenario, identify the self-autonomous agents.

(ii). The interaction **P** involves storing and retrieving patient records for Agent 1.Interaction **R** involves updating treatment information in the database. Explain the interactions **Q** and **S**.

(iii). After long-term use, it is decided to remove the Search Agent because the database already contains many treatment records. State one major disadvantage of removing the Search Agent

(e). The hospital has introduced a mobile application that allows patients nearby to book appointments and receive medical consultation services online.

(i). State one advantage of limiting appointment services to patients within the nearby area.

(ii). State an alternative method that can be used to confirm appointments until an online payment system is introduced.

8. A smart restaurant uses a digital ordering system to manage customer orders.

Each table in the restaurant has a tablet device where customers can place orders. The system stores the ordered item names and their prices.

(a). The following Python code inputs four prices of food items and calculates the total bill.

```
prices   ||
total   0.0
for i in range(4):
     p = float(input("Enter item price: "))
     prices.append(p)
     total = total + p
print(prices)
print(total)
```

What is the output of the above code if the following prices are entered?

- 1200
- 850
- 650
- 1300

(b). The restaurant manager now wants the system to identify the most expensive food item and its price using the food prices entered in part (a).

Write a Python function called ExpensiveItem() that:

- Takes two separate lists for names of food items and their prices as parameters.
- returns the name of the food item with the highest price.

State your assumptions, if any.

(c). he restaurant later introduces a smart kitchen monitoring system. The kitchen has 3 cooking sections:

- Baking Section
- Frying Section
- Grilling Section

Temperature sensors are installed in each section to record temperatures during 3 different time periods of the day:

- Morning
- Afternoon
- Evening

The recorded temperatures are stored in a two-dimensional array as follows:

Temp = [[180, 200, 190], [210, 205, 195], [175, 185, 220]]

Write a Python program to:

- Find the highest temperature in the array.
- Display whether the kitchen temperature is Safe or Danger.
    - "Safe" if the highest temperature is less than or equal to 220.
    - "Danger" if the highest temperature is above 220.

9.(a). The following are the details required to create a database system for a private bank.

- The bank [Bank] consists of a unique registration number and bank name.[RegCode, BankName]
- The bank has several branches [Branch]. Each branch has a unique branch number, branch name, and address.[BrNo, BrName, Address]
- Each branch maintains different customer accounts [Account]. An account contains a unique account number, account type, deposited amount, time period, interest, deposit date, and maturity date. [AccNo, AccType, DepPrice, TimePeriod, Interest, DepDate, MatureDate]
- Customers [Customer] can open one or more accounts through a bank branch. The customer should provide personal information including NIC number, customer name, date of birth, address, and email address. A customer may also have multiple mobile phone numbers. [NIC, CusName, DOB, Address, Email, MobileNo]
- An account can be maintained individually or jointly by customers. When a customer opens an account, the system should record the account opening date and account status. [OpenDate, AccountStatus]

(i). Study the above scenario carefully and draw an ER diagram.

Note : use only the terms given within square brackets in the above description fir the entities and attributes.

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

(b). Consider the following table which shows software projects of a private company.

Project

PCode	PTile	MID	MName	EmpNo	EmpName	MobileNo	DepNo	DepName	Budget
LK120	OOS	E002	Yasantha	P_623	Prasad	0712212303	01	Personal	US$2000
UK50	DAS	E005	Sunil	S_443	Dulitha	0773694455	02	Sales	US$1500
LK170	LMS	E002	Yasantha	P_623	Prasad	0712212303	01	Personal	US$500
NZ78	GPS	E006	Kumara	P_928	Sadamali	0705846111	01	Personal	US$4500
UK57	ODS	E002	Yasantha	S_443	Dulitha	0773694455	02	Sales	US$200

(i). State three data anomalies and explain one of the anomalies using the above table.

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

(iii). Convert the table into next normal form and write relational schema.

10. (a). The following activities take place in a fully computerized Workshop Management System of an educational institute.

- **Handling Online Registration**

Students access the online workshop management system through the institute website to view available workshops. The system checks the workshop database and displays available workshops, schedules, and seat availability.

If the student decides to register, the student enters personal details through an online registration form. The system stores the entered details in the student database and automatically generates a unique student number.

- **Handling Online Payments**

  The student uses the generated student number to make an online payment through the payment gateway. The system verifies the payment with the bank system, updates the payment database, and generates an electronic receipt & login detail. A copy of the receipt and the generated login details are saved in the student database.

- **Handling Workshop Materials & Reporting**

  After the successful payment, student logs into the system using by entering login details and downloads workshop materials such as note sets and additional resources.

  At the end of each month, the system automatically generates workshop reports using data from the student database, workshop database, and payment database, and sends the reports to the Academic Manager.

  Using standard symbols,

  (i). Draw the Context Diagram for the above system.

  (ii). Using standard symbols, draw the Level-1 Data Flow Diagram (DFD).

(b). During the system development process, the institute evaluates different types of feasibility to determine whether the system should be implemented successfully.

Identify the most suitable feasibility type for each situation.

(i). The management evaluates whether the new workshop management system supports the institute's future educational goals and policies.

(ii). Before introducing the computerized workshop management system, the institute checks whether enough computers, servers, and internet facilities are available.

(iii). Some registration officers are not willing to use the new computerized workshop management system and prefer the old manual method.

(iv). The institute compares the cost of developing the workshop management system with the expected benefits such as faster registration and reduced paperwork.

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