



NEW

Department of Examinations - Sri Lanka

G.C.E. (A/L) Examination - 2019

# 20 - Information and Communication Technology New Syllabus

Marking Scheme

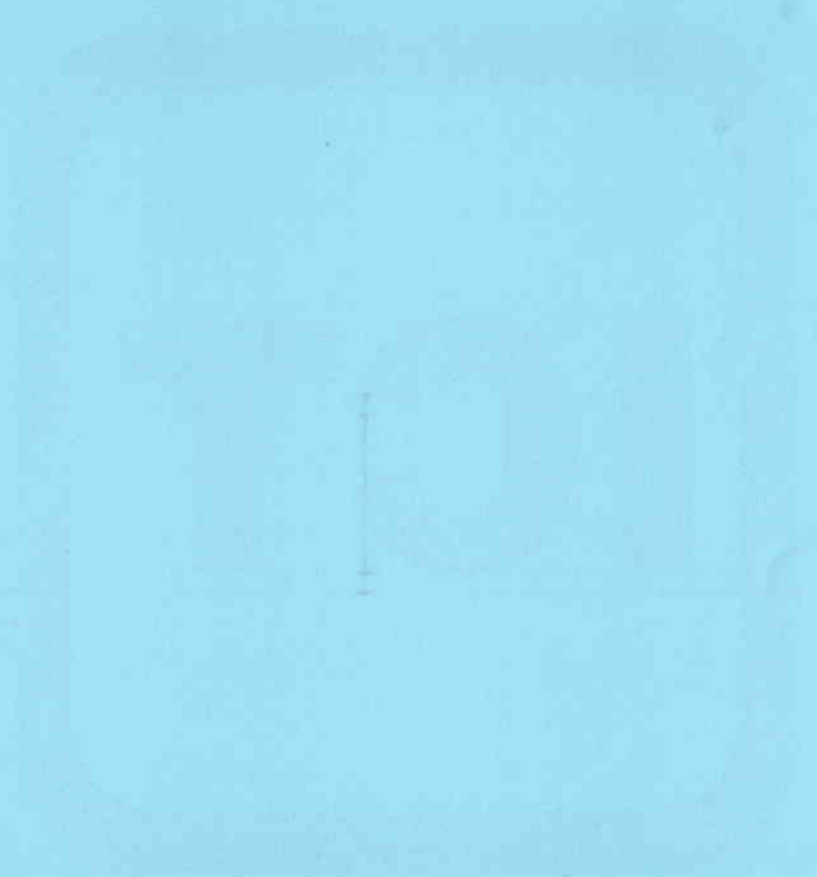


This document has been prepared for the use of Marking Examiners. Some changes would be made according to the views presented at the Chief Examiners' meeting.

Amendments to be included



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இலங்கைப் பரீட்சைத் திணைக்களம்  
අ.පො.ස. (උ.පෙළ) විභාගය/ ක.පො.த. (உயர் தர)ப் பரீட்சை - 2019

නව නිර්දේශය/ புதிய பாடத்திட்டம்

විෂය අංකය  
பாட இலக்கம்

20

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

❖ විශේෂ උපදෙස්/ விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට/ ஒரு சரியான விடைக்கு 01 ලකුණු බැගින්/புள்ளி வீதம்  
මුළු ලකුණු/மொத்தப் புள்ளிகள் 1 × 50 = 50

AL/2019/20/E-II (NEW)

- 2 -

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

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

```
<html>
<body>
<!--Effects of Social Networking -->
<p>Social networking has <br> <u>advantages</u> and disadvantages </p>
</body>
</html>
```

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

```
<html>
<body>
<table border="1">
<caption>Schedule</caption>
<tr><th>Time</th><th>Event</th></tr>
<tr><td>8 am</td><td>Drama</td></tr>
<tr><td>10 am</td><td>News</td></tr>
<tr><td colspan="2">Lunch</td></tr>
</table>
</body>
</html>
```

A/L 2017/2018-11 (NEW)

- 3 -

MARK SCHEME

(b) (i) Write **two** advantages of using *external style sheets* when creating a web page.

(1) .....

(2) .....

(ii) Consider the following HTML elements require the styles as given in the table.

Element Name	Attribute	Attribute Value
<i>p</i>	<i>color</i> <i>font-family</i> <i>text-align</i>	<i>red</i> <i>Calibri</i> <i>justify</i>
<i>h1</i>	<i>color</i> <i>font-family</i>	<i>red</i> <i>Calibri</i>
<i>h2</i>	<i>color</i> <i>font-family</i> <i>text-align</i>	<i>red</i> <i>Calibri</i> <i>justify</i>

Write an *external style sheet* in the **most efficient way** to fulfil the above requirements using only the **CSS group selector** concept.

.....

.....

.....

.....

(c) The following PHP code is intended to add data into 'name' and 'class' fields of the table named 'student' in the MYSQL database called 'school\_db'. User name and password to login to 'school\_db' are 'admin' and 'A!2t\*' respectively.

Complete the PHP code segment by filling the blanks.

```
<?php
$conn = new mysqli('localhost', ..... , .....);
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}

$sql = "..... into ..... (..... , ..... )
values ('Piyal', 'I2-B')";

if ($conn->query(.....) ==true) {
    echo "New record created successfully";
} else {
    echo "Error: " . $sql . "<br>" . $conn->error;
}

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

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I see page four

- 4 -

2. (a) Match each of the given phrases (i) - (vi) relating to commerce with the most suitable item from the list below:

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List = {advertising as a revenue model, credit-cards, Government e-Tendering service, Government to Citizen (G2C) service, group purchasing, harmful explosives, online marketplace, payment gateway, perishable goods, social commerce, subscription as a revenue model, traditional marketplace}

**Phrases:**

- (i) a place where buyers and sellers interact physically for exchanging goods and services for a price
- (ii) these are usually prohibited to be sold or purchased through e-commerce systems
- (iii) users pay a regular fee to have full access to a website of a business
- (iv) a subset of e-commerce that involves using social media to assist in the online buying and selling of products and services
- (v) facilitates a payment transaction by the transfer of information between the e-commerce application and the back-end financial service providers through secure means
- (vi) the renewal of vehicle revenue licence using the Online Vehicle Revenue Licence Service offered by the relevant government office

**Note:** Write only the matching item against the phrase number.

- (i) .....
- (ii) .....
- (iii) .....
- (iv) .....
- (v) .....
- (vi) .....

- (b) Consider the following Python program:

```
x = 0
n = int(input())
while (n > 0):
    if n > x:
        x = n
    n = int(input())
print(x)
```

- (i) Write the output of the program if the input is 4 6 3 2 8 -1.

.....

- (ii) What is the purpose of this program?

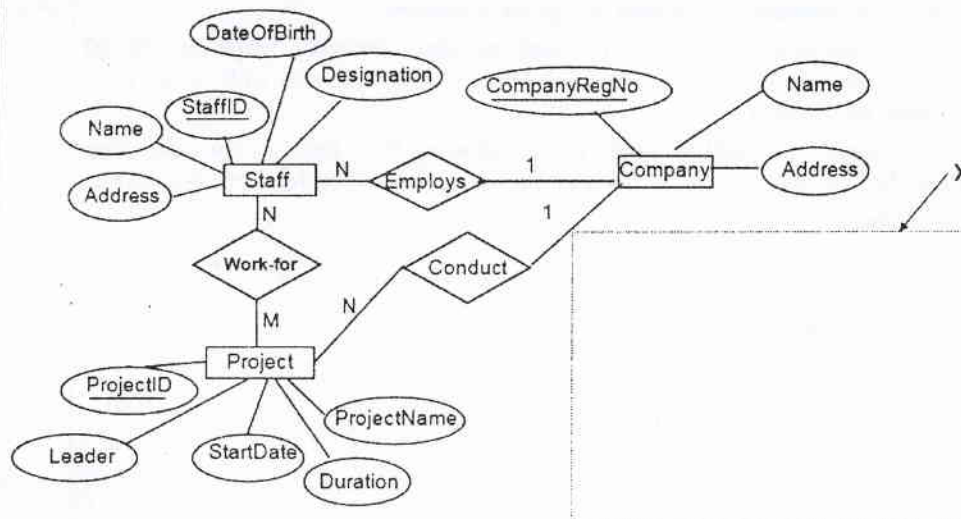
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3. (a) Consider the following Entity Relationship (ER) diagram which represents the information about projects conducted by staff attached to a software development company.

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- (i) The number of hours (*NoOfHours*) that each staff member works on each project is recorded.  
Draw the attribute *NoOfHours* in the relevant position of the ER diagram with the correct symbol and the label.
- (ii) For each accepted project, a temporary location is rented for the staff, for the duration of the project. For each Location, the OwnerName, PhoneNo, Address, Rent, RentedDate and RentedPeriod are recorded. One project has only one location. A rented location is used for only one project. When a certain project is completed, the location rented for the project will be released and handed over to the owner.  
Draw the Entity 'Location' with relevant attributes inside the area X in the diagram and link it to the existing ER diagram by indicating the cardinality.
- (b) Write down the most appropriate term from the given list to fill the blank in each statement given below.
- List = {ALOHA, Application Layer, CIDR, DHCP, Domain Name System, Network Layer, Packet Switching, Parity Bit, Parity Byte, Proxy Server}
- (i) ..... provides IP addresses for the given URLs and web addresses.
- (ii) File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP) and the Telnet service are implemented in the .....
- (iii) With the ..... a device may get a different IP address every time it connects to the network.
- (iv) ..... helps to effectively manage the available IP address space.
- (v) In data transmission, for the process of error detection, a ..... is added to a binary string to ensure that the total number of 1-bits in the string is either even or odd.

AL/2019/20/E-II (NEW)

- 6 -

4. (a) An operating system uses *Process Control Blocks (PCBs)* to maintain important information about each process.

Read the following scenario and answer the given questions:

*Rani starts a computational application on a single processor computer. While the relevant computations are in progress, she starts a web browser application as well, in order to search for some information.*

Write down the content that will be stored in the following PCB fields of the **computing process** when the "*computing process* → *web browser process*" context switch is made.

- (i) Program counter

.....

- (ii) Process state (*Ready, Running or Blocked*?)

.....

- (b) (i) What is meant by *contiguous file space allocation*?

.....

.....

.....

- (ii) Write down **one** drawback of *contiguous file space allocation*.

.....

.....

- (iii) However, contiguous allocation is feasible to store a set of files on a CD ROM. Why?

.....

.....

- (iv) In addition to the normal data items, write down **one** other information that will exist in a file block in the *linked file space allocation scheme*.

.....

- (c) Assume that a 32 KB program is run on a computer having 32 KB of physical memory. The page size of the system is 4 KB. The page table of this process at a particular time is shown on the table below.

**Notes:**

- Only a few selected fields of each page table entry is shown.
- The *frame number* is indicated in binary.
- The virtual addresses on page 0 are from 0 to 4095 and on page 1 are from 4096 to 8191 and so on.
- The *Present/absent* bit indicates the validity of the entry. If this bit is 1, the entry is valid and can be used. If it is 0, then the relevant virtual page is not in physical memory.

Page number	Frame number	Present / absent
0	110	1
1	001	1
2	010	1
3	100	1
4	011	1
5	000	0
6	000	0
7	101	1

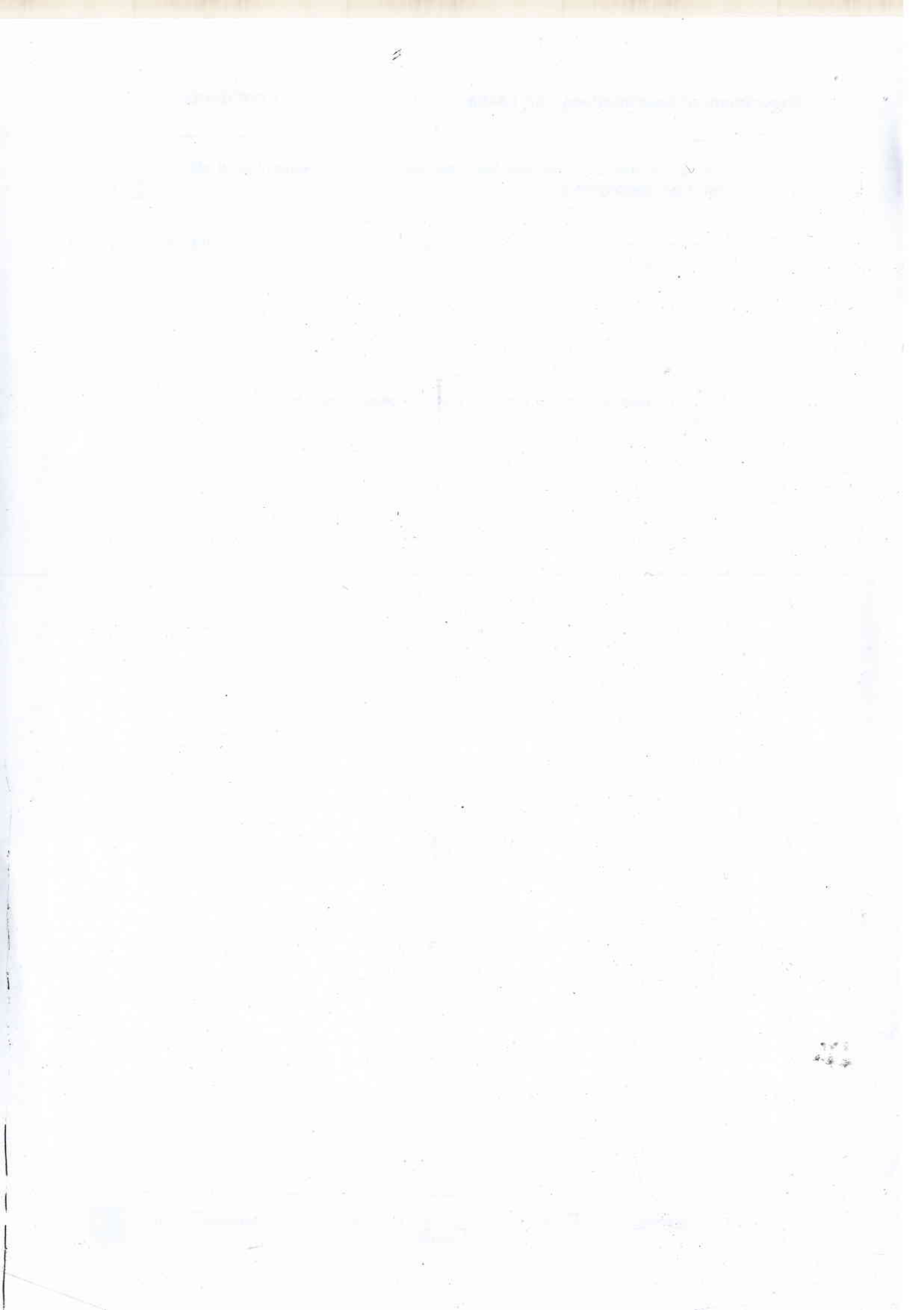
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[see page seven



<p>(i) Assume this program requires accessing virtual address 8200. To which physical address will it get transformed to?</p> <p>.....</p> <p>(ii) Write down <b>one</b> advantage that the use of page tables bring with respect to program sizes compared to the size of physical memory.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>(iii) Give <b>one</b> reason as to why a particular page of a process could be absent in physical memory.</p> <p>.....</p> <p>.....</p>	<p>Do not write in this column</p> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 10px auto;"></div>
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\* \*



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**தல தர்சேச / புதிய பாடத்திட்டம் / New Syllabus**

**NEW**

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව Sri Lanka Department of Examinations	தமிழ்நாடு தேர்வுத்துறை Department of Examinations	இலங்கைப் பரீட்சைத் திணைக்களம் Sri Lanka Department of Examinations	श्री लंका परीक्षा विभाग Sri Lanka Department of Examinations	ಶ್ರೀ ಲಂಕಾ ಪರೀಕ್ಷಾ ವಿಭಾಗ Sri Lanka Department of Examinations	ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව Sri Lanka Department of Examinations	தமிழ்நாடு தேர்வுத்துறை Department of Examinations	இலங்கைப் பரීட்சைத் திணைக்களம் Sri Lanka Department of Examinations	श्री लंका परीक्षा विभाग Sri Lanka Department of Examinations	ಶ್ರೀ ಲಂಕಾ ಪರೀಕ್ಷಾ ವಿಭಾಗ Sri Lanka Department of Examinations	ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව Sri Lanka Department of Examinations
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சுமையான பொதுக் கல்வியைப் பெற்ற (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ட்  
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ட்  
General Certificate of Education (Adv. Level) Examination, August 2019

தொழில்நுட்ப அல்லது தொழில்நுட்பத் துறை	II
தகவல், தொடர்பாடல் தொழினுட்பவியல்	II
<b>Information &amp; Communication Technology</b>	<b>II</b>

20 E II

## Part B

\* Answer any four questions only.

1. The Boolean function known as the *majority function* takes  $n$  binary inputs and outputs 1 if a majority (at least half) of the inputs are 1, otherwise it outputs 0. Let us consider the case when  $n=3$ , which is the 3-input majority function, whose inputs are A, B and C and the output is Z.
- Give the truth table for the 3-input majority function.
  - Using Karnaugh maps, derive a simplified Boolean expression for the output Z in the 3-input majority function.
  - Construct a logic circuit for the 3-input majority function using NAND gates only.

2. Consider the following scenario:

A school has acquired the following resources to its *Administrative (Admin)*, *Laboratory (Lab)* and *Library (Lib)* buildings:

Building	Resources
Admin	5 computers, 1 printer
Lab	40 computers, 1 printer
Lib	10 computers, 1 printer

A school computer network has to be created to fulfil the following requirements:

- Each building needs to have its own local area network (LAN) in order to share the printer.
- The above three networks are also to be interconnected so that the School Information System (SIS) which is running on one computer in the *Admin* building and the Library Information System (LIS) running on one computer in the *Lib* building are accessible from all computers.
- All computers are to be given efficient Internet connectivity as well. For this purpose, the school has subscribed to an Internet Service Provider (ISP) who is to supply the Internet connectivity to the *Lab* building. The *Lab* building is separated from the other two buildings by approximately 500m. One computer in the *Lab* building is to be used as the DNS server. Another computer in the *Lab* building is to be used as the proxy server.
- The entire network is to be protected through a firewall.

- (a) The Principal has received the 192.248.16.0/24 IP address block for the school. The IP addresses for the computers are to be allocated after making three subnets from this address block for the three buildings.

Assuming such subnetting is done, write down the relevant network address, subnet mask and the allocated range of IP addresses for each building using the following table format to present your answer:

Building	Network Address	Subnet Mask	IP Address Range
Admin			
Lab			
Lib			

*I see page nine*

(b) Give **one** reason as to why a fully connected (all-to-all) network topology is not suitable for this school computer network.

(c) The Lab administrator who is responsible to setup the school computer network has requested for *switches* and a *router*.

Showing clearly the network connection topology and the devices, draw the network diagram to represent the logical arrangement for the school computer network that the Lab administrator can implement to fulfil the school requirements.

(d) Give **one** reason as to why TCP is preferred over UDP as the transport protocol for the school computer network.

3. (a) ABC Books (Pvt.) Ltd. specializes in buying and selling used secondhand books. At present the business operations are fully manual (*pure brick*).

(i) ABC Books (Pvt.) Ltd. starts a website and allows its customers to purchase books online. What is the revenue model (method of revenue) applicable in this scenario?

(ii) Moving from *pure brick* type to *brick and click* business model, what is the most significant challenge unique to ABC's business? Explain your answer.

Hint - Compare with the online sales of new books

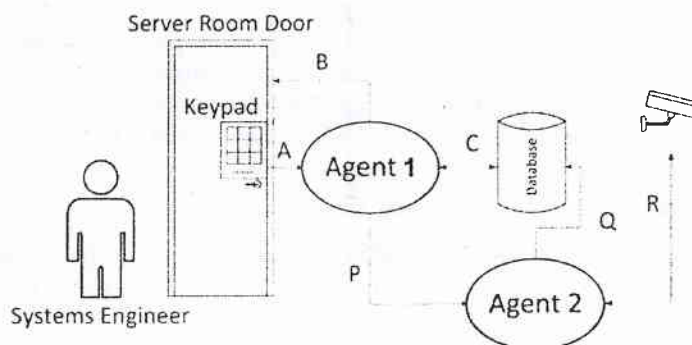
(iii) ABC Books (Pvt.) Ltd. has proposed to extend its website to an e-commerce marketplace for used books. This marketplace supports B2C, B2B and C2C business types and allows other businesses to participate as well. Explain briefly between whom the transactions in each of the business types B2C, B2B and C2C will take place in the proposed marketplace.

(iv) Other than the revenue model you mentioned in (i) above, identify another suitable revenue model to be followed by the ABC Books (Pvt.) Ltd. in their proposed e-commerce marketplace.

(v) Identify and write down a possible way to make payments within this e-commerce marketplace.

(vi) Briefly explain how book publishing companies can use the proposed e-commerce marketplace data for their businesses.

(b) Multi-agent systems can be useful when complex system interactions are implemented. The following diagram shows a simplified version of a multi-agent system that manages the secure access to the server room of a data-center.



A brief scenario of the usage is as follows:

All authorized system engineers must use their access code, which is a 6-digit number to enter the restricted server room.

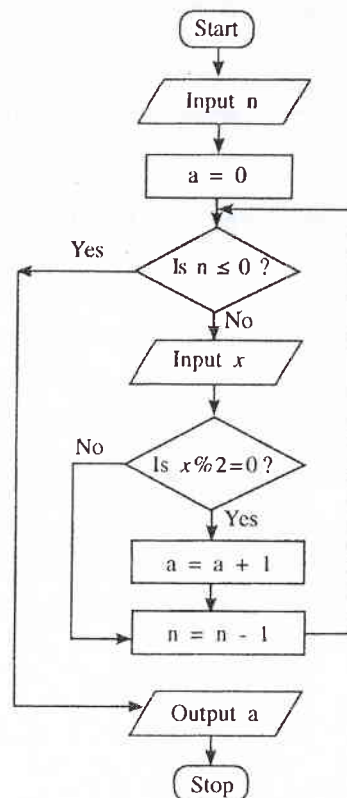
When the access is granted to the server room, a set of movable CCTV cameras starts recording the server area.

The processed data of CCTV input are saved in the database. Interactions are shown using A, B, C, P, Q, and R arrows.

(A/L/2017/20/E-11 (ICT II))

- 19 -

- (i) Identify the agent with no user interactions (self-autonomous) in this setup.
  - (ii) Sense-Compute-Control is a widely used 3-step design style of agent-based system implementations.  
From A, B and C interactions, separately identify and write down the most suitable interaction arrow to represent each step, i.e., Sense, Compute, and Control.
  - (iii) C and R interaction links are shown for two directions. Explain the reasons for the duplex links for both C and R interactions separately.
  - (iv) Interaction A can be seen as a *user-to-agent* interaction. Identify an *agent-to-agent* interaction and explain the operational use of that interaction.
  - (v) Give **one** reason as to why the CCTV inputs are sent to the database through the Agent 2 instead of sending directly.
4. (a) The ICT teacher in a school needs to process the marks obtained by all the students in a class for the ICT subject and compute the average mark for the class. Construct a flow chart to express an algorithm for this purpose. Assume that the first input is the number of students in the class,  $n$ . Next, the marks of  $n$  students will be input one-by-one.
- (b) Consider the flow chart given below. Note that  $x \% 2$  represents  $(x \bmod 2)$ .



- (i) What would be the output if the first input ( $n$ ) was 6 and the next inputs were 3, 6, 4, 12, 11, 9?
- (ii) What is the purpose of this algorithm?
- (iii) Develop a Python program to implement the algorithm expressed by the flow chart.

[see page eleven]



AL/2019/20/E-II (NEW)

- II -

5. A vehicle rental company has registered vehicle owners. Vehicles are obtained from the owners and rented to the customers. Consider the following relations regarding the vehicle rental company.

I. Customer (Customer\_NIC, Customer\_Name, City, Postal\_Code)

II. Vehicle\_Owner (Owner\_Id, Owner\_Name, Contact\_No)

III. Vehicle (Vehicle\_Reg\_No, Description, Owner\_Id)

- The Customer relation contains customer's national identity card number (NIC) which is unique, name, city where he/she is living and the postal code of the city. A customer lives in a single city and there are many customers in one city. The postal code depends on the city.
- The Vehicle\_Owner relation contains the Owner\_Id which is unique, owner's name and the contact number.
- The Vehicle relation contains the vehicle registration number which is unique, a description about the vehicle and the Owner\_Id.

A customer can rent more than one vehicle. Also, it is possible to rent one vehicle to many customers at different instances. Each vehicle is owned by one owner and one owner can have more than one vehicle.

- (a) In which *normal form* do the above relations given in I, II, III above exist? Justify your answer.
- (b) Convert the above relations to the next *Normal Form* from the current *Normal Form* which you have stated in 5(a). (Present the contents relevant to the labels  $\textcircled{P}$  to  $\textcircled{U}$  indicated in the following table as your answer.)

Relation No.	Next Normal Form	Relation/s in Next Normal Form
I	$\textcircled{P}$	$\textcircled{S}$
II	$\textcircled{Q}$	$\textcircled{T}$
III	$\textcircled{R}$	$\textcircled{U}$

- (c) Draw an Entity Relationship (ER) diagram to depict the above relations by identifying the relationships, key attributes, other attributes and the cardinality.
- (d) It is necessary for the company to keep the details of renting vehicles by customers. Create a relation called "Rent", including the details Rent\_Date, Start\_Time and End\_Time.
- (e) Write an SQL statement to select Owner\_Id and Vehicle\_Reg\_No of all the vehicles owned by each vehicle owner.

## 6. (a) A blood testing centre has the following activities:

The patient hands over the test request slip to the receiving counter. Receiving counter issues an invoice to the patient and sends a copy to the cashier. The patient checks the invoice, approves it and hands it over to the cashier with the payment. Cashier issues a receipt to the patient and also sends a copy of the receipt to the laboratory. Patient hands over the receipt to the laboratory. The laboratory verifies the patient and conducts the blood test and returns the updated receipt marked as 'done' to the patient. The laboratory sends the report to the receiving counter. Later, the patient hands over the updated receipt to the receiving counter and the receiving counter hands over the report to the patient with the re-updated receipt marked as 'issued'.

- (i) The context diagram for the above activities, with missing data flows (P), (Q), (R), (S) and (T), is given in Figure 1 below.

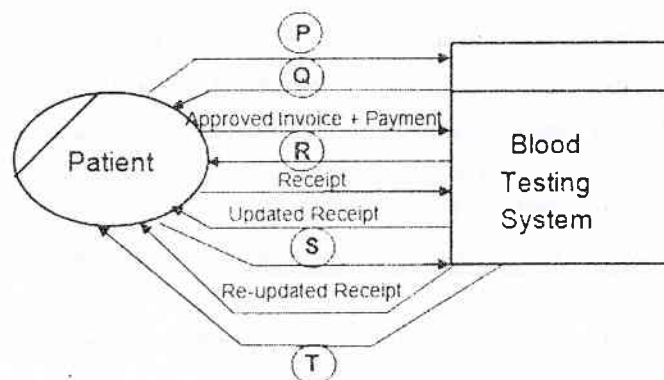


Figure 1

Identify the **five** missing data flows from the description given above and write them down.

- (ii) Level 1 of the DFD for the above context diagram is shown in Figure 2.

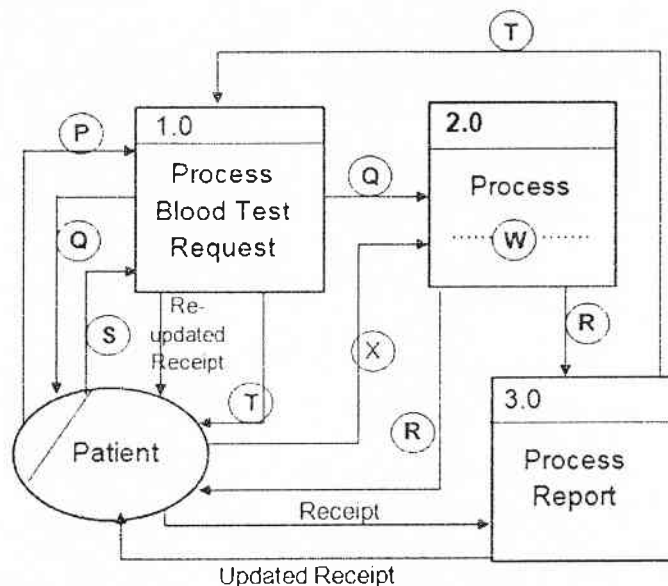


Figure 2

- (A) Write a suitable term to replace the label (W) in Process 2.0.  
 (B) Identify and write down the missing data flow labelled (X).

A/L 2017/2018-11 (NEW)

- 15 -

- (b) (i) What is *requirement analysis*?
- (ii) List **two** advantages of requirement analysis.
- (iii) Give **one** method that can be used to verify whether a functional requirement is satisfied in a system.
- (iv) The following list consists of some *functional*, *non-functional* and other requirements of a proposed school library management system where users can borrow and return books in addition to other usual tasks.
- (A) The system should authenticate users through username and password.
- (B) The system should enable users to search for books based on the *title*, *type*, *ISBN No.* or *publisher name*.
- (C) The total cost for the library system should be less than Rs. 500 000.00.
- (D) The system should be available 99% of the total time.
- (E) The system development should be completed within 9 months.
- (F) Book lending details should be preserved even if the system crashes during operation.
- (G) The book database of the school library management system must be secured by preventing unauthorized access.
- (H) Since the Past Pupils Association has indicated its willingness to develop the system, preference will be given to them.

From A to H, identify and write down the labels of **two functional** requirements and **two non-functional** requirements respectively.

\* \* \*

**Paper II (Part A)**

- 1 (a) (i) Social networking has advantages and disadvantages [1]

- (ii) Ignore border style. [2]

Schedule

Time	Event
8 am	Drama
10 am	News
Lunch	

Marks allocated as follows:

A: **1 mark** for centered caption, two bold headings and three rows with correct data

B: **1 mark** for the merged last row with *Lunch* left aligned

- (b) (i) Two points from [2]

- It is easy to keep one standard throughout the page.
- Less code lines to manage (modification in one place can be applied to the whole web site or multiple web pages) / Easy maintenance
- Reduced code complexity / Easy to understand
- Efficiency as it reduces the code lines / Page will load quicker when the main CSS file has been cached

- (ii) Exact syntax and spellings essential. [2]  
Ignore *spacing* defects and case.

p, h1, h2 {color: red; font-family: Calibri;}

p, h2 {text-align: justify;}

Marks allocated as follows:

A: **1 mark** for row 1

B: **1 mark** for row 2

- (c) One mark for each correct row. [3]

Ignore case of INSERT.

Double or single quotations can be used.

Row 1: 'admin' , 'A!2t\*' , 'school\_db'

Row 2: INSERT, student, name, class

Row 3: \$sql

2 (a) One mark per each correct row.

[6]

No mark for a row if more than one item in that row.

Ignore spelling defects and case.

Phrase no.	Item
(i)	traditional marketplace
(ii)	harmful explosives
(iii)	subscription as a revenue model
(iv)	social commerce
(v)	payment gateway
(vi)	Government to Citizen (G2C) service / G2C service / G2C

(b) (i) 8

[2]

(ii) Any purpose from

[2]

- Finding the maximum / largest / highest / greatest in a list of positive numbers
- Find the maximum / largest / highest / greatest from a given input



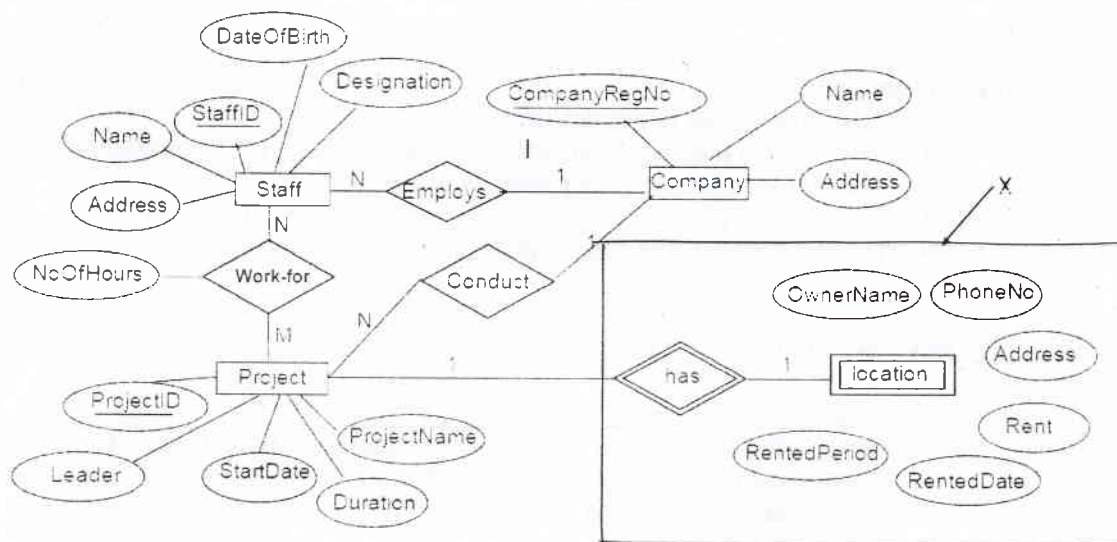
3 (a) (i) NoOfHours

[1]

(Correct symbol, exact spelling, case and proper positioning is **essential**. Ignore spacing defects.)

(ii)

[4]



Marks allocated as follows:

- A: 1 mark for Location with correct symbol and label
- B: 1 mark for has relationship with correct symbol and linked to Project entity with proper cardinality
- C: 1 mark for all six Location attributes with correct symbols
- D: 1 mark for completeness (full marks for A,B,C, exact spellings and case with no spaces)

Note: If Company entity is linked to Location entity, do not deduct marks.

(b) One mark per each correct row.

[5]

No mark if more than one term in any row.

Ignore spelling defects.

- (i) Domain Name System / DNS
- (ii) Application Layer
- (iii) DHCP
- (iv) CIDR
- (v) Parity Bit

- 4 (a) (i) Address of the next instruction to be executed [1]
- (ii) Ready [1]
- (No mark if more than one state given.)
- (b) (i) Space for a file is allocated as a collection of consecutive / adjacent / contiguous / continuous blocks [1]
- (ii) Any one point from [1]
- Extending the file size is difficult
  - May result in fragmentation / external fragmentation / Defragmentation can take up a lot of time and may need the system to be down
  - The expected final file size must be known at the time of creation
  - Finding space for a new file is difficult
- (iii) Any one point from [2]
- Final sizes of the files to be stored are known
  - On a CDROM, there is no deletion of files thus there is no danger of fragmentation
  - There is no need to extend file sizes
- (iv) Any one point from [1]
- Address of the next block of the file / next block number
  - End-of-File marker
  - Pointer to the next block
- (c) (i) Any one from [1]
- $8200_{10}$
  - $010000000001000_2 / 10000000001000_2$
- (Students need not write the bases.)
- (ii) The program size could be larger than the size of the physical memory [1]
- (iii) Any one point from [1]
- That page would not have been accessed before
  - That page would have got evicted / removed / expelled from physical memory

**Paper II (Part B)**

1 (a)

[4]

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

*Marks allocated as follows:***Four marks** for all 8 rows correct**Three marks** for maximum 6,7 rows correct**Two marks** for maximum 4,5 rows correct**One mark** for maximum 3 rows correct

(b)

[6]

		AB			
		00	01	11	10
C	0	0	0	1	0
	1	0	1	1	1

$$Z = AB + BC + AC$$

*Marks allocated as follows:***A: 1 mark** for correct map entries**B: 3 marks** for the **three** correct loops (1 mark X 3)**C: 2 marks** for the final simplified expression

(c)

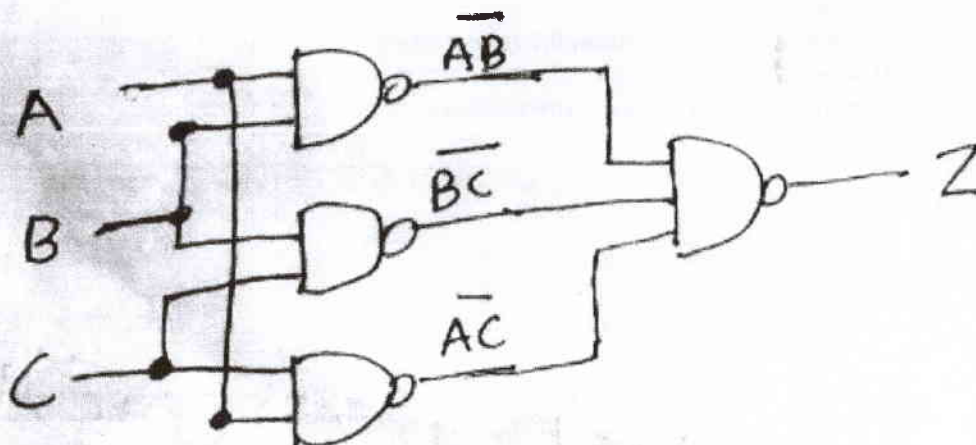
[5]

**Zero marks** if any other gate is used or if **all the inputs** are not labelled. Deduct **1 mark** if the output is not labelled.

Equation not essential.

$$Z = AB + AC + BC$$

$$Z = \overline{AB} \cdot \overline{AC} \cdot \overline{BC}$$



*Marks allocated as follows:*

**5 marks** if the diagram is as above (ignore intermediate terms)

Alternative:

For a logically correct but an unoptimized NAND gate arrangement (using many gates) give a total of **2 marks**

2 (a) 2 marks per correct row

[6]

Building order may be different.

Building	Network address	Subnet mask	IP Address range
Admin	192.248.16.0	255.255.255.192	192.248.16.1 - 192.248.16.62 or 192.248.16.0 - 192.248.16.63
Lab	192.248.16.64	255.255.255.192	192.248.16.65 - 192.248.16.126 or 192.248.16.64 - 192.248.16.127
Lib	192.248.16.128	255.255.255.192	192.248.16.129 - 192.248.16.190 or 192.248.16.128 - 192.248.16.191

Alternative answer for any row:

Network address	Subnet mask	IP Address range
192.248.16.192	255.255.255.192	192.248.16.193 - 192.248.16.254 or 192.248.16.192 - 192.248.16.255

Alternative answer 1:

Building	Network address	Subnet mask	IP Address range
Admin	192.248.16.0	255.255.255.128	192.248.16.1 - 192.248.16.126 or 192.248.16.0 - 192.248.16.127
Lab	192.248.16.128	255.255.255.192	192.248.16.129 - 192.248.16.190 or 192.248.16.128 - 192.248.16.191
Lib	192.248.16.192	255.255.255.192	192.248.16.193 - 192.248.16.254 or 192.248.16.192 - 192.248.16.255



Alternative answer 2:

Building	Network address	Subnet mask	IP Address range
Admin	192.248.16.0	255.255.255.192	192.248.16.1 - 192.248.16.62 or 192.248.16.0 - 192.248.16.63
Lab	192.248.16.64	255.255.255.192	192.248.16.65 - 192.248.16.126 or 192.248.16.64 - 192.248.16.127
Lib	192.248.16.128	255.255.255.128	192.248.16.129 - 192.248.16.254 or 192.248.16.128 - 192.248.16.255

(From the two ranges given for each *IP Address Range*, only the first one gives the range of *usable* IP addresses.)

**Note:**

If only **two columns** correct in a row, give **one mark** for that row.

(E.g., if only 2 columns are correct in each of the three rows, then give a total of **three marks** [1 mark X 3] for this part.)

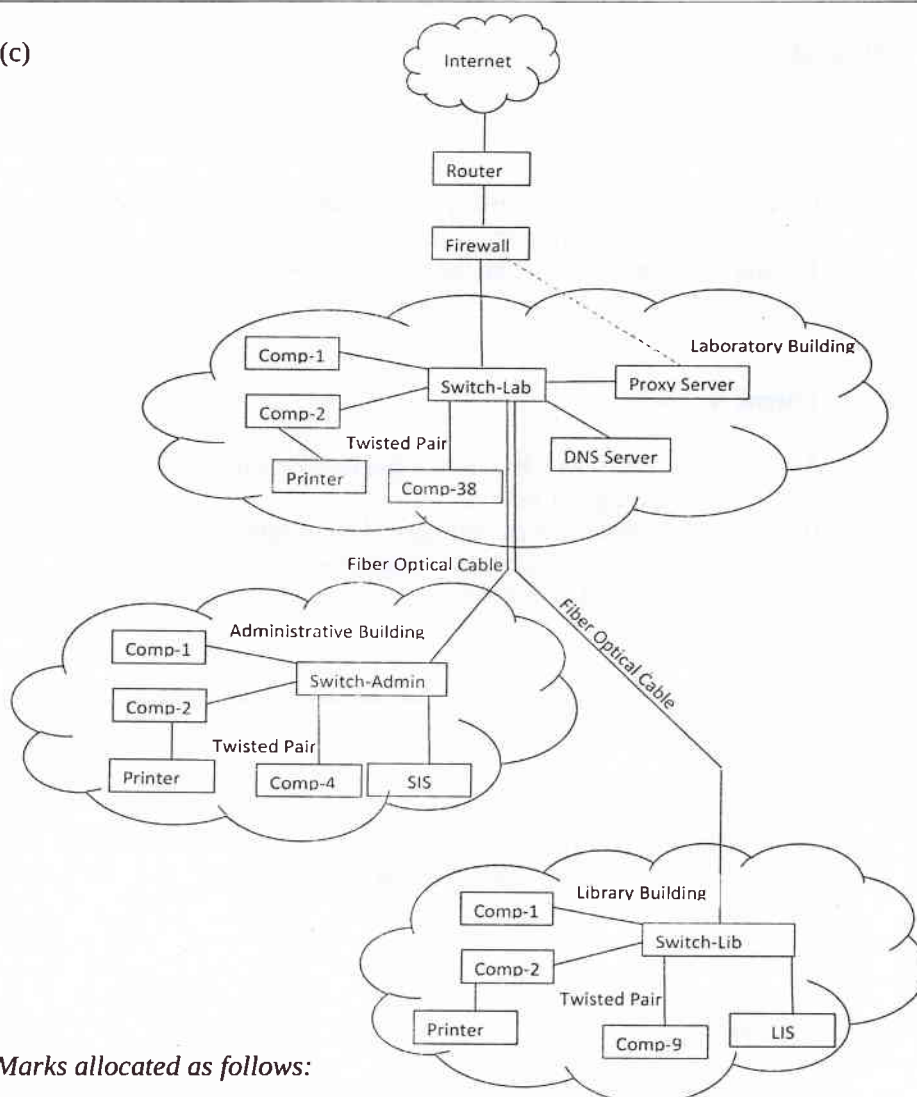
(b) Any one point from

[1]

- Costly / difficult to install / impractical due to buildings being geographically separated
- Difficult to configure
- There is no such connectivity requirement for the school

(c)

[7]



Marks allocated as follows:

- A: **1 mark** for Internet – Router – Firewall link
  - B: **1 mark** for getting the Internet connection to the Lab switch
  - C: **1 mark** for interconnecting the Admin and Lib switches to the Lab switch
  - D: **1 mark** for properly locating Proxy and the DNS servers
  - E: **1 mark** for properly connecting SIS to Admin switch and LIS to Lib switch
  - F: **1 mark** for properly identifying the number of nodes in each building
  - G: **1 mark** for properly connecting the printer<sup>†</sup> and for not using unnecessary devices
- <sup>†</sup> As the printer type is not indicated, connecting each printer directly to the relevant switch is also acceptable

(d) Any one point from

[1]

- The applications that the school will be using will benefit from the many desirable features of TCP such as reliability, in-order delivery, connection oriented nature, flow-control, congestion control, error recovery and re-transmission of packets when necessary
- The transmission time required for the school applications is not very critical
- TCP is used for the web and email applications

- 3 (a) (i) Online sales [1]
- (ii) Any one from [1]
- Customers being reluctant to buy second hand books online as they do not have the ability to inspect their quality
  - Having to compete against online sellers of new books / e-books
- (iii) 1 mark for each [3]
- A: B2C – Between ABC Books and its customers / Between a business and its customers
- B: B2B – Between ABC Books and other businesses / Between two other businesses
- C: C2C – Between individual customers of the marketplace
- (iv) Any one from [1]
- Advertising support / revenue
  - Subscription fees
  - Transaction fees / commissions
- (v) Any one from [1]
- through credit/debit cards / payment gateways / electronic payment cards
  - through e-banking / Internet banking
  - transactions using mobile phones
  - through third party payment facility providers
- (vi) Any one from [1]
- Analyzing high demand books
  - Analyzing the purchase trends
  - Analyzing customer preferences

(b) (i) Agent 2 [1]

(ignore spelling defects and case)

(ii) [2]

Sense – A  
Compute – C  
Control - B

*Marks allocated as follows:*

**Two marks for all three correct**  
**One mark for one or two correct**

(iii) 1 mark for each [2]

C – Database read and write operations  
R – Camera input feed and Camera control commands

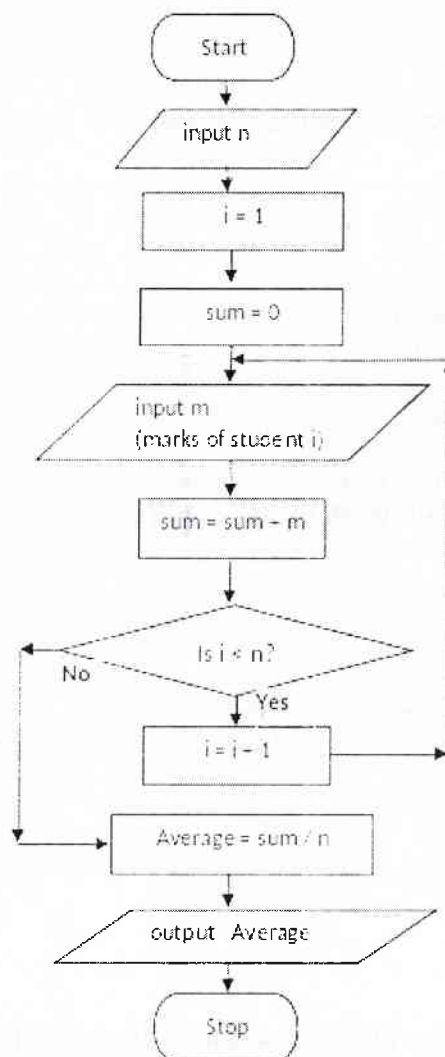
(iv) P: informing Agent 2 to operate [1]

(v) [1]

CCTV raw data input need to be processed before storage in the DB.  
Processing allows data reduction, annotations and other value added functions.

4 (a)

[8]



Marks allocated as follows:

- A - 1 mark for the input of  $n$
- B - 1 mark for both initializations
- C - 1 mark for the loop check
- D - 1 mark for the input of a mark (if properly inside loop)
- E - 1 mark for the summation computation and computing next loop index (if properly inside loop)
- F - 1 mark for the correct average computation
- G - 1 mark for printing the correct average
- H - 1 mark for correct symbols and arrows



(b) (i) 3 [1]

(ii) Any one from [1]

- Count the number of even numbers in a list
- Print the number of even numbers in a list

(iii) [5]

```
n= int(input())
a = 0
while (n > 0):
    x = int(input())
    if (x % 2 == 0):
        a = a + 1
    n = n - 1
print (a)
```

An alternative code:

```
n = int(input())
a = 0
while True:
    if n <= 0:
        break
    x = int(input())
    if x%2 == 0:
        a = a + 1
    n = n - 1
print (a)
```

**Note:** Any other correct Python program that correctly implements the algorithm is also acceptable (E.g., Through the use of a *for* loop)

*Marks allocated as follows:*

A: 1 mark for correctly placed `n= int(input())`

B: 1 mark for correctly placed `while (n > 0):`  
`n = n - 1`

C: 1 mark for the following if correctly placed inside loop  
`x= int(input())`

D: 1 mark for the correctly placed `a = 0`

and for the following if correctly placed inside loop

```
if (x % 2 == 0):
    a = a + 1
```

and for the correctly placed

```
print (a)
```

E: 1 mark for correct *indentation*

5 (a)

[2]

Relation I:

Normal form	Justification
2	As all non-key attributes are fully functionally dependent on the primary key / There are transitive dependencies

Relation II and Relation III: **Any one or both** from

Normal form	Justification
2	As all non-key attributes are fully functionally dependent on the primary key / There are transitive dependencies

Normal form	Justification
3	No transitive dependencies

*Marks allocated as follows:***Two marks** for all **three** relations correct**One mark** for **one or two** relations correct

(b)

[5]

Relation I:

P: 3 / 3 NF

S: Customer (Customer\_NIC, Customer\_Name, City)  
Customer\_City (City, Postal\_Code)

Relation II:

**Any one** from

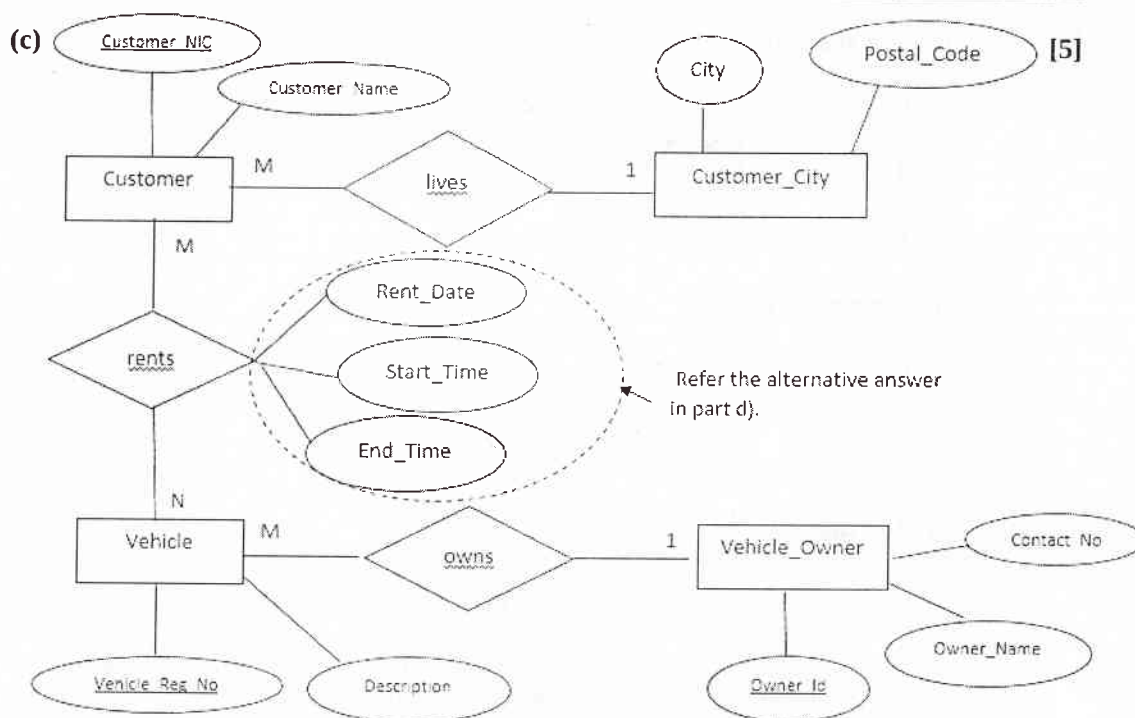
- Q: 3 / 3 NF  
T: Vehicle\_Owner (Owner\_Id, Owner\_Name, Contact\_No)
- Q: It cannot be normalized further from 3 NF  
T: - / Vehicle\_Owner (Owner\_Id, Owner\_Name, Contact\_No)

Relation III:

**Any one** from

- R: 3 / 3 NF  
U: Vehicle(Vehicle\_Reg\_No, Description, Owner\_Id)
- R: It cannot be normalized further from 3 NF  
U: - / Vehicle(Vehicle\_Reg\_No, Description, Owner\_Id)

*Marks allocated as follows:*P - **1 mark**S - **2 marks** (one mark per relation with primary keys marked)Q and T - **1 mark**R and U - **1 mark**



Marks allocated as follows:

A: **1 mark** per relationship (*rents*, *owns*) with correct cardinality (Total **2 marks**)

B: **1 mark** for *Customer*, *Vehicle* and *Vehicle\_Owner* entities with all attributes

C: **1 mark** for correctly denoting all three keys

D: **1 mark** for completeness (spellings, case, spacing)

(d) [1]  
 Rent(Customer\_NIC, Vehicle\_Reg\_No, Rent\_Date, Start\_Time, End\_Time)

Alternative answers:

1. This relationship may also be incorporated to the ER diagram in (c) **with** the keys correctly marked.

2. CREATE TABLE Rent

(Customer\_NIC varchar(10),

Vehicle\_Reg\_No varchar (8), Rent\_Date date, Start\_Time time, End\_Time time,

PRIMARY KEY (Customer\_NIC, Vehicle\_Reg\_No);

Note: The primary key can also be introduced as a constraint.

(e) **Any one** answer from [2]

- SELECT Owner\_Id, Vehicle\_Reg\_No FROM Vehicle GROUP BY Owner\_Id;
- SELECT Owner\_Id, Vehicle\_Reg\_No FROM Vehicle;

Marks allocated as follows:

A: **1 mark** for correct query (ignore case of SELECT)

B: **1 mark** for completeness (correct syntax, correct names, semicolon use)

6 (a) (i) One mark per each. [5]

- |   |   |                                  |
|---|---|----------------------------------|
| P | - | Test request slip / Request slip |
| Q | - | Invoice                          |
| R | - | Receipt                          |
| S | - | Updated receipt                  |
| T | - | Report                           |

(ii) One mark per each. [2]

- (A) W - Payments
- (B) X - Approved invoice + payment

(b) (i) Any one point from [1]

- Analysing / finding the requirements of an information system before its development
- Finding the functional and non-functional requirements of a system
- Analysing the requirements of a proposed system
- Studying and analyzing the user needs to define the problem domain and system requirements
- Determining user expectations for a new or modified product

(ii) Any two advantages from [2]

- Allows to discover the system scope/boundary and the nature of system interaction within its environment
- Allows to detect and resolve conflicts between the requirements
- Allows to prioritize requirements relatively to each other
- Helps in deciding the critical success factors
- Reduces project / implementation risks
- Helps in distinguishing *functional* and *non-functional* requirements

(iii) Any one point from [1]

- Through testing based on functional requirements (**Except** system/integration testing)
- Through validation / verification

(iv) One mark per each correct requirement (Max. **two marks** per set). [4]

Functional requirements: A, B

Non-functional requirements: **Any two** from D, F, G

(Deduct 1 mark for any incorrect **extra** label. Note: Minimum 0 marks )



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