Contents

1 Marking instructions

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

1. Use a red color ball point pen for marking. (Only Chief/Additional Chief Examiner may use a mauve color pen.)

2. Note down Examiner's Code Number and initials on the front page of each answer script.

3. Write off any numerals written wrong with a clear single line and authenticate the alterations with Examiner's initials.

4. Write down marks of each subsection in a $\triangle$ and write the final marks of each question as a rational number in a $\square$ with the question number. Use the column assigned for Examiners to write down marks.

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) $\frac{3}{5}$ = $\boxed{\frac{10}{15}}$

MCQ answer scripts (Template)

1. Marking templates for G.C.E.(A/L) and GIT examination will be provided by the Department of Examinations itself. 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.

Structured essay type and essay type answer scripts

1. Cross off any pages left blank by candidates. Underline wrong or unsuitable answers. Show areas where marks can be offered with check marks.

2. Use the right margin of the overland paper to write down the marks.

3. 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*.

4. Add the total 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.

Preparation of Mark Sheets

Except for the subjects with a single question paper, final marks of two papers will not be calculated within the Evaluation Board this time. Therefore, add separate mark sheets for each of the question papers.

Write Paper I marks in the Paper I column of the mark sheet and write them in words too. Write Paper II marks in the paper II Column and write the relevant details. For the *Subject 51 Art*, marks for Papers I, II and III should be entered numerically in the mark sheets.

2   Paper I

009564

සියලුම හිමිකම් ඇවිරිණි/(முழுப் பதிப்புரிமையுடையது/All Rights Reserved]

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව **ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව** ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரீட்சைத் **இலங்கை, பரீட்சைத் திணைக்களம்**s, Sri Lanka Department of Examinations, Sri Lanka
Department of Examinations, Sri Lanka Department of **Department of Examinations, Sri Lanka**
ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පතු (උසස් පෙළ) විභාගය, 2021(2022)
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2021(2022)
General Certificate of Education (Adv. Level) Examination, 2021(2022)

තොරතුරු හා සන්නිවේදන තාක්ෂණය	I				පැය දෙකකි
தகவல், தொடர்பாடல் தொழினுட்பவியல்	I	**20**	**E**	**I**	இரண்டு மணித்தியாலம்
Information & Communication Technology	I				*Two hours*

Instructions:
* ✳ *Answer **all** the questions.*
* ✳ *Write your **Index Number** in the space provided in the answer sheet.*
* ✳ *Instructions are also given on the back of the answer sheet. Follow those carefully.*
* ✳ *In each of the questions **1** to **50**, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct or most appropriate** and **mark your response on the answer sheet with a cross (×)** in accordance with the instructions given on the back of the answer sheet.*
* ✳ *Use of calculators is **not allowed**.*

1. Which of the following pairs contains types of software that are **different** with respect to *ownership / licensing?*
   (1) Application software and open-source software
   (2) Application software and utility software
   (3) Proprietary software and open-source software
   (4) Proprietary software and systems software
   (5) Systems software and utility software

2. Which of the following is a good example for *batch processing?*
   (1) an air traffic control system
   (2) driving system in a driver-less (autonomous) car
   (3) Intensive Care Unit (ICU) patient monitoring and care system
   (4) payroll system
   (5) nuclear plant control system

3. There are different storage components which vary in capacity and access speed.
   Consider that the shown diagram portrays capacity and access speed variation of the storage components *L1 cache, L2 cache, main memory, registers* and the *hard disk*. The capacity increases and access speed decreases from top to bottom, as shown.

   Capacity   Access speed
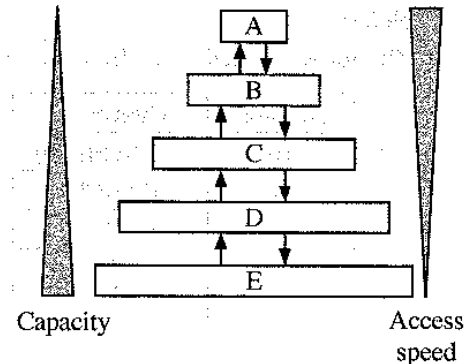
   Which is correct with respect to the A, B, C, D and E above?
   (1) A – hard disk, B – registers, C – L2 cache, D – L1 cache, E – main memory
   (2) A – L1 cache, B – L2 cache, C – registers, D – hard disk, E – main memory
   (3) A – main memory, B – registers, C – hard disk, D – L1 cache, E – L2 cache
   (4) A – registers, B – L1 cache, C – L2 cache, D – main memory, E – hard disk
   (5) A – registers, B – main memory, C – L2 cache, D – L1 cache, E – hard disk

[*See page two*

4. Consider the following paragraph:

   To run a program, the program code is copied from ......A...... into ......B...... The Central Processing Unit's (CPU's) *program counter* register is set to the memory location where the first instruction of the program has been saved and execution of the program starts. The ......C...... implements the fetch – decode – execute cycle.

   Which of the following is the correct combination for A, B and C?

   (1) A – CPU, B – primary memory, C – secondary storage
   (2) A – CPU, B – secondary storage, C – primary memory
   (3) A – primary memory, B – secondary storage, C – CPU
   (4) A – secondary storage, B – CPU, C – primary memory
   (5) A – secondary storage, B – primary memory, C – CPU

5. What is the correct result of bit-wise XOR operation between the two binary numbers 01011100_2 and 11111001_2?

   (1) 00000010   (2) 01011000   (3) 01011010   (4) 10100101   (5) 11111101

6. What is the correct 2's complement binary representation of decimal -32_{10} using 8-bits?

   (1) 00100000   (2) 10100000   (3) 11011111   (4) 11100000   (5) 11100001

7. What is the correct decimal equivalent of hexadecimal 88.8_{16}?

   (1) 88.5_{10} (2) 88.8_{10} (3) 129.5_{10} (4) 136.5_{10} (5) 136.8_{10}

8. A particular command can be used to output the values of every byte in a file in decimal format. Assume a file contains the following text:

   ## Love trees!

   Referring the two **Notes** (i) and (ii) given below, select the correct output that will result when the said command is run on that file.

(1) 76	111	118	101	32	116	114	101	101	115	10
(2) 76	111	118	101	116	114	101	101	115	33	10
(3) 76	111	118	101	32	116	114	101	101	115	33	10
(4) 108	111	118	101	116	114	101	101	115	33	10
(5) 108	111	118	101	32	116	114	101	101	115	33	10

   Notes:

   (i) Some selected rows from the ASCII table are given below:

Decimal	Character	Decimal	Character
10	(LINE FEED)	108	l
32	(SPACE)	111	o
33	!	114	r
76	L	115	s
101	e	116	t
		118	v

   (ii) The file ends with a LINEFEED character.

9. Consider the following Karnaugh map and the logic circuit implemented based on it where A, B and C are the inputs and Z is the output:

AB

|		00	01	11	10
	0	0	e	f	0
C	1	1	g	h	1

(a) Karnaugh map   (b) Logic circuit based on Karnaugh map

For the logic circuit to correctly implement the logic function represented in the Karnaugh map, what should be the values of **e, f, g, h**?

(1) e=0, f=0, g=1, h=1   (2) e=0, f=1, g=1, h=1
(3) e=1, f=0, g=1, h=1   (4) e=1, f=1, g=0, h=0
(5) e=1, f=1, g=0, h=1

10. Amara logs into a single-processor computer and starts a program to work on his presentation. He opens up a web browser too to get some information as well.
Consider the following process state transition diagram with respect to the process corresponding to Amara's **presentation program.**
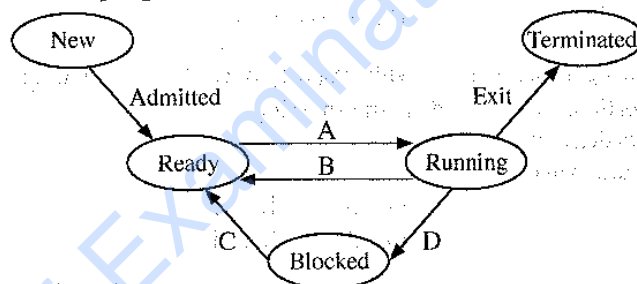
Consider some reasons for above state transitions:

Reason	Description
1	Amara saving his presentation on the hard disk
2	Operating system scheduling the presentation process to run on the processor
3	Operating system suspending the presentation process to let the web browser process to run on the processor
4	The finishing of saving the presentation on the hard disk

Which of the following gives a correct combination of reasons for transitions A to D?

(1) A – 1, B – 2, C – 3, D – 4   (2) A – 2, B – 3, C – 4, D – 1
(3) A – 3, B – 4, C – 1, D – 2   (4) A – 4, B – 1, C – 2, D – 3
(5) A – 4, B – 1, C – 3, D – 2

11. A *page table* is
   (1) a computer hardware unit through which all memory references pass.
   (2) a data structure that keeps information about the pages that are in processor caches.
   (3) a hardware component in memory that facilitates page movement.
   (4) an operating system data structure that keeps virtual to physical address mapping of a process' pages.
   (5) a piece of processor hardware that keeps a count of the number of pages of a process that are in virtual memory.

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12. The *block size* of a disk is 4KB. A portion of its **File Allocation Table** (**FAT**) at a particular time is shown below. The portion shown gives the blocks of the *myprog.py* file as well.

FAT

100	101
101	−1
102	
103	100
104	

Notes: 1. The last block of a file is indicated by −1.

2. The *directory entry* of a file contains the block number of the first block of the file.

Which of the following gives the *directory entry* for the *myprog.py* file **and** the disk space allocated for the *myprog.py* file respectively?

(1) 100, 12KB   (2) 101, 12KB   (3) 101, 16KB   (4) 103, 12KB   (5) 103, 16KB

13. Which of the following is/are correct with respect to a *digital signal*?

    A – denoted by a square wave
    B – contains a continuous range of values
    C – uses discrete values to represent information

(1) A only   (2) B only   (3) C only
(4) A and B only   (5) A and C only

14. Which of the following is/are correct with respect to *guided media* used for data transmission?

    A – a physical path is used for data transmission
    B – signal is broadcast through air
    C – Example: radio waves

(1) A only   (2) A and B only   (3) A and C only
(4) B and C only   (5) All A, B and C

15. Which of the following could be used to digitally represent analog signals?

(1) attenuation   (2) decoding   (3) distortion
(4) pulse code modulation   (5) synchronization

16. Read the following sentence:

    When devices send and receive data over a network, a protocol is used uniquely identify the sender interface and the correct delivery of the data to the receiver's interface.

What is the protocol that the writer in above sentence is referring to?

(1) FTP   (2) HTTP   (3) MAC   (4) TCP   (5) UDP

17. Given below are some characteristics of *Transmission Control Protocol (TCP)* and *User Datagram Protocol (UDP)*:

    A – best suited for applications that need high reliability and where the transmission time is less critical
    B – faster and requires fewer resources
    C – guarantees that no packets are missing
    D – packets may not arrive in order
    E – used for voice communications over internet

Which of the above are the characteristics of **UDP**?

(1) A, B and C only   (2) A, C and E only   (3) A, D and E only
(4) B, C and D only   (5) B, D and E only

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18. Which of the following is/are examples for the use of the *Client-Server* model?

     A – A user printing a document using a printer connected to her computer

     B – A bank customer accessing online banking services with a web browser

     C – A cashier of a shop that accepts payments by credit cards

   (1) A only   (2) B only   (3) C only

   (4) A and C only   (5) B and C only

19. Sender A wants to send the message HELLO to receiver B. Before sending the message, it is converted to IFMMP. Which of the following is correct with respect to this scenario?

     A –   HELLO is the *plaintext* while IFMMP is the *ciphertext*.

     B –   IFMMP is the result of applying the ASCII code to HELLO.

     C –   +1 is the *encryption key* while −1 is the *decryption key*.

   (1) A only   (2) A and B only   (3) A and C only

   (4) B and C only   (5) All A, B and C

20. Consider the following paragraph with three blanks labelled A, B and C:

     When there are multiple computers in an office, each computer can be given a private IP address. The router in the office gets a ......A...... IP address, and each of the computers connected to that router through guided/unguided media gets a private IP address from the ......B...... via the ......C...... protocol.

   Which of the following is the correct combination for the blanks A, B and C?

   (1) A – private,   B – file server,   C – HTTP

   (2) A – private,   B – Internet,   C – DHCP

   (3) A – private,   B – router,   C – FTP

   (4) A – public,   B – file server,   C – FTP

   (5) A – public,   B – router,   C – DHCP

21. Consider the information system types in **List A** and some examples in **List B**:

List A	List B
A1 – Enterprise Resource Planning System	**B1** – A customer account system in a bank
A2 – Expert system	**B2** – A system that facilitates manufacturing, marketing and sales of a garment business
A3 – Transaction processing system	**B3** – A system that prescribes ayurvedic medicines using a knowledge base

   A good matching between lists **A** and **B** is:

   (1) A1-B1, A2-B2, A3-B3   (2) A1-B2, A2-B3, A3-B1

   (3) A1-B3, A2-B1, A3-B2   (4) A1-B2, A2-B1, A3-B3

   (5) A1-B3, A2-B2, A3-B1

22. Which of the following is **incorrect** about the *Agile Method*?

   (1) It cannot be used when the project has a fixed set of requirements.

   (2) It recommends a time sliced schedule for task completion.

   (3) It delivers gradual builds of the working product in an iterative manner.

   (4) It facilitates stakeholders (e.g., buyer, user) to review progress and provide feedback at every phase.

   (5) The product of each build is tested independently.

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23. Which of the following statements is/are correct with respect to *Object Oriented Programming*?

     A – System output is determined by the object behaviour and their interactions.
     B – System is modelled as a collection of objects.
     C – Writing a program in this method is different from writing one according to the *structured programming* method.

     (1) A only   (2) B only   (3) C only
     (4) A and C only   (5) All A, B and C

24. Which of the following lists the activities of Structured System Analysis and Design Methodology (SSADM) in the correct order?

     (1) Feasibility study, Physical design, Requirement analysis, Requirement specification, System development
     (2) Feasibility study, Requirements analysis, Requirement specification, Logical system specification, Physical design
     (3) Feasibility study, Requirement specification, Requirements analysis, Logical system specification, Physical design
     (4) Requirements analysis, Logical system specification, Feasibility study, Requirement specification, Physical Design
     (5) Requirements analysis, Requirement specification, Feasibility study, Physical design, System development

● A system that gives the list of closest taxi drivers to a passenger is to be developed. Answer questions **25** and **26** with respect to it.

25. Assume that the following is the *Level 1 DFD* for this system:
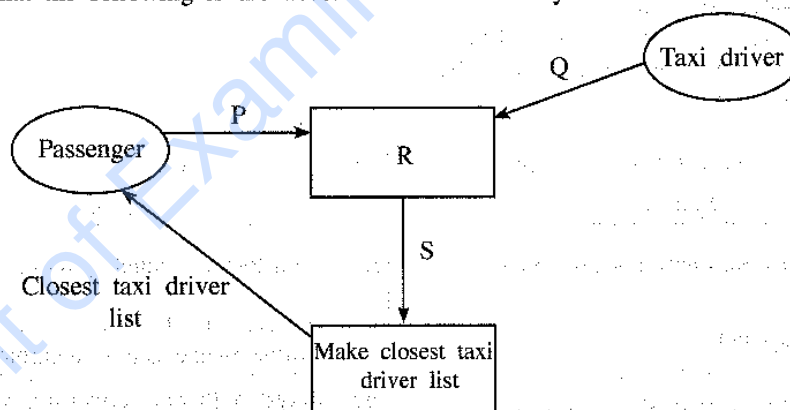
Which of the following contains the suitable replacements for P, Q, R and S in the above diagram?

     (1) P – Location, Q – Driver code, R – Get passenger and driver locations, S – Passenger and driver locations
     (2) P – Location, Q – Driver code and location, R – Get passenger and driver details, S – Passenger and driver details
     (3) P – NIC number, Q – NIC number, R – Get passenger and driver NIC numbers, S – Passenger and driver NIC numbers
     (4) P – Passenger code, Q – Driver code, R – Get passenger and driver codes, S – Passenger and driver codes
     (5) P – Passenger code, Q – Location, R – Get passenger and driver locations, S – Passenger and driver locations

26. Above Level-1 DFD was later improved so that a data store (D1) was connected to the process labelled R. What could be this data store?

     (1) NIC data   (2) Passenger details   (3) Taxi driver details
     (4) Travel cost details   (5) Weather records

0002617

27. Which of the following gives a suitable order of activities to follow when developing a system that involves a database?
    (1) Design the database, Draw the DFD, Draw the ER diagrams, Do the coding, Write the pseudo-code
    (2) Design the database, Write the pseudo-code, Draw the ER diagrams, Draw the DFD, Do the coding
    (3) Do the coding, Write the pseudo-code, Design the database, Draw the ER diagrams, Draw the DFD
    (4) Draw the DFD, Draw the ER diagrams, Design the database, Write the pseudo-code, Do the coding
    (5) Draw the ER diagrams, Do the coding, Write the pseudo-code, Design the database, Draw the DFD

28. Which of the following statements is/are correct about *acceptance testing*?
    A – Acceptance testing is done when the user requirements of the software are analysed.
    B – An essential activity in acceptance testing is checking through the conditional statements and loops in the code.
    C – Users may refuse to accept the software after the Acceptance Test.
    (1) A only   (2) B only
    (3) C only   (4) A and C only
    (5) All A, B and C

29. Which of the following statements is correct about software deployment?
    (1) *Direct deployment* has the highest risk of complete failure but may be the only suitable method for some cases.
    (2) *Direct deployment* is the most expensive and offers slowest learning to the users.
    (3) *Parallel deployment* is the least expensive deployment option.
    (4) *Phased deployment* does not provide the freedom for the relevant organization to make any needed adjustments to the system.
    (5) *Pilot deployment* always rolls out the new system to a test user group larger than 50% of the users.

30. Which of the following statements is/are correct?
    A – *Business Process Re-engineering* helps to modify the existing business practices to fit with Commercial-Off-The-Shelf (COTS) software.
    B – Users may have to pay for certain features of COTS even if those are not needed.
    C – A well developed *custom software* can bring a competitive advantage to an organization.
    (1) A only   (2) B only
    (3) A and B only   (4) B and C only
    (5) All A, B and C

31. Which of the following is a (are) good practice(s) to follow in database development?
    A – the use of meaningful names for tables and fields
    B – letting different tables repeat the same information (other than the primary keys)
    C – avoiding a field and and its table having the same name (in order to avoid confusion while writing queries)
    (1) A only   (2) B only
    (3) C only   (4) A and B only
    (5) A and C only

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● Consider the following **Results** and **Subjects** tables to answer questions from **32** to **35**:

Results

StudentNo	NIC	FirstName	SubjectID	Grade
S1234	986888457V	Nilam	ENG	B
S1447	992562321V	Praveena	PHY	C
S1234	986888457V	Nilam	ACC	A
S1323	900251452V	Thilan	ENG	S
S1323	900251452V	Thilan	ACC	B

Subjects

SubjectID	SubjectName
ENG	English
PHY	Physics
ECO	Economics
ACC	Accountancy

32. Which of the following is most suited to be selected as the *primary key* of the **Results** table with respect to the given details?
    (1) NIC
    (2) SubjectID
    (3) StudentNo
    (4) StudentNo and NIC
    (5) StudentNo and SubjectID

33. What is the correct SQL statement to retrieve the values of attributes **StudentNo**, **SubjectName** and **Grade**?
    (1) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN ON Results.SubjectID = Subjects.SubjectID;
    (2) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN Results.SubjectID = Subjects.SubjectID;
    (3) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN Subjects IN Results.SubjectID = Subjects.SubjectID;
    (4) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN Subjects ON Results.SubjectID = Subjects.SubjectID;
    (5) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade INNER JOIN Results AND Subjects Results.SubjectID = Subjects.SubjectID;

34. Which of the following is the correct statement about the **Results** table?
    (1) All the non-key attributes are fully functionally dependent on the primary key.
    (2) It has one candidate key.
    (3) It is in the *First Normal Form* (1NF).
    (4) It is in the *Second Normal form* (2NF).
    (5) The cardinality of the table is four.

35. Which dependency is removed when converting the **Results** table to next normal form?
    (1) foreign key dependency
    (2) fully functional dependency of non-key attributes on the primary key
    (3) multivalued dependency
    (4) partial dependencies of non-key attributes on the primary key
    (5) transitive dependency of non-key attributes

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36. Following are the steps involved in creating an *Entity Relationship* (ER) *Diagram*:

      I. Determine the .....**A**..... in your diagram.

      II. Add ....**B**.... to each ....**C**....

      III. Include the ...**D**.... between the ....**A**....

      IV. Add ....**E**.... to every relationship

Which of the following gives suitable choices for the **A, B, C, D** and **E** blanks in the above steps?

(1) A – attributes, B – entities, C – attribute, D – cardinality, E - entities

(2) A – attributes, B – cardinality, C – attribute, D – entities, E- entity

(3) A- entities, B – attributes, C – entity, D – relationships, E – cardinality

(4) A- entities, B – relationship, C – entity, D – attributes, E – cardinality

(5) A – relationships, B – cardinality, C – relationship, D – attributes, E – entities

37. Which of the following can be modelled with an *Extended Entity Relationship* diagram?

    A – subclasses of an entity

    B – inheritance of attributes
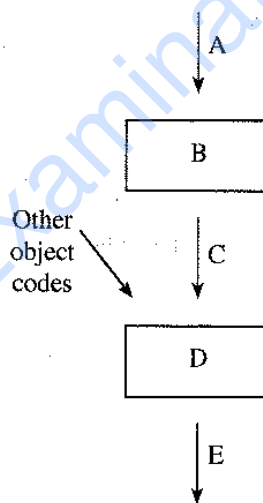
    C – specialization of entities

(1) A only   (2) B only   (3) C only

(4) A and C only   (5) All A, B and C

38. A teacher of a programming class draws the following diagram and asks the students to identify the components indicated by A, B, C, D and E:

Which of the following gives the correct choices for A, B, C, D and E?

(1) A – compiler, B – executable code, C – source code, D – linker, E – object code

(2) A – compiler, B – source code, C – executable code, D – object code, E – linker

(3) A – linker, B – source code, C – object code, D – executable code, E – compiler

(4) A – source code, B – object code, C – linker, D – compiler, E – executable code

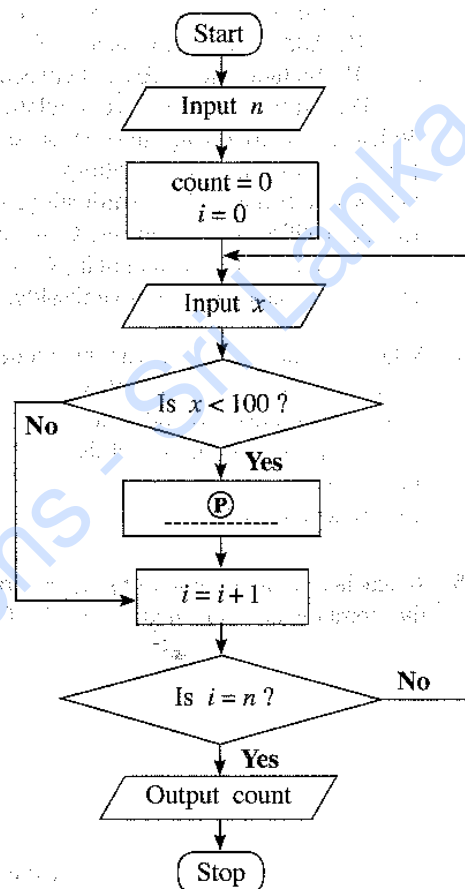(5) A – source code, B – compiler, C – object code, D – linker, E – executable code

● Consider the algorithm expressed by the flowchart and answer questions **39** and **40**.

This algorithm takes as input first an integer n (≥ 1) followed by a sequence of n integers one by one. The algorithm is expected to output the count of integers that are less than 100 among the sequence of n inputs.

39. For the algorithm to function correctly as expected, what should be inserted at the blank Ⓟ ?

  (1) count = count + 1
  (2) count = count + i
  (3) count = count + x
  (4) n = n – 1
  (5) n = n + 1

40. Which of the following Python programs implement the algorithm in the flowchart?

```
I   n = int(input())
    count = 0
    for i in range(n):
            x = int(input())
            if (x < 100):
                    count = count + i
    print(count)
II  n = int(input())
    count = 0
    for i in range(n):
            x = int(input())
            if (x < 100):
                    count += 1
    print(count)
III n = int(input())
    count = i = 0
    while (i < n):
            x = int(input())
            if (x < 100):
                    count = count + 1
    print(count)
```

  (1) Only I   (2) Only II   (3) Only I and II
  (4) Only II and III   (5) All I, II and III

0002620

AL/2021(2022)/20/E-I   - 11 -

41. What would be the output after executing the following Python code?

```
n = 117
m = (n & 127) // (2 ** 3)
print(m)
```

(1) 1   (2) 14   (3) 14.625   (4) 15   (5) 19

42. What will be the result when the following Python code is executed?

```
x = 10
def myfun(a):
        global x
        a = x + a
        x = 30
        return a
print(myfun(x))
```

(1) 10   (2) 20   (3) 30   (4) 40   (5) an error

43. What will be the output of the following Python code segment?

```
S = ["covid", "pandemic", "vaccine", "booster", "virus"]
V = "aeiou"
count = 0
for i in range(len(S)):
        for j in range(len(S[i])):
                if (S[i][j] in V):
                        count = count + 1
print(count)
```

(1) 0   (2) 5   (3) 12   (4) 13   (5) 32

44. What will be the output when the following Python code is executed?

```
s = 1
for  i  in  range(1,10):

        if (i < 5):
                s = s * i
        elif (i < 8):
                s = s - i
        else:
                s = s + i
                break
print(s)
```

(1) 6   (2) 14   (3) 23   (4) 33   (5) 121

45. Read the following sentence about *website development*:

To make an effective website, it is important to identify its objectives and the target .....A..... and then design the most useful information layout for the website accordingly.

Which of the following is the correct choice for the blank **A** above?

(1) audio   (2) images   (3) text   (4) users   (5) video

46. Which of the following is the correct example for CSS group selector?
(1) h1{text-align:left ; color:blue;}
(2) h1,h2{text-align:left , color:blue;}
(3) h1.h2{text-align:left; color:blue;}
(4) h1:h2{text-align:left; color:blue;}
(5) h1,h2{text-align:left; color:blue;}

[See page twelve

47. Consider the following HTML code:

```
<!DOCTYPE html>
<html>
<head>
<style>
body {
    background-image: url('srilanka.jpg');
}
</style>
</head>

<body>
<h2>Sri Lanka</h2>
<p>Sri Lanka, the island of serendipity, is really a <i>pearl in the
orient</i>.</p>
</body>
</html>
```

Which of the following statements is/are correct about the observations when the above code is viewed through a web browser?

   A – The srilanka.jpg image (if existing) will be displayed as the background to the web page.
   B – The **Sri Lanka** word which is enclosed within <h2> and </h2> tags will appear in italics.
   C – The **pearl in the orient** phrase enclosed within <i> and </i> tags will appear in italics.

(1) A only   (2) B only   (3) C only
(4) A and B only   (5) A and C only

48. Which of the following statements is correct about the following code line when it is rendered through a web browser?

```
<input type="radio" name="vaccinate" value="Yes">
```

(1) It shows a radio button with a label named vaccinate at left side.
(2) It shows a radio button with a label named vaccinate at right side.
(3) It shows a radio button with a label named Yes at left side.
(4) It shows a radio button with a label named Yes at right side.
(5) The word Yes is not shown to user.

49. Consider the following PHP code line which is used to create a MySQL database connectivity:

```
$conn = new mysqli($var1, $var2, $var3, $var4);
```

Which of the following is the correct representation for the above variables?

(1) $var1 = database, $var2 = server name, $var3 = user name, $var4 = password
(2) $var1 = database, $var2 = user name, $var3 = password, $var4 = server name
(3) $var1 = server name, $var2 = database, $var3 = user name, $var4 = password
(4) $var1 = server name, $var2 = user name, $var3 = password, $var4 = database
(5) $var1 = user name, $var2 = password, $var3 = server name, $var4 = database

50. What would be the output when the following PHP code is executed?

```
<html>
<body>
<?php
    $class = array ("12-A", "12-B", "13-A");
    echo "IT classes are " . $class[1] . " and " . $class[2] ;
?>
</body>
</html>
```

(1) IT classes are 12-A and 12-B   (2) IT classes are "12-A" and "12-B"
(3) IT classes are 12-B and 13-A   (4) IT classes are .12-A. and .12-B
(5) IT classes are .12-B. and .13-B

* * *

0002622

3   Paper I answers

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය/ க.பொ.த. (உயர் தர)ப் பரீட்சை - 2020 / 2021
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.	3	11.	4	21.	2	31.	5	41.	2
02.	4	12.	4	22.	1	32.	5	42.	2
03.	4	13.	5	23.	5	33.	4	43.	4
04.	5	14.	1	24.	2	34.	3	44.	2
05.	4	15.	4	25.	2	35.	4	45.	4
06.	4	16.	3	26.	3	36.	3	46.	5
07.	4	17.	5	27.	4	37.	5	47.	5
08.	3	18.	5	28.	3	38.	5	48.	5
09.	2	19.	3	29.	1	39.	1	49.	4
10.	2	20.	5	30.	5	40	2	50	3

☼ විශේෂ උපදෙස්/ விசேட அறிவுறுத்தல் :

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

4 Paper II

09564

AL/2021(2022)/20/E-II

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2021(2022)
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தரப் பரீட்சை, 2021(2022)
General Certificate of Education (Adv. Level) Examination, 2021(2022)

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

20 E II

පැය තුනයි	අමතර කියවීම් කාලය - මිනිත්තු 10 යි
மூன்று மணித்தியாலம்	மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Three hours	**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 **13** 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 - 7)

* 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 8 - 13)

* 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

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

1. (a) (i) In the following HTML code, underline the parts containing errors. (Please ignore line numbering.)

```
1.    <html>
2.    <body  background-color="green">
3.    <h1> Welcome  all  of  you  to  online  ICT  Seminar  </h1>
4.    <a  url="#one"  >A/L Student Section</a>
5.    <p> O/L ICT is not available</a>
6.    <-- Section 1 -->
7.    <h4> A/L ICT  </h4>
8.    <hr><p>Good Morning</p></hr>
9.    <br><p> This section is for students </p>
10.   </body></html>
```

[**02** *marks*]

(ii) Write the relevant correct code lines to make "A/L Student Section" (in line number 4) a hyperlink to "A/L ICT" (in line number 7).

Code for Line 4 : ....

Code for Line 7 : ....

....

[**01** *mark*]

(b) Consider the styles in Table 1, to answer the given questions.

Table 1

Selector	Description of the Style
Class with a class name "**art**"	Size of the font is 14px, Text should be centered
Header 1	Text color is yellow

(i) It is expected to use the above styles in several web pages on a web site. Write a suitable cascading style sheet to define the styles given in Table 1 to satisfy this requirement.

....

....

....

[**01** *mark*]

(ii) Write the relevant HTML code lines to include the style sheet defined in part (b)(i) into a web page. [Assume that the style sheet created in part (b)(i) is saved with the name **neat**.]

....

....

....

[**01** *mark*]

[*see page three*

(c) An output of an HTML code rendered by a browser is shown below.

Chess Tournament

Category I

- Team A
- Team C

Category II
　　Team B
　　Team D

Registration Form

Select the team: [Team A ▾]

Your Comments: [　　　　　　　　　　]

☐ Food Required ☐ Accommodation Required

[Submit]

(i) The relevant HTML code (incomplete) is given below. Fill the blanks in it in order to get the required output.

```
<html><body>
<h2>Chess Tournament</h2>
<...............>
      <dt>Category I <...........><li>Team A</li><li>Team C</li></.............></dt>
      <dt>Category II<...........>Team B</...........><...........>Team D</...........></dt>
</...........>
<h3>Registration Form</h3>
<form method="get">
    <.............................>
            <label for="Team">Select the team:</label>
            <............................. name="team">
            <option value="a">Team A</option>
            <option value="b">Team B</option>
            <option value="c">Team C</option>
            <option value="d">Team D</option>
          </............><br><br>
        <label for="comment">Your Comments:</label>
        <........................ name="comment" rows="3" cols="30"></........................ ><br><br>
        <input type=............................. name="food">
        <label for="fr">Food Required</label>
        <input type=............................. name="accom">
        <label for="ar">Accommodation Required</label><br><br>
        <............................. type="submit" value="Submit">
    </.............................>
</form>
</body></html>
```

[04 marks]

(ii) Write the relevant HTML code line to show "Team B" as the default selection for "Select the team".

....

....

[01 mark]

2. (a) Cloud Computing allows us to obtain computing resources and capabilities as a service. The three main types of cloud computing services are: *Infrastructure as a Service* (IaaS), *Platform as a Service* (PaaS), and *Software as a Service* (SaaS).

From those three cloud computing service types, write down the suitable service type for each of the following scenarios.

    (i) To obtain an environment for application deployment and execution from a cloud service provider – ....

    (ii) To obtain hard disk space for data storage from a cloud service provider – ....

    (iii) To obtain data file sharing, office applications and email services from a cloud service provider – .... **[03 marks]**

(b) Fill the blanks in the following statements with suitable words from the given list of words.

    (i) .... helps to ensure the confidentiality of our data and information.

    (ii) .... is the attempt to acquire sensitive information by pretending as a trustworthy entity in an electronic communication.

    (iii) The illegal copying, distribution, or use of software is known as .... and .... helps us to protect our software from such illegal use.

List of words : {Encryption, Copyright, Phishing, Plagiarism, Software piracy} **[02 marks]**

(c) The following extract was taken from a software project feasibility report:

"....The software development team does not have the knowledge or prior experience of the relevant technology; the developers must be trained first and as a result of this training cost, the project will not make any profit. However it is expected that the users of the proposed product will use it willingly and no user resistance is expected..."

By considering the above extract, write either **True**, **False**, or **Cannot comment** in the blank for each of the following statements:

The proposed project has *technical feasibility*.   {...}

The proposed project has *operational feasibility*. {...}

The proposed project has *organizational* (*institutional*) *feasibility*.

{...}

[03 marks]

(d) You have decided to start an E-Business to sell your home-made food through an online store (web site). Once the customers place orders and pay through debit/credit cards, you will deliver the ordered food to their addresses.

    (i) Business to Business (B2B), Business to Consumer (B2C) and Consumer to Consumer (C2C) are three E-Business transaction types. Out of these, which transaction type will occur in your E-Business?

....

[01 mark]

Do not write in this column

(ii) Incorporating a reputed software service to enable debit or credit card purchases from customers will improve customer perception and trust in your e-Commerce system. What is this software service commonly called?
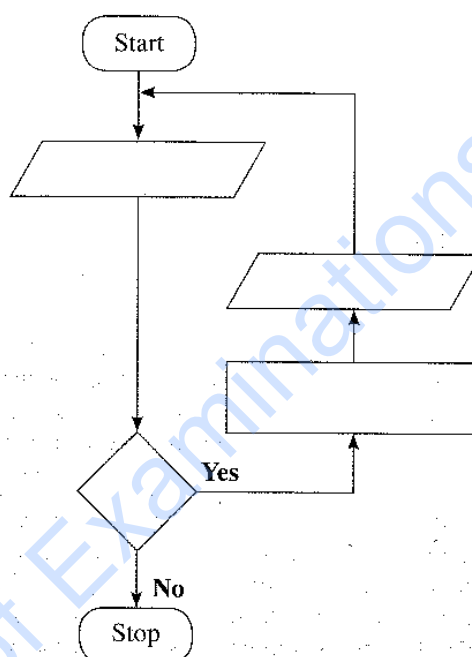
....

[01 *mark*]

3. (a) A flowchart is to be drawn for an algorithm to calculate and output the *areas* of triangles. The *base* and *height* of each triangle are given as inputs.

Note: Area of triangle = $\frac{1}{2}$ × base × height

The algorithm should stop when an input is less than or equal to zero.

Complete the flowchart by writing the required content for the four components left blank.

[04 *marks*]

(b) Complete the four (4) blanks (indicated by ......) in the following Python program to calculate the factorial of an integer.

Note: The factorial of a positive integer is defined as the product of that integer and all the integers below it. e.g., factorial of 4 is equal to $1 \times 2 \times 3 \times 4 = 24$. The factorial of 0 is defined as 1.

```
#  Get  input  from  user
...........=int(input("Enter  a  number:"))
factorial  =  1
if  num  <  0:
      print("Factorial  is  not  defined  for  negative  numbers!")

elif  ........................................  :
      print("The  factorial  of  0  is  1")
else:
      for  i  in  range(1,num  +  1):

            ...............................................
print("The  factorial  of",num,"is",...........................................)
```

[04 *marks*]

[*see page six*

(c) Consider the following Python program:

```
lower = 2
upper = 5

for num in range(lower, upper + 1):
    flag = 1
    if num > 1:
        for i in range(2, num):
            if (num % i) == 0:
                flag = 0
                break

        if flag == 1:
            print(num)
```

Write the output of the above program.

....

[02 marks]

4. A database application is to be developed for a hospital clinic. The design is as follows.

The registered patients in the clinic are given patient numbers and their details are stored in the PATIENTS data store. The dates and times of clinic appointments of patients are stored in the APPOINTMENTS data store.

Once a patient arrives for a clinic visit and gives the patient number, the reception officer does a **validity check** of the patient and the appointment date by checking the PATIENTS and APPOINTMENT data stores. If valid, the patient number is added to the PRESENT data store. If not, an "unregistered patient" or "invalid appointment" message is given.

When a doctor at a counter in the clinic is ready, s/he selects the next patient according to the PRESENT data store resulting in the relevant patient number and the doctor counter being shown on the display panel in the patient sitting area. When the patient comes and sits at the relevant doctor counter, the doctor retrieves patient's clinical records by accessing the PATIENTS data store. Once the doctor examines patient and prescribes any medicines for him, the PATIENTS data store is updated with the new prescription data and an entry is made to the MEDICINES data store. If needed, the doctor also schedules the next visit date/time for the patient by updating the APPOINTMENTS data store.

The pharmacist gets the prescription data from the MEDICINES data store, prepares the medicines for the patient and makes the patient number displayed on the pharmacy display panel so that the patient can pick the medicines.

(a) If a maximum of 20 patients are to be examined by the clinic doctors per an hour, write down **one** (1) functional requirement with respect to appointment scheduling.

....

....

[01 mark]

(b) The hospital expects to avoid a long queue of people being formed at the clinic reception for the **validity check**. Write down **one** (1) non-functional requirement with respect to that need.

....

....

[01 mark]

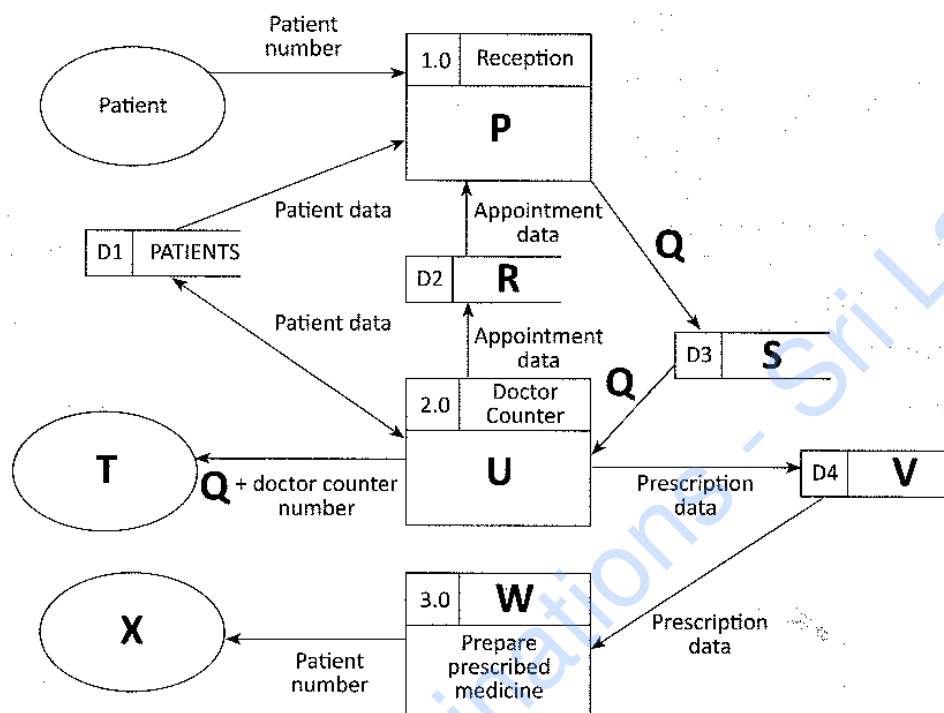*[see page seven*

(c) The following is the labeled data flow diagram for the events that take place when a patient visits the clinic to consult a doctor.

Write in the spaces provided below, the **Number** of the suitable content for each of the labels **P** to **X** choosing from the given list.

P - ......   Q - ......   R - ......   S - ......   T - ......

U - ......   V - ......   W - ......   X - ......

List

Number	Content
1	APPOINTMENTS
2	Examine patient
3	MEDICINES
4	Patient sitting area display panel
5	Pharmacy
6	Pharmacy display panel
7	PRESENT
8	Validate patient number
9	Validated patient number

[07 *marks*]

(d) Give **one** (1) difference between *white box testing* and *black box testing*.

....

....

[01 *mark*]

＊＊

- 8 -

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கை பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2021(2022)
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2021(2022)
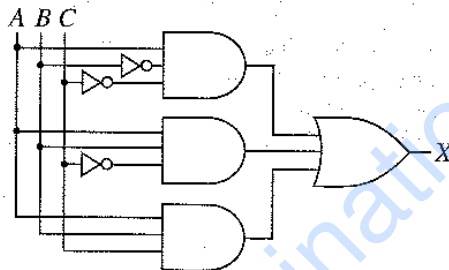General Certificate of Education (Adv. Level) Examination, 2021(2022)

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

20 **E** **II**

Part B

✳ Answer any **four** questions only.

5. Consider the logic circuit shown in the figure, in which A, B and C are the inputs and X is the output.

(a) Show the complete truth table for the given circuit.   [**02** *marks*]

(b) Complete the Karnaugh map, according to the following format.

```
              AB
       00    01    11    10
    +-----+-----+-----+-----+
  0 |     |     |     |     |
    +-----+-----+-----+-----+
C 1 |     |     |     |     |
    +-----+-----+-----+-----+
```

[**04** *marks*]

(c) Using the Karnaugh map, derive an optimal (most simplified) sum-of-products (SOP) expression for the output X. Show the loops clearly on the Karnaugh map.   [**03** *marks*]

(d) Using the Karnaugh map, derive an optimal (most simplified) product-of-sums (POS) expression for the output X. Show the loops clearly on the Karnaugh map.   [**03** *marks*]

(e) Of the optimal SOP and POS expressions you obtained in (c) and (d) above, which is better (or more suitable) to implement a simplified logic circuit? Explain your answer.   [**03** *marks*]

[see page nine

6. (a) *Parity Check* is a simple technique to detect errors in data communications.

Assume the seven bits 1010110 need to be transmitted. Explain how the odd parity check can be performed to detect any error in its transmission.   [02 *marks*]

(b) The **ABC company** has two main divisions, namely **Production** and **Marketing**. Under the **Production** division, there are three units, namely **Stores, Supplies** and **Operations** having 10, 12 and 18 computers, respectively. **Marketing** division has 40 computers. ABC company has been given the 192.174.19.0/25 IP address block. All the computers of the ABC company are to be assigned IP addresses after making the subnets from this address block.

The following incomplete table shows the sub-netting. Copy it to your answer sheet and fill the empty entries.

Division/ Unit	Network ID	Broadcast ID	Subnet Mask	No. of Nodes	Usable IP Address Range
Marketing	192.174.19.0			64	
Stores		192.174.19.79		16	
Supplies	192.174.19.96			16	
Operations		192.174.19.159		32	

[06 *marks*]

(c) Mohan has ten (10) desktop computers and a router having 2 ports with a 64 Mbps Internet connection. Each computer has an adequate number of network interface cards. He also has a sufficient number of RJ 45 connected twisted pair cables.

Mohan wants to start an Internet Browsing Center with the above equipment and seeks your advice for it. He informs you that he is not in a position to invest money for any new equipment.

(i) Which network topology will you suggest for Mohan?   [01 *mark*]

(ii) Draw the logical arrangement of the network that you propose.   [02 *marks*]

(iii) Mohan would like to improve the connection speed to the clients while saving the existing bandwidth of the Internet connection. Further he needs to have the control of the Internet access while ensuring the privacy of the client. What is the technical suggestion you would give for this?   [01 *mark*]

(iv) There is a need to protect this private network by filtering the communication traffic and blocking outsiders from gaining unauthorized access. What mechanism will you suggest to achieve this?   [01 *mark*]

(v) Include the solutions that you proposed for (iii) and (iv) above in the logical network arrangement that you drew for (ii).   [02 *marks*]

7. (a) **PQR Books**, a book shop in your area starts an E-Commerce site to expand its business and to provide services to the customers in other areas. Through it the customers can select their desired books and stationery products and confirm their orders online.

   (i) What is the E-Commerce business type applicable in this scenario?   **[01 mark]**

   (ii) What is the revenue model used in this E-Commerce site of PQR Books?   **[01 mark]**

   (iii) With the successful implementation of its E-Commerce site, PQR Books decides to offer digital learning material such as e-books and audio-visual content to its customers. Do you recommend the same revenue model of (ii) above for this as well? Justify your answer.
   [01 mark]

   (iv) For an increased customer base and popularity, PQR Books plans to provide free access to these digital content through its streaming channel.
   Suggest a strategy to increase its business revenue with the help of this proposed streaming channel.   **[01 mark]**

   (v) Write down a key challenge this bookshop has to face when implementing this digital content channel proposed in (iv) above.   **[01 mark]**

   (vi) Name a suitable expansion solution for this E-Commerce site to incorporate both related (e.g., books, stationery etc.) and unrelated (e.g., grocery items, etc.) products or services to enable a more competitive purchasing experience to its customers.   **[01 mark]**

(b) The following description is about **myShopper**, a multi-agent system which enables a buyer to search the entire online marketplace for the best products. In addition to the price, reviews by other buyers, special offers, reputations of the merchants and the lengths and types of warranties are also considered.

When a **user** (buyer) accesses the **myShopper** website, a **chat-bot** agent starts interacting with the user. User can use voice or text as the input medium to give his/her requirements for a product. During the interaction, the **chat-bot** passes the extracted information to a **search-agent** who will takeover the search for the best product for the user. For this, the **search-agent** will start several **domain-agents** specifying each of them the requirements of the user and specific domains (web sites) to search in. To speedup the search, each **domain-agent** will start several **sub-agents** to search sub-domains under its main domain. After the search, each **sub-agent** will pass the appropriate results back to its parent **domain-agent**. Once all such results from the sub-agents are received, each **domain-agent** compares them and submits the best results to the **search-agent**. The **search-agent** will then compare all such results and gives the details of the best product back to the **chat-bot**. The **chat-bot** will then display it to the **user** as text.

   (i) Draw a simplified agent diagram for the above multi-agent system. Name all the entities in your diagram and clearly indicate the interactions between them.   **[06 marks]**

   (ii) Write **one** major advantage of this multi-agent system.   **[01 mark]**

   (iii) Write down **one** ICT related challenge which has to be faced when developing a **sub-agent**.   **[02 marks]**

8. (a) Suppose the ages (in years) of **n** (**n** > 1) students in a school are in a list **L**. Assuming the list **L** and an integer **k** are inputs, express an algorithm using **either** a flowchart **or** pseudo-code to compute and output the average age of students in **L** whose age is less than **k** years.

[**05** *marks*]

(b) Consider the algorithm expressed by the flowchart. L1 and L2 are non-empty lists of integers. Each of L1 and L2 has unique elements (no duplicates). But there can be elements that are in both L1 and L2. The notation L[x] denotes the element at Index x of a list L. If there are N elements in list L, then the indices are from 0, 1, 2, ... to (N-1).
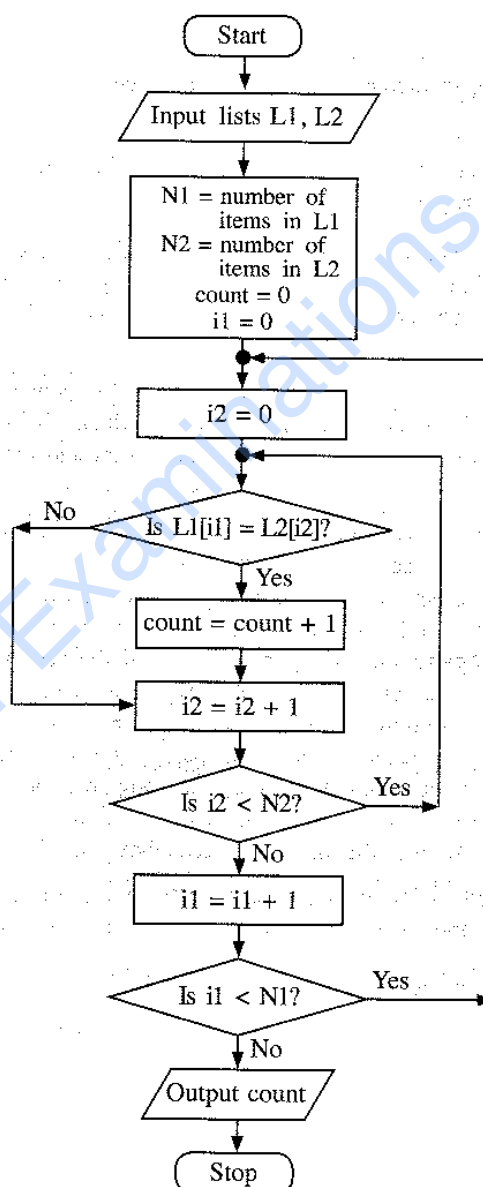
(i) What would be the output if L1= 2, 4, 7, 9, 3, 5 and L2 = 1, 3, 8, 9, 6, 5, 7?

[**02** *marks*]

(ii) What is the purpose of this algorithm? [**02** *marks*]

(iii) Develop a Python program to implement the algorithm expressed by the flowchart.

[**06** *marks*]

9. (a) A **virtual** supermarket has registered suppliers to supply the customer orders placed online. The supermarket always fulfils its customer orders through these suppliers. One supplier is responsible only for the customers who live in the supplier's area. A customer has only one supplier. Each supplier is characterized by a code (unique), address and contact numbers. A supplier can have several contact numbers.

Each customer is characterized by an email address (unique), name and location.

A customer can confirm orders. Each order has only one supplier and one customer.

An order is characterized by an order number (unique), description and a value. A supplier can supply more than one order.

Note: Use only the terms from the list given below for your ER diagrams of parts (i) and (ii).

List: {address, agent, code, confirms, contactNo, customer, description, email, hires, location, name, order, orderNo, supplier, supplies, value}

(i) Draw the Entity Relationship (ER) diagram for the above description.   **[07 marks]**

(ii) Sometimes suppliers hire agents to support the order supplies. However, the supermarket identifies the agents only through registered supplier codes. An agent is characterized by a name and a contact number. Each agent is working only for one supplier and a supplier is also getting only one agent's service.

Add these details to the ER diagram you drew for part (i).   **[04 marks]**

(b) A building construction company signs contracts with its clients. Each contract is handled by an agent of the company.

The **Contracts** table contains the details of the contracts. It has contract number, agent's code, name and mobile phone number represented with **CNo**, **ACode**, **AName** and **AMobile** attributes respectively. The client's name is represented with **Client**. Primary key of the **Contracts** table is **CNo**.

Contracts

CNo	ACode	AName	AMobile	Client
C-112	EP003	Anura	0714545866	Srimal
C-103	EP006	Navod	0774511320	Abish
C-116	EP003	Anura	0714545866	Nehara
C-224	EP015	Virah	0763538147	Srimal

(i) Write an SQL statement to change in the **Contracts** table, the mobile number of the agent whose agent code is EP003 to 0772222222.   **[01 mark]**

(ii) In which normal form does the **Contracts** table exist?   **[01 mark]**

(iii) Convert the **Contracts** table into next normal form. (It is **not** necessary to write the data in derived relations in the next normal form.)   **[02 marks]**

10. (a)   (i)   Explain **one (1)** way in which the *bar code technology* can be beneficial to a library management system.   **[02 *marks*]**

     (ii)   Most modern computers have multiple processors in them. Explain **one (1)** way in which the multiple processors in such computers can be beneficial.   **[02 *marks*]**

     (iii)   Explain what is meant by *volatile memory* **and** write down **one (1)** example for such selecting from the list below.

       List: {Dynamic RAM (DRAM), Hard disk, L1 cache, Registers}   **[02 *marks*]**

  (b)   (i)   A student asks you how all applications started by him execute simultaneously although he has a **single-processor computer**. Write down your explanation.   **[03 *marks*]**

     (ii)   Programs whose sizes are even larger than the size of the available physical memory of a computer could be executed on it. How can that be possible?   **[04 *marks*]**

     (iii)   When *linked allocation* is used for disk space allocation, each file needs slightly more storage space than when *contiguous allocation* is used. Explain the reason for it.

                                            [02 *marks*]

✴ ✴ ✴

5   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. Rounding off of 0.5 marks should only be done to the **final total** for Paper II.

1.   (a)   (i) | Underline parts containing errors. | **[2]**

1.	\<html\>
2.	\<body background-color="green"\>
3.	\<h1\> Welcome all of you to online ICT Seminar \</h1\>
4.	\<a url="#one" \>A/L Student Section\</a\>
5.	\<p\> O/L ICT is not available\</a\>
6.	\<-- Section 1 --\>
7.	\<h4\> A/L ICT \</h4\>
8.	\<hr\>\<p\>Good Morning\</p\>\</hr\>
9.	\<br\> \<p\> This section is for students \</p\>
10.	\</body\>\</html\>

The above total mark is decided as follows:

2 marks for **4 or 5** places distinctly underlined
1 mark for maximum **1, 2 or 3** places distinctly underlined

NOTE:

▼ Deduct **1 mark** for one or more incorrect underlines.
▼ If everything is underlined, then **0 marks**.

(ii) Write relevant code lines to make A/L Student Section (line 4) a hyperlink to A/L ICT (line 7).   **[1]**

0.5 marks for each:

```
Line 4: <a  href="#one"> A/L Student Section </a>
Line 7: <h4  id = "one">  A/L ICT  </h4>
Or
Line 7: <a id="one"><h4> A/L ICT  </h4></a>
Or
Line 7: <a name="one"><h4> A/L ICT  </h4></a>
```
NOTE: HTML 5 does not support it.
h4 tag can be written as the outer tag as well. i.e.,
```
Line 7: <h4> <a id="one"> A/L ICT  </a></h4>
```

NOTES:

★ Instead of "one", any other id (without spaces) can also be used on lines 4 and 7.

★ Quotes on lines 4 and 7 are essential.

★ Ignore space and case defects.

(b) (i) Write a suitable cascading style sheet.   **[1]**

0.5 marks for each line:

```
.art {font-size: 14px; text-align: center;}
h1 {color: yellow;}
```

NOTES:

▼ "art" must be in lower case as in question.

▼ If written within the `<body> ... </body>` or `<head> ... </head>`, then do **NOT** give marks.

(ii) Write relevant HTML code lines to include style sheet to a web page.   **[1]**

```
<head>
<link   rel="stylesheet" type="text/css"  href="neat.css">
</head>
```

NOTES:

★ "text/css" is optional.

▼ "stylesheet" has to be a single word.

(c) (i) | Fill the blanks in the code. | **[4]**

```html
<html><body>
<h2>Chess Tournament</h2>
<dl>
  <dt>Category I <ul><li>Team A</li><li>Team C</li> </ul> </dt>
  <dt>Category II<dd>Team B</dd><dd>Team D</dd></dt>
</dl>
<h3>Registration Form</h3>
<form method="get">
  <fieldset>
        <label for="Team">Select the team:</label>
          <select name="team">
              <option value="a">Team A</option>
              <option value="b">Team B</option>
              <option value="c">Team C</option>
              <option value="d">Team D</option>
          </select><br><br>
        <label for="comment">Your Comments:</label>
        <textarea name="comment" rows="3" cols="30"></textarea><br><br>
        <input type="checkbox" name="food">
        <label for="fr">Food Required</label>
        <input type="checkbox" name="accom">
        <label for="ar">Accommodation Required</label><br><br>
        <input type="submit" value="Submit">
  </fieldset>
</form>
</body></html>
```

0.5 marks *allocated to each of the following:*

A: 2 dl tags

B: 2 ul tags

C: 4 dd tags

D: 2 fieldset tags (▼ "fieldset" has to be a word.)

E: 2 select tags

F: 2 textarea tags (▼ "textarea" has to be a word.)

G: 2 checkbox tags (▼ "checkbox" has to be a word.)

H: 1 input tag

NOTES:

★ Ignore case.

(ii) | Write the relevant HTML code line to show "Team B" as the default selection. | **[1]**

```
<option value="b" selected >Team B</option>
```
NOTES:

★ Ignore case in all **except** for "b".

2. **(a)**   Write down the suitable cloud computing service type.   **[3]**

1 mark for each:

```
(i) Platform as a Service / PaaS
(ii) Infrastructure as a Service / IaaS
(iii) Software as a Service / SaaS
```

NOTE:

★ Ignore case.

(b)   Fill the blanks in the statements.   **[2]**

0.5 marks for each:

```
(i) Encryption
(ii) Phishing
(iii) Software piracy
Copyright
```

NOTE:

★ Ignore case.

(c)   Write **True**, **False** or **Cannot comment**.   **[3]**

1 mark for each:

```
(technical feasibility) False
(operational feasibility) True
(organizational/institutional feasibility) Cannot comment
```

NOTE:

★ Ignore case.

(d) (i) | E-Business selling foods: B2B, B2C or C2C? | **[1]**

```
B2C / Business to Consumer / Business to Customer
```

NOTE:
- ▼ Upper case needed for the abbreviated answer (i.e., B2C)
- ★ Ignore case for the other answer (i.e., Business to Consumer)

(ii) | What is the electronic payment service commonly called? | **[1]**

```
payment gateway
```

NOTE:
- ★ Ignore case.

3. (a) Fill the four components in the flowchart.   **[4]**

1 mark for each correct component.
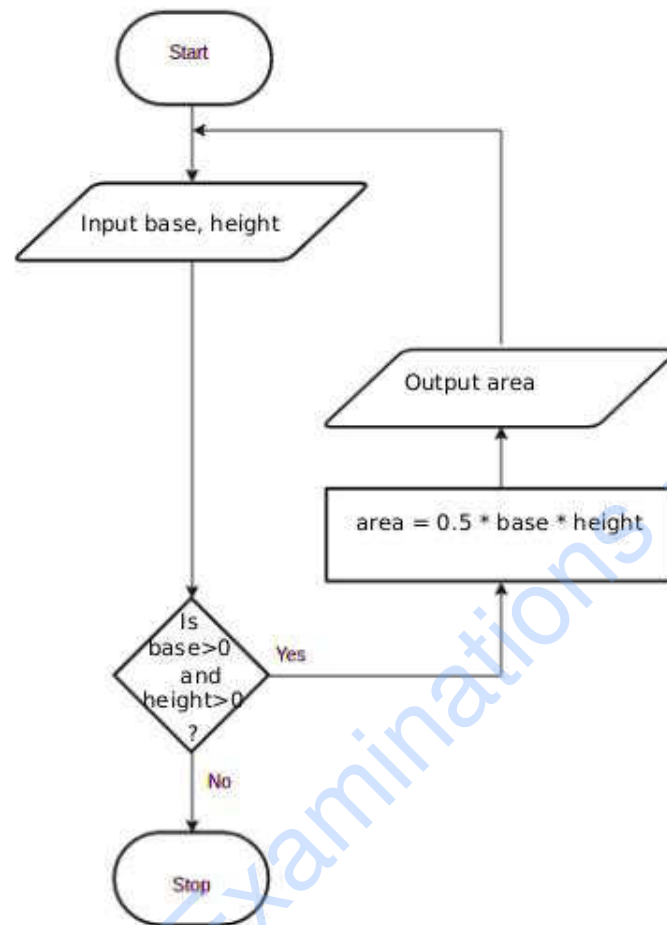
NOTES:

★ For "input": any other word that conveys the meaning is acceptable. e.g., *get, read*

★ For "output": any other word that conveys the meaning is acceptable. e.g., *display, print, show*

★ For condition: "is base and height > 0?" is also acceptable and "is", "?" are not essential.

★ For variable names: b/B,h/H acceptable. Other meaningful names are also acceptable. If any other *single letter* is used for a variable, then it has to be defined.

▼ For credit for the output component to be given, it has to indicate displaying whatever was computed in the computation block.

(b) [Fill the four blanks in the factorial code.]   **[4]**

1 mark for each:

```
num
num == 0
factorial = factorial*i (correct indentation essential.)
factorial
```

NOTE:

★ "`factorial *= i`" is also acceptable for the third blank.

▼ Correct case essential.

(c) [Write the output of the python program.]   **[2]**

```
2
3
5
```

The above total mark is decided as follows:

2 marks for the exact answer (with or without vertical alignment)
1 mark for either 2 3 or 2,3,5 or 2,3

NOTES:

▼ Correct order important.

4. **(a)** | Write down one functional requirement w.r.t. appointment scheduling. | **[1]**

Any answer having the following meaning:

```
For any given hour, no more than 20 patients should be
scheduled.
```

(b) | Give one non-functional requirement w.r.t. the validity check. | **[1]**

Any answer having the following meaning:

```
The validity check should be done fast.
```

(c) | Write the suitable content numbers. | **[7]**

```
P – 8   Q – 9   R – 1   S – 7   T – 4

U – 2   V – 3   W – 5   X – 6
```

The above total mark is decided as follows:

7 marks for all 9 labels correct
6 marks for maximum 8 labels correct
5 marks for maximum 7 labels correct
4 marks for maximum 5 or 6 labels correct
3 marks for maximum 4 labels correct
2 marks for maximum 3 labels correct
1 mark for maximum 1 or 2 labels correct

(d) | Give one difference between white box and black box testing. | **[1]**

Any **one** from the following:

White box	Black box
code remains visible to testers	code remains hidden from testers
a low-level testing that involves detailed testing of code	high-level testing that does not involve detailed program level testing
Generally done by developers	Generally done by independent testers/users
Design documents are usually used for testing	Specification document is required for testing
Tests the logic and implementation of software	Tests functionality of software
Programming knowledge and implementation details are required	Prior knowledge of programming is not required
Types of tests include path testing, control structure testing, loop testing, conditions testing	Types of tests: boundary value analysis, comparison tests etc
Generally tesing tools depend on programming language	Generally tesing tools are independent of programming language

NOTE:

▼ No partial marks. Comparison must involve both types.

5. **(a)** | Show the complete truth table for the given circuit. | **[2]**

A	B	C	X
0	0	0	0
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	1

The above total mark is decided as follows:

2 marks for all 8 rows correct
1.5 marks for maximum 5,6,7 rows correct
1 mark for maximum 3,4 rows correct
0.5 marks for maximum 1,2 rows correct

NOTE:

★ Having *Output* as the X column title is acceptable.

▼ If the *X* column is not labelled, or the label is different from *X / Output*, **reduce 1 mark** from the earned total.

(b) | Complete the Karnaugh map according to the given format. | **[4]**

0.5 marks for each correct cell:

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

(c) Using the K map, derive a simplified SOP expression for X. **[3]**

AB

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

$X = AB + A\overline{C}$

Marks allocated as follows:

A: **2 marks** for marking the two loops on the correct Karnaugh map (**1 mark** for each)

B: **1 mark** for correct, simplified final SOP expression as $X = AB + A\overline{C}$ (←-- A)

NOTE:

★ For component **B**, the term **X** is not compulsory.

(d) Using the K map, derive a simplified POS expression for X. **[3]**

AB

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

$X = A(B + \overline{C})$

Marks allocated as follows:

A: **2 marks** for marking the two loops on the correct Karnaugh map (**1 mark** for each)

B: **1 mark** for correct, simplified final POS expression as $X = A(B + \overline{C})$ (←-- A)

NOTE:

★ For component **B**, the term **X** is not compulsory.

(e) | Out of the two expressions which one is better to implement a more simplified logic circuit than the given logic circuit? Explain. | **[3]**

The POS, $X = A(B + \overline{C})$, is better than the SOP, $X = AB + A\overline{C}$.

Explanation:

With POS, we can implement a simpler logic circuit with one OR gate, one AND gate and one NOT gate (only three gates) whereas the SOP leads to a logic circuit with two AND gates, one OR gate and one NOT gate (four gates).

Marks allocated as follows:

A: **1 mark** for correctly identifying that the POS is better than the SOP
($\leftarrow$-- correct SOP and POS expressions for 5(c) and 5(d))

B: **2 marks** for correct explanation on why the POS is better than the SOP given as follows:
($\leftarrow$-- A)

   1 mark: POS has fewer (3) literals and leads to a logic circuit with 3 gates

   1 mark: SOP has more (4) literals and leads to a logic circuit with 4 gates

or alternatively:

B: **2 marks** for correctly showing the two correct circuit diagrams and identifying the better one **or** for indicating generally that POS results in a circuit that has fewer gates when compared to the circuit resulting from SOP ($\leftarrow$-- A)

IMPORTANT: Note the dependency in marking component **A**. This basically means **not** to give credit for part **(d)** if the student is not basing his/her argument using the expressions $X = AB + A\overline{C}$ and $X = A(B + \overline{C})$.

6. (a) | Explain how the odd parity check could be used to detect any error in the transmission of 1010110. | **[2]**

Marks allocated as follows:

A: **1 mark** for `adding 1 as the parity bit`
B: **1 mark** for `receiver has to get the total number of bits odd;`
`if not error`

NOTE:

★ Ignore the position where the parity bit is added.

(b) | Fill the empty entries in the IP address table. | **[6]**

0.5 marks for each correct cell.

Division/ Unit	Network ID	Broadcast ID	Subnet Mask	No. of Nodes	Usable IP Address Range
Marketing	192.174.19.0	192.174.19.63	255.255.255.192	64	192.174.19.1- 192.174.19.62
Stores	192.174.19.64	192.174.19.79	255.255.255.240	16	192.174.19.65- 192.174.19.78
Supplies	192.174.19.96	192.174.19.111	255.255.255.240	16	192.174.19.97- 192.174.19.110
Operations		192.174.19.159		32	

IMPORTANT: **Any** or **no** answer to the three cells on the last row (Operations) is considered acceptable.

(c) (i) | Which network topology will you suggest for Mohan? |

[1]

`ring`

or alternatively

`mesh`

NOTE: `mesh` is acceptable as an answer. But may not be very beneficial due to extra interconnections needed, performance degradation and inadequate user requirement to go for a mesh.

(ii) | Draw the logical arrangement of the network. | **[2]**

Ring:
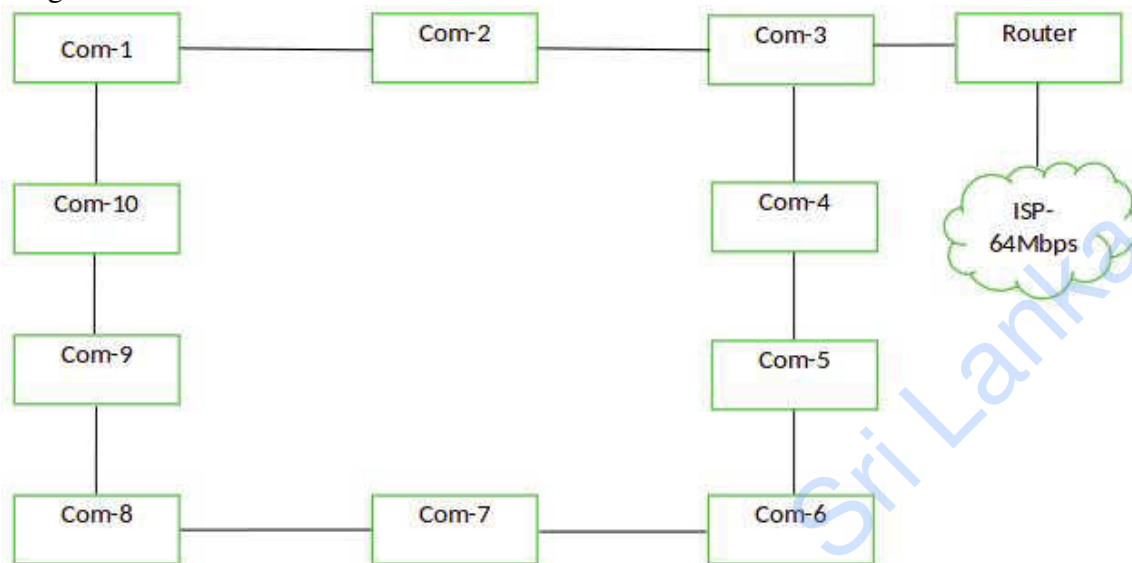
[if the student has chosen a mesh:]
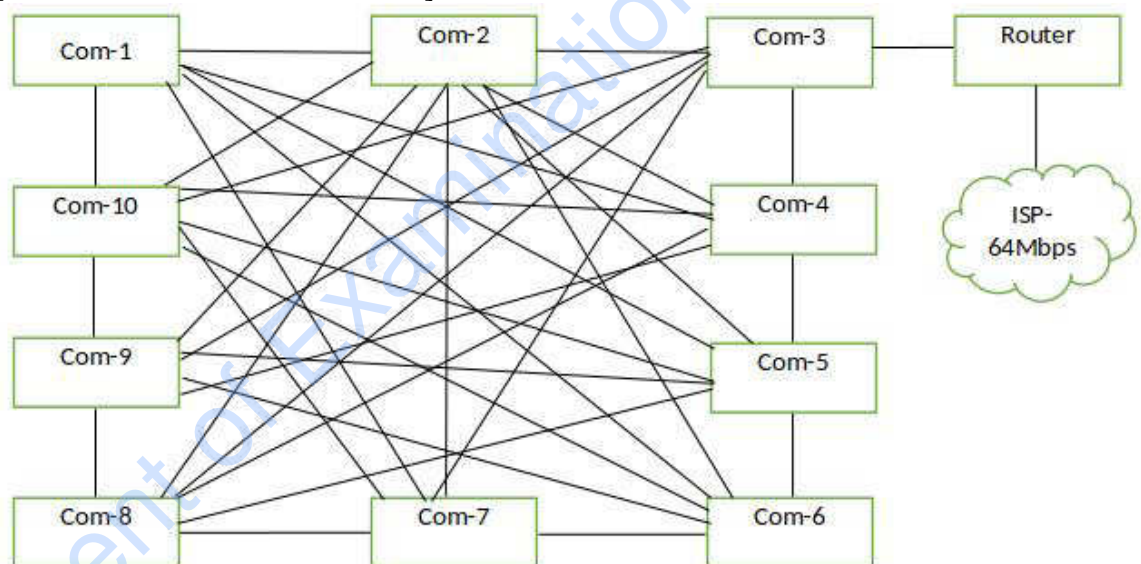
1 mark for each:

A: 10 computers properly connected to Router /

    10 computers properly connected to Router along with a firewall and/or proxy

(←-- topology chosen is either **ring** or **mesh**)

B: Router connected to Internet connection

NOTES:

★ The following symbols are also accepted for this part and for part (v):

Router	Firewall

★ Instead of "ISP", "Internet" is also acceptable.

(iii) | Technical suggestion to improve connection speeds for clients. | **[1]**

Add a <u>Proxy Server</u>

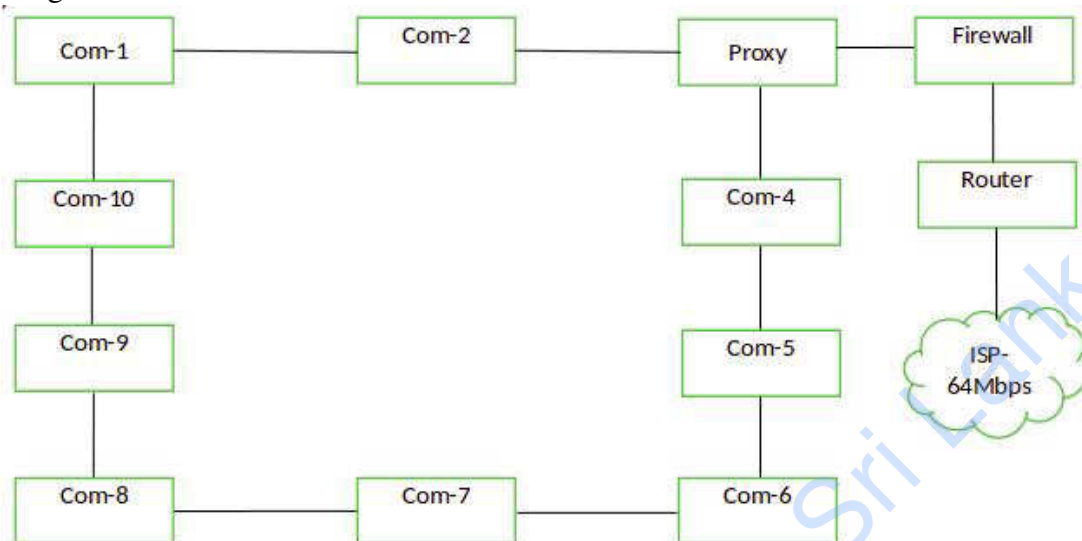**(iv)** | Mechanism to protect the network by filtering the communication traffic | **[1]**

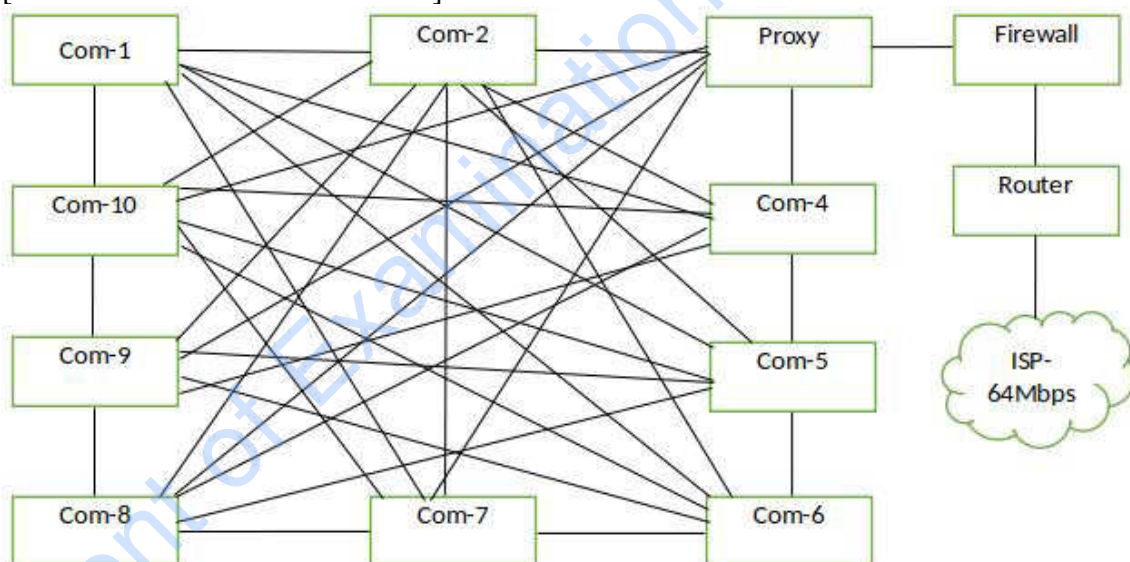Have a <u>firewall</u>

(v) | Include the solutions for (iii) and (iv) in the logical network arrangement. | **[2]**

Ring:

[if the student has chosen a mesh:]

1 mark for each:

A: properly adding and labelling proxy (←-- topology chosen is either **ring** or **mesh**)

B: properly adding and labelling firewall

7. (a) (i) | What is the ecommerce business type applicable in this scenario? | **[1]**

```
B2C / Business to Consumer / Business to Customer
```

(ii) | What is the revenue model used in this E-Commerce site? | **[1]**

```
online sales
```

(iii) | Do you recommend the same revenue model of (ii) for offering digital learning material? Justify. | **[1]**

If **Yes**, then justification should relate the possibility of online sales as a revenue model for digital content.

If **No**, then justification should relate the challenges with online sales for the digital content (in that case, use subscription as a revenue model).

(iv) | Suggest a strategy to increase the business revenue with the help of the proposed streaming channel. | **[1]**

Advertisements as a revenue model or a suitable answer

(v) | Write down a key challenge the bookshop has to face when implementing the digital content channel. | **[1]**

Answer could be in the following themes with an explanation why it is important:

- `Cost-effectiveness: giving` *free* `access to this service`
- `Content quality: Recording/preparation and editing must meet standards; reducing bandwidth consumption of the viewers`
- `Copyright issues: Should avoid improper use of IP/Copyright material within content and through the channel offering`
- `Technical suitability: Should provide uninterrupted service (availability); compatibility with many devices/browsers (compatibility), service efficiency, security, etc.`

(vi) | Name a suitable expansion solution to incorporate both related and unrelated products or services. | **[1]**
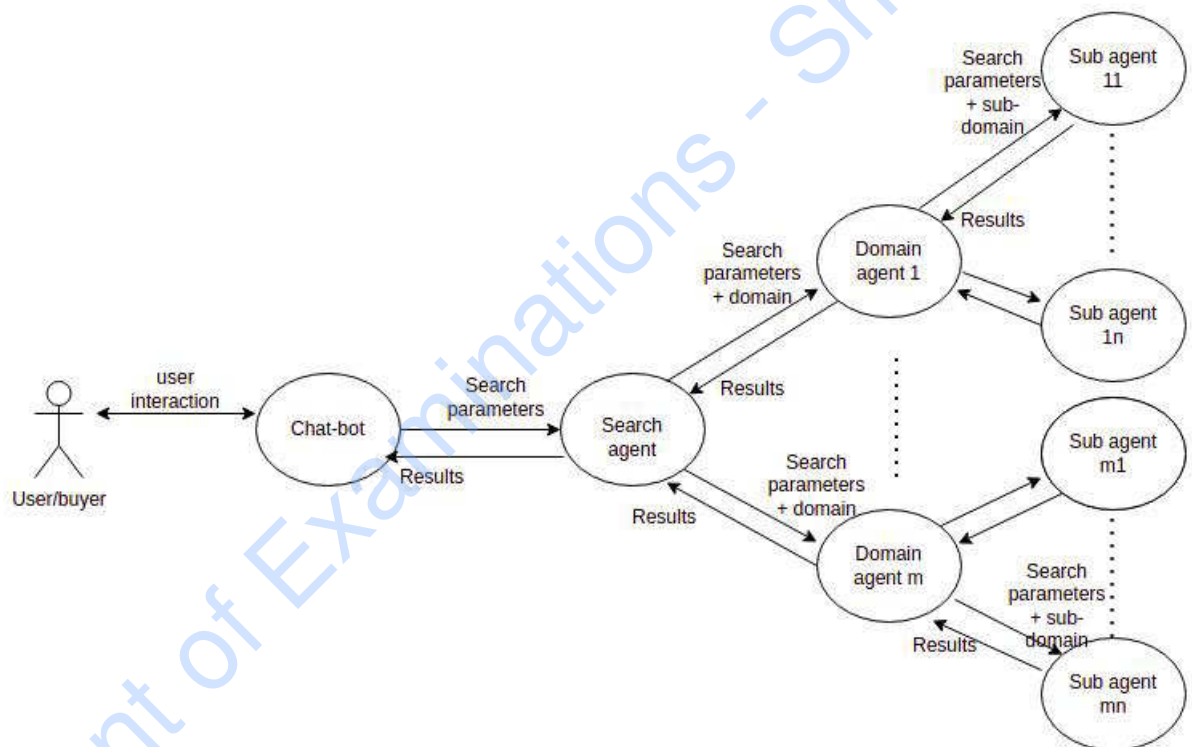
```
an E-Commerce market place / E-Marketplace /
On-line marketplace
```

(b) **(i)** | Draw a simplified agent diagram and name important entities and interactions. | **[6]**

Entities: user/buyer, Chat-bot Agent/Chat-bot, Search-Agent, Domain Agent, Sub-agent

Marks allocated as follows:

   A: **1 mark** for *User to ChatBot Agent interaction* (two-way arrow)

   B: **1 mark** for *ChatBot Agent to Search agent interaction* (two-way arrow)

   C: **1 mark** for *Search Agent to Domain Agent interactions* (two-way arrows)

   D: **1 mark** for *Domain Agent to Sub-agent interaction* (two-way arrows)

   E: **1 mark** for indicating *multiple* domain agents **and** *multiple* sub-agents

   F: **1 mark** for describing all interactions correctly

NOTE:

   ★ If a student has included a *user interface*, ignore that additional information and mark as given in the scheme.

   ★ Describing **all** interactions along **only** one complete path from beginning to end is sufficient for F component above.

(ii) Write one major advantage of this multi-agent system.   **[1]**

Any **one** from the following:

- Convenience to buyer: Buyer need not do
  the evalutation him/herself
- Increased speed of getting the result
- Buyer does not have to type lengthy description
  of his requirement as a Chat-bot helps
- Cost effeciveness for buyer as s/he need not
  physically visit multiple shops

**(iii)** Write one ICT related challenge when developing a sub-agent.   **[2]**

Any **one** from the following:

- Information on different websites may be in different
  formats.
- Language processing may be required to extract
  information from sites.
- Information on different websites may be in different
  lanugages.
- Sub-agents should not take a long time to give the
  results.
- Two sub-agents should not search the same site through
  indirect access.

8. **(a)** | Construct a flow-chart or pseudo-code to output the average age of students in L whose age is < k years. | **[5]**
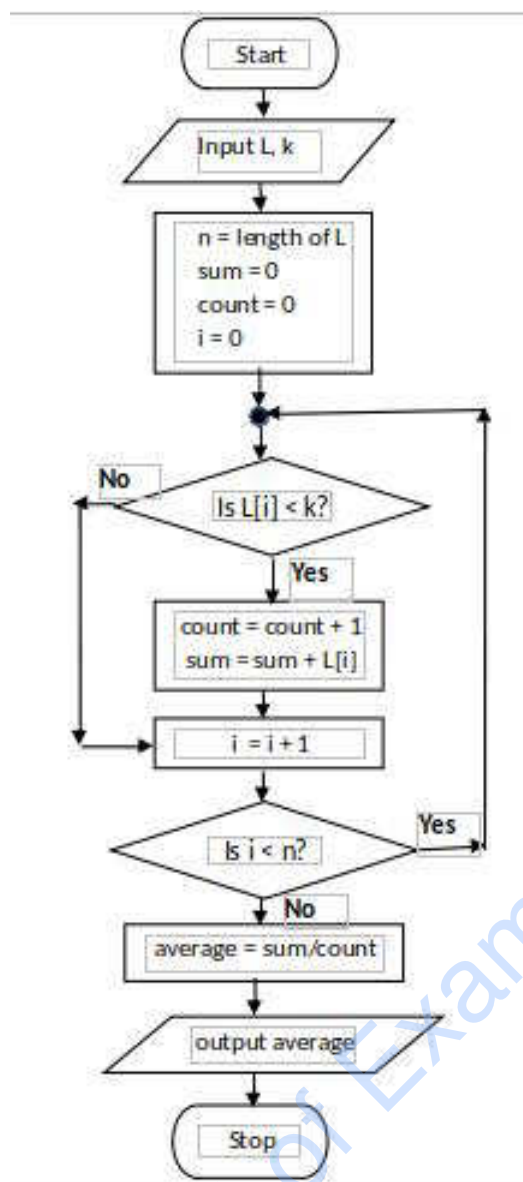
Using for-loop
```
input L, k
n = length of L
sum = 0
count = 0
for i = 0 to n
  if (L[i] < k)
     count = count + 1
     sum = sum + L[i]
  end-if
end-for
average = sum/count
output average
```

Alternative using while-loop
```
input L, k
n = length of L
sum = 0
count = 0
i = 0
while (i < n)
  if (L[i] < k)
     count = count + 1
     sum = sum + L[i]
  end-if
  i = i + 1
end-while
average = sum/count
output average
```

Marks allocated for either flowchart or pseudo-code as follows:

A: **1 mark** for getting inputs correctly

B: **1 mark** for correct $< n$ looping

C: **1 mark** for correct computation ($\leftarrow -- B$)

D: **1 mark** for correct output action ($\leftarrow -- C$)

E: **1 mark** for completeness ($\leftarrow -- D$)

   FLOWCHART: important arrows and correct symbols for start, stop, input/output, processes, conditions

   PSEUDO-CODE: Begin-End, indentation

NOTE:

★ Acceptable synonyms: (Start, Begin), (Stop,End,Finish),
   (Input,Get,Read), (Output,Print,Show,Display) [ignore case]

★ n could also be a user input.

★ Loop index can go from 1 to n as well.

(b) (i) | What would be the output if L1 = 2,4,7,9,3,5 and L2 = 1,3,8,9,6,5,7? | **[2]**

4 / `Output = 4` / or anything similar to indicate the output is 4.

(ii) | What is the purpose of this algorithm? | **[2]**

`Output the number (count) of elements that are in both lists L1 and L2`

Marks allocated as follows:
  1 mark for *the number (count) of elements that are in both lists L1 and L2*
  1 mark for displaying the result

(iii) | Develop a python program to implement the algorithm expressed by the flowchart. | **[6]**

```
# Inputs: L1, L2 are non-empty lists of integers
#         Each of L1, L2 have unique elements (no duplicates)
# Output: number (count) of elements that are in both L1 and L2
#
inL1 = input("Enter the elements in L1: ")
L1 = [int(x) for x in inL1.split()]
inL2 = input("Enter the elements in L2: ")
L2 = [int(x) for x in inL2.split()]
count = 0
for i1 in L1:            // or for i1 in range(len(L1)):
    for i2 in L2:        // or for i2 in range(len(L2)):
        if i1 == i2:     // or if (L1[i1] == L2[i2]):
            count = count + 1
print(count)
```

Allocate marks as follows:
  A: **1 mark** for getting inputs correctly
  B: **1 mark** for correct outer loop
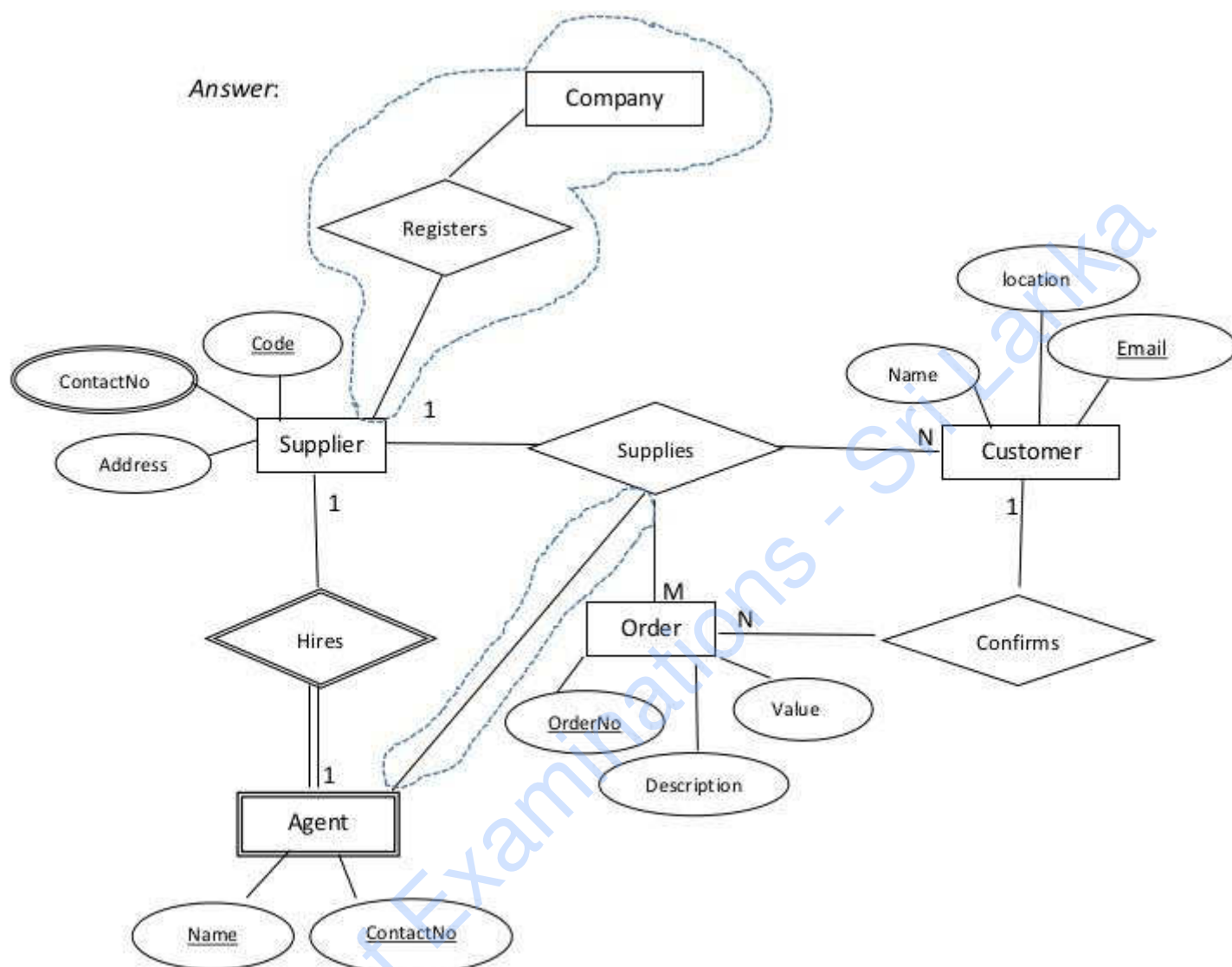 C: **1 mark** for correct inner loop ($\leftarrow-- B$)
  D: **1 mark** for correct if construct ($\leftarrow-- C$)
  E: **1 mark** for correct output printing ($\leftarrow-- D$)
  F: **1 mark** for correct indentation ($\leftarrow-- E$)

9. (a) (i) | Draw an ER diagram for the given description. | **[7]**

Answer:

Marks allocated as follows:

A: **3 marks** for the strong entities (*Supplier, Customer, Order* with correct attributes and primary keys marked (←-- correct entity and attribute symbols)
   NOTE: **1 mark** for each entity

B: **3 marks** for the relationships *(confirms, Supplies [Order and customer], Supplies [Supplier and customer])* with correct cardinality
   NOTE: **1 mark** for each relationship

C: **1 mark** for *ContactNo* (multi-valued attribute)

NOTES:

★ Ignore case of letters.

★ Do NOT deduct marks if the student has drawn additional details which are shown within dotted enclosures.

▼ Deduct a maximum **1 mark** from the total earned mark if any other additional parts are drawn.

▼ If there is any spelling mistake (one or two letters) deduct **one mark** from the earned total. Naming entities in plural forms (e.g., suppliers) is also considered as spelling mistakes.

(ii) | Add the *agent* to the ER diagram. | **[4]**

    Marks allocated as follows:

      A: **1 mark** for [agent] being a weak entity

      B: **1 mark** for attributes of agent

      C: **1 mark** for *weak* relationship (total participation not necessary)

      D: **1 mark** for correct cardinality

(b) **(i)** | Write an SQL statement to change the mobile number of EP003 agent to 0772222222. | **[1]**

```
UPDATE Contracts SET AMobile = '0772222222' WHERE
ACode = 'EP003';
```

NOTES:

▼ Exact case is required for those that are underlined. Ignore case for the rest.

★ Ignore quotes in '0772222222'.

★ Ignore semicolon.

(ii) | In which normal form does the **Contracts** table exist? | **[1]**

```
2NF / second normal form
```

(iii) | Convert the **Contracts** table to the next normal form. | **[2]**
    | (It is not required to write the data in the derived relations.) |

1 mark for each:
```
A: Contracts(CNo, ACode, Client)
B: Agent(ACode, AName, AMobile)
```

NOTES:

★ Ignore case.

★ Other meaningful names for "Contracts" and "Agent" relations also acceptable.

▼ The primary keys should be marked as shown.

10. **(a)** **(i)** | Explain one way in which bar code technology can be beneficial to a library management system. | **[2]**

Marks allocated as follows:
  A: **1 mark** for fixing a bar code to each book
  B: **1 mark** for explaining the benefit

(ii) | Explain one way in which multiple processors in computers can be beneficial. | **[2]**

Any **one** from the following:

- When there are multiple processes that the user has
  started on the computers, they can run on the
  different processors simultaneously to finish
  everything quicker.
- Can be used for *parallel computing*; complicated
  tasks can be split to parts and the parts can be
  programmed to run on the different processors to
  finish everything quicker.

The above total mark is to be decided as follows:
Give the full **2 marks** if the answer is complete. Else, give **1 mark**.

(iii) | Explain what is meant by *volatile memory* and select an example from the list. | **[2]**

Marks allocated as follows:
  A: **1 mark** for explaining *volatile memory*: computer storage that
    only maintains its data while the device is powered
  B: **1 mark** for any **one** from (Dynamic RAM (DRAM), L1 cache, Registers)

(b) **(i)** | How all applications "execute simultaneously" on a single processor computer? | **[3]**

Marks allocated as follows:
  A: **2 marks** - explaining the concept of multiprogramming / time sharing
  B: **1 mark** - switching between processes happens fast

(ii) How can the programs whose sizes are larger than physical memory could be run on a computer?   **[4]**

The marks allocated as follows:

A: **1 mark** for `Entire program is not brought to physical memory at once`

B: **1 mark** for `Program stored in virtual memory / hard disk`

C: **1 mark** for `Program divided into ''pages''`

D: **1 mark** for `Pages are brought into physical memory when needed` ($\leftarrow\!\!-- C$)

(iii) Why each file needs slightly more space in *linked allocation*?   **[2]**

Marks allocated as follows:

A: **1 mark** for `Each block contains a pointer to the next block.`

B: **1 mark** for `That block takes some space.` ($\leftarrow\!\!-- A$)