

3 Paper I answers

தமிழ்நாடு கல்வி மற்றும் அறிவியல் துறை அமைச்சர்
 இயங்ககூடம் பரிகாரத், திண்டிவனம்

ஏ.ஏ.ஏ.டி. (உயர) பரீட்சை / உயர் தர)ப் பரீட்சை - 2023 (2024)

மொத்த மதிப்பு
 மொத்த மதிப்பு

20

மொத்த மதிப்பு
 மொத்த மதிப்பு

Information and Communication
 Technology

ஒவ்வொரு கேள்விக்கும் மதிப்பு / புள்ளி வழங்கும் திட்டம்
 1 மதிப்பு / புள்ளி

கேள்வி எண்	மதிப்பு	கேள்வி எண்	மதிப்பு	கேள்வி எண்	மதிப்பு	கேள்வி எண்	மதிப்பு	கேள்வி எண்	மதிப்பு
01.	5	11.	4	21.	5	31.	2	41.	1
02.	5	12.	5	22.	5	32.	2	42.	4
03.	5	13.	3	23.	3	33.	1	43.	2
04.	1	14.	1	24.	3	34.	5	44.	1
05.	5	15.	1	25.	5	35.	3	45.	3
06.	2	16.	5	26.	4	36.	2	46.	1
07.	3	17.	5	27.	3	37.	2,5	47.	2
08.	2	18.	4	28.	1	38.	3	48.	2
09.	2	19.	4	29.	1	39.	1	49.	1
10.	4	20.	2	30.	5	40.	1	50.	3

0 மதிப்பு கேள்வி / மதிப்பு வழங்கப்படாது

மொத்த மதிப்பு / மொத்த மதிப்பு ஒவ்வொரு கேள்விக்கும் மதிப்பு / புள்ளி வழங்கும் திட்டம்

மொத்த மதிப்பு / மொத்த மதிப்பு 1 X 50 = 50

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. Answers where *minor* spelling mistakes are acceptable are indicated. A minor spelling mistake is where *at most one character* is either missing, wrong or in excess.
5. **Rounding off of 0.5 marks** should only be done to the **final total** for Paper II.

1. (a) Draw the expected output of the given HTML code.

[1]

Cricket
Football
Hockey

* should be [left aligned] [no bullets]
left justified

NOTE:

★ Ignore minor spelling mistakes.

★ Ignore case defects.

* Should be left justified and display in the left half of the displaying area

- (b) Choose suitable number replacements for A to N.

[7]

0.5 marks for each

A - 7	B - 8	C - 14	D - 1	E - 18	F - 15	G - 5
H - 16	I - 4	J - 17	K - 11	L - 20	M - 2	N - 12

NOTE:

Number should be there. [No wordings allowed]

▼ If the same number is used in more than one occasion, do not give marks for any of them. [for the sections where the same answers are]

(c) Write down the purpose of section P and the purpose of section Q.

[2]

1 mark for each:

P - Get the data entered to the form to variables ^{if mandatory} Sname etc.
(without even examples give relevant mark)

Q - Build the SQL query using those variables (+-- P)

සමස්ත / Query ~~කොටස~~. (executing SPL) X

2. (a) Write down the second and third steps of the data life-cycle.

[1]

0.5 marks for each:

2nd: management of data

3rd: removal of obsolete data

අලුතෙන් / නවීකරණ / අවසරය.

- (b) (i) Cloud computing model used for storage of data for AI.

[1]

සේවාවක් ලෙස භාවිතයට ගන්නා දත්ත
Infrastructure as a service / IaaS

NOTE:

- ★ Ignore minor spelling defects.
- ★ Ignore case defects.

- (ii) Make a suggestion to make the power of quantum computers available for general public. [2]

providing the use of quantum computers as a cloud service to the interested users /
making it available through the cloud via Infrastructure as a Service (IaaS)

The above total mark is decided as follows:

2 marks if the answer is complete as given above

1 mark if the student has some idea but has not given an answer that is worth full marks

(c) Write down the numbers of the replacements for the blanks.

[2]

(i) 7 (ii) 3 (iii) 6 (iv) 8 (v) 4

The above total mark is decided as follows:

four or

2 marks if all five correct

1 mark if two or three correct

(if only 1 correct No marks.)

NOTE:

▼ If the same number is used in more than one occasion, consider all of them as wrong.

All zero

[0 marks for duplicated answers]

(d) (i) Explain what *digital divide* is.

[2]

Any one from the following:

- economic and social inequality with regard to access to, use of, or impact of information and communication technologies
- the gulf between those who have ready access to computers and the internet, and those who do not
- the gap between demographics and regions that have access to modern information and communications technology (ICT), and those that do not or have restricted access
- unequal access to digital technology, including smartphones, tablets, laptops, and the internet
- the gap between people who have access to modern information and communications technology and those who do not
- the distinction between those who have internet access and are able to make use of new services offered on the World Wide Web, and those who are excluded from these services
- the gap between those with Internet access and those without it

The above total mark is decided as follows:

2 marks if the answer is complete as given above

1 mark if the student has some idea but has not given an answer that is worth full marks

- (ii) Write down a step to follow to reduce the environmental impact of our e-waste. [2]

Any one from the following:

3 R + 1

- Reduce the unwanted/extravagant use of electronic equipment (e.g., if one already has a working electronic item, it is good for him/her to not to buy a another one)
- Reuse electronic equipment as much as possible (e.g., a broken computer should be repaired if possible)
- Without throwing electronic items that cannot be repaired to garbage dumps, recycle them/their parts to other uses
- If the electronic items have to be disposed, give them to designated e-waste recycling locations
- Without buying new items buy refurbished items
- Extend the lifespan of items by protecting them, using proper maintenance practices, keeping them clean, regularly updating software, protecting them from virus attacks, using protective cases, using screen protectors, using surge protectors etc
- Donate or sell unwanted electronics
- Go for digital minimalism (e.g., decluttering and organizing files, reducing unnecessary downloads and backups, and deleting unused applications)

The above total mark is decided as follows:

2 marks if the answer is complete as given above

1 mark if the student has some idea but has not given an answer that is worth full marks

3. (a) Write down the replacements for A to G in the flowchart.

[3]

Marks allocated as follows:

AB 0.5 marks: A: no B: yes
 C 0.5 marks: sum = sum + count
 sum += count (←-- AB)

ALTERNATIVE 1:
 E 1 mark: count ≤ 18? ~~count < 19?~~ *count ≤ 20?*
 count < 19? ~~count < 20?~~ (←-- C)
 DF 0.5 marks: D: yes F: no (←-- E)

ALTERNATIVE 2:
 E 1 mark: count > 18? ~~count > 20?~~ ~~count ≥ 19?~~ (←-- C)
 DF 0.5 marks: D: no F: yes (←-- E)

G 0.5 marks: print sum / output sum / display sum / show sum (←-- DF)

NOTE:

- ▼ For the E condition, the question mark symbol (?) is essential.
- ★ For C and E, correct textual descriptions are also acceptable.
- ★ Ignore case.

(b) (i) What is the output of the given Python code?

[2]

[4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30]

Marks allocated as follows:

- A: 1.5 marks for correct list content
- B: 0.5 marks for [] and commas (←-- A)

NOTE:

- ★ Ignore space defects.

(ii) What would be the output if `i%2==0:` is replaced with `i%2!=0:` ?

[2]

[5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29]

Marks allocated as follows:

A: 1.5 marks for correct list content

B: 0.5 marks for [] and commas (+-- A)

NOTE:

★ Ignore space defects.

(c) Write down the replacements for the labels in the python code to find the largest in a set of numbers.

[3]

0.5 marks for each:

A: Any negative value / 0 / 1 / 2 / 3 / 4 / myList[0]

B: myList (--- exact spelling, case)

C: largest: (--- A, B, exact spelling, exact case, col

D: i (--- C, exact case)

E: largest ^{in largest's must be there} and , (--- D, exact spelling, exact case)

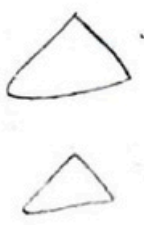
F: list1 (--- exact spelling, exact case)

4. (a) Write down the numbers of the replacements for DFD labels.

[4]

0.5 marks for each:

- P: 5
- Q: 4 (+-- P)
- R: 2 (+-- Q)
- S: 3
- T: 6
- U: 7 (+-- P)
- V: 8 (+-- U)
- W: 1



NOTE:

(for all the repeating answers)

▼ If the same number is used in more than one label, consider all of them as wrong.

(b) Write down one functional requirement w.r.t. reservations.

[1]

Any one from the following:

- Authentication of student when he/she logs into the system
- Computers to be available for reservation for weekend 30 minute time slots between 8am and 5pm
- A student to be given a maximum of two 30 minute time slots
- One computer to be reserved by only one student for a particular time slot

Even the answer is split & correct give marks

computers to be available for reservations for weekends 30 mins time slots

- (c) Write down one thing to do when checking technical feasibility of the project. [1]

Any one from the following:

- whether it is technically possible to do the project
- whether it is possible to develop the product with the available technology in the school
- whether it is possible to add more technical resources if needed
- whether the chosen technology is the right choice to help the team complete the system within the budget and time allocated for the project or whether there are other better choices
- whether the school requires specific technology, or is the school open to developing the product, irrespective of the technology
- whether open source software could be used
- whether the technical resources (software/hardware) are available
- whether the technical resources are adequate
- whether the technical team is capable to make a working system
- whether the system should be compatible with other existing systems in the school

- (d) Why a proper requirement analysis is critical for the timely completion of this project which uses the waterfall model? [1]

In the waterfall model, each phase must be completed before the next phase can begin. Thus if the requirement analysis is not properly done during its phase then it is likely that a system that will be rejected by the customers will be developed. It will be very costly and time consuming to correct that mistake.

- (e) What is *integration testing* in this example? [1]

After the unit testing of the three modules are done, then the modules need to be integrated into a single system. Testing this single system as a combined unit is done during integration testing.

(f) Why didn't the teacher suggest a *parallel deployment*?

[1]

Any one from the following:

- more resources are needed for it
- it is more time consuming to maintain two systems
- it is more costly to maintain two systems
- it takes effort to keep the two systems consistent
- it can cause confusion and frustration
- as it is for school's own use, one need not take the effort of parallel deployment as any mistakes can be remedied comparatively easily
- this is not a high risk system that warrants a parallel deployment

(If advantages of other deployments are written → X marks)

(g) Why should a COTS for this system be rejected?

[1]

Any one from the following:

- it may not fit the school requirements
- customization restrictions
- vendor dependence
- integration challenges
- may have a higher cost
- the need for substantial training
- students missing a learning opportunity
- may not have Sinhala, Tamil language support
- may have unnecessary features
- may have licensing costs
- can be more expensive over time
- can be impossible or inflexible to change if one needs it
- school may not have control
- may not be supported after some time
- upgrades can cost extra

- it may not have the exact features the school needs
- might not fit school's work processes

5. (a) (i) Draw the complete truth table for the required circuit.

[3]

A	B	C	Z
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

The above total mark is decided as follows:

3 marks for all 8 rows correct

2.5 marks for maximum 6,7 rows correct

2 mark for maximum 3,4,5 rows correct

1 mark for maximum 1,2 rows correct

NOTE:

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

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

(ii) Complete the Karnaugh map according to the given format.

[2]

⁰¹
0.25 marks for each correct cell: Row

ALTERNATIVE 1:

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

ALTERNATIVE 2:

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

no need groupings

NOTE:

▼ For both alternatives, indicating all 1's and 0's are compulsory for credit.

the 0-groupings although drawn here is required for part (iii)

the

is requir

- (iii) **Using the K map, derive a simplified POS expression for X.**

[3]

Simplified POS expression for ALTERNATIVE 1:

$$Z = (A' + C')(A + C)(B + C)$$

Simplified POS expression for ALTERNATIVE 2:

$$Z = (A + C)(A' + C')(A' + B)$$

Marks allocated as follows:

A: 1.5 marks for marking the three loops on the correct Karnaugh map (0.5 marks for each)

B: 1.5 marks for correct, simplified final POS expression for the used alternative

NOTE:

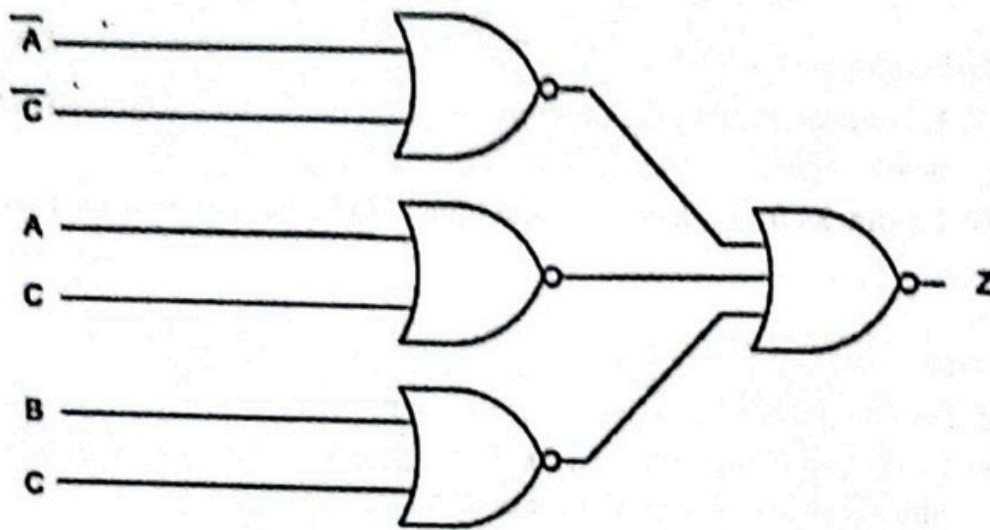
- ★ For component B, the term Z is not compulsory.
- ★ 1 cells not being indicated on the Karnaugh map is permissible as the student has already being penalized for it in Part (ii).

(iv) Draw a logic circuit for the above simplified expression by only using NOR gates.

[2]

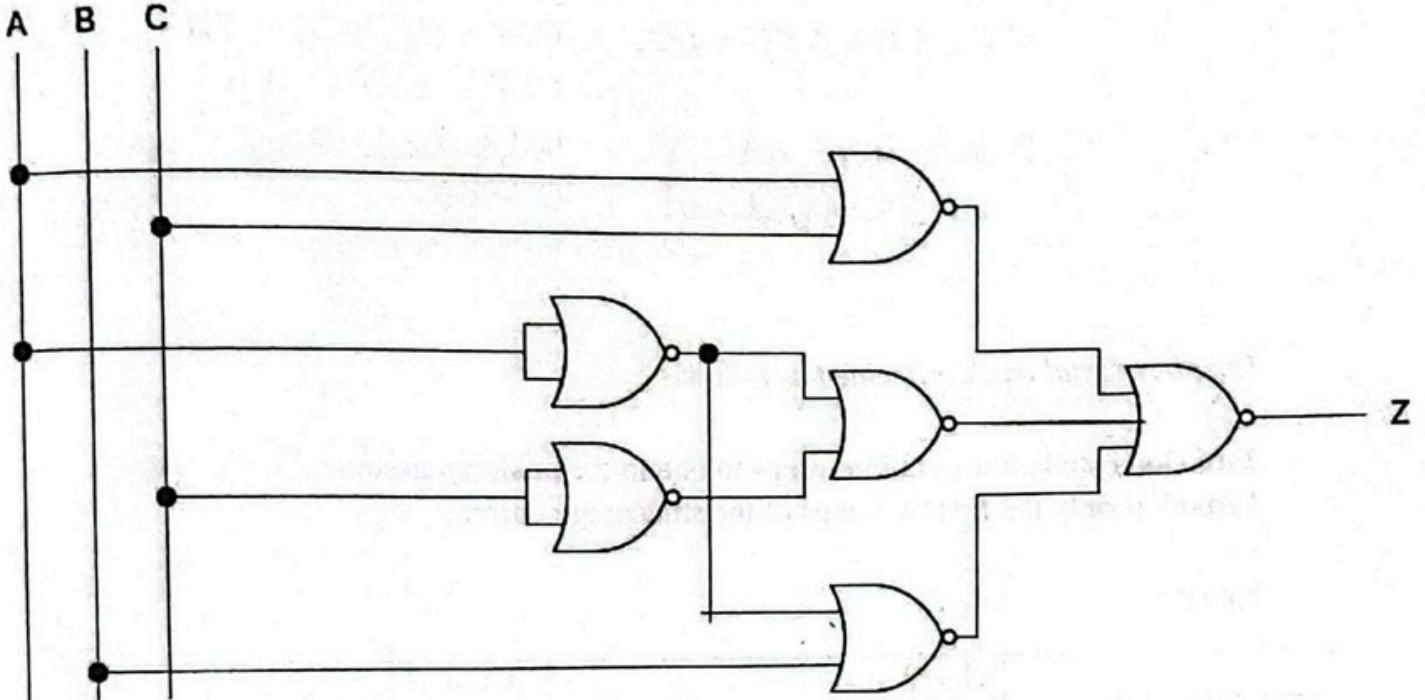
FOR ALTERNATIVE 1:

$$Z = (A' + C')(A + C)(B + C)$$



FOR ALTERNATIVE 2:

$$Z = (A + C)(A' + C')(A' + B)$$



Marks allocated as follows for the drawn alternative:

- A: 1 mark for the first set of NOR gates (←-- Correctly simplified expression for Z)
- B: 1 mark for the final NOR gate (←-- A)

NOTE:

▼ If the wire connections are not clearly indicated on a correct circuit, then give only a maximum of 1 mark. The student can either indicate the wire connections using the dark dots (as shown in the diagram or use half-circles) to indicate non-connecting wires.

★ The Z term is not compulsory.

* Complimented inputs can be input using NOR gates in altertire parts. Similarly complemented inputs can be obtained directly is altertibe 2.

- (b) Using Boolean algebra, show that $A'C + A'B + AB'C + BC$ is equivalent to $C + A'B$. [2]

$$\begin{aligned}
 A'C + A'B + AB'C + BC &= C(A' + AB' + B) + A'B \\
 &= C(A' + A + B) + A'B \\
 &= C(1 + B) + A'B \\
 &= C + A'B
 \end{aligned}$$

Rules are not compulsory

The above total mark is decided as follows:

- 2 marks if student uses correct steps to obtain the final expression
- 1 mark if only the first two steps of the student are correct

NOTE:

	$A + 0 = A$	$A.1 = A$
Inverse/Complement	$A + A' = 1$	$A.A' = 0$
	$A + A = A$	$A.A = A$
Identity	$A + 1 = 1$	$A.0 = 0$
Involution	$(A')' = A$	
Commutative	$A + B = B + A$	$AB = BA$
Associative	$A + (B + C) = (A + B) + C$	$A(BC) = (AB)C$
Distributive	$A(B + C) = AB + AC$	$A + BC = (A + B)(A + C)$ Derivative: $A + A'B = A + B$
DeMorgan	$(A + B)' = A'B'$	$(AB)' = A' + B'$
Absorption	$A + AB = A$	$A(A + B) = A$

Table 1: Postulates and theorems of Boolean Algebra

(c) (i) Output at Q when S=1 and R=0? [1]

1

(ii) Q when S is now made 0? [1]

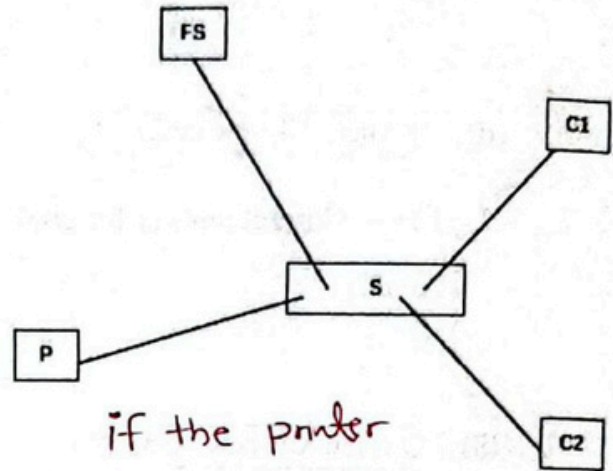
1 (←-- Correct answer for c(i))

(iii) Q when R is now made 1? [1]

0

6. (a) Sketch how a FS, S, P, C1 and C2 should be connected in a star topology.

[1]



if the printer is connected to a computer give marks.

The printer could be connected to one of the computers as well.

(b) The use of the port number in an Internet connection?

it identifies the service point [1]

It identifies the process that is relevant to the connection.

(It identifies the process.)

Identify correct application / software

(c) (i) Write an example IP address that can be assigned to a host attached to this subnet.

[1]

An example IP address is 192.168.56.138

Any answer that lies between 192.168.56.129 and 192.168.56.190 (both inclusive) is also acceptable.

- (ii) Write the first and the last usable host addresses in this network. [1]

0.5 marks for each:

first address: 192.168.56.129

last address: 192.168.56.190

- (iii) How many host addresses are available for use in this subnet? [1]

62

if 61 is written must what happened to other 1

- (d) (i) Write the subnet mask of the given IP address block in dotted decimal notation. [1]

255.255.255.192

- (ii) Write the number of host bits needed to create the required number of subnets. [1]

2

(iii) Fill the table.

[4]

ALTERNATIVE 1:

Give 1 mark for each correct row.

Subnet	Network Address	First Usable IP address	Last usable IP address	Broadcast address
A	192.168.56.0	192.168.56.1	192.168.56.14	192.168.56.15
B	192.168.56.16	192.168.56.17	192.168.56.30	192.168.56.31
C	192.168.56.32	192.168.56.33	192.168.56.46	192.168.56.47
D	192.168.56.48	192.168.56.49	192.168.56.62	192.168.56.63

ALTERNATIVE 2:

Give 1 mark for each correct row.

Subnet	Network Address	First Usable IP address	Last usable IP address	Broadcast address
A	192.168.56.32	192.168.56.33	192.168.56.38	192.168.56.39
B	192.168.56.40	192.168.56.41	192.168.56.46	192.168.56.47
C	192.168.56.48	192.168.56.49	192.168.56.54	192.168.56.55
D	192.168.56.56	192.168.56.57	192.168.56.62	192.168.56.63

(e) (i) Write two functions of a proxy server in a computer network.

[2]

Any two from the following with 1 mark for each:

- acting as an intermediary between the user's computer and the Internet / offering access to uncensored Internet / allowing client computers to make indirect network connections to other network services / helping users browse the web anonymously / providing a high level of privacy / hiding actual IP addresses of users

- storing recently requested web objects/pages for future requests
- reducing the time required to access web pages because of caching
- hiding a network from outside and thus securing that network / preventing attackers from entering a private network
- forwarding web requests
- content filtering
- acting as a firewall
- saving network bandwidth / improving network performance / network connection sharing
- helping control Internet usage of users

(ii) Write two properties of MAC addresses assigned to devices connected to a network. [2]

Any two from the following with 1 mark for each:

- They are 48 bits in length. / They are divided into six blocks separated by colons. / It is a six byte hexadecimal address. / It is a 48-bit address that contains six groups of two hexadecimal digits separated by colons.
- They are physical addresses. / MAC address is hardware oriented. / They are hard-coded into the device. / They are attached to the network interface (host).
- They are assigned by the manufacturer.
- They are permanent. / They cannot be changed.
- They are unique addresses assigned to interfaces of a host. / MAC address sharing is not allowed.
- When data is sent, MAC addresses enable the unique identification of the device interface. / They uniquely identify the devices on a network. / MAC addresses support the correct delivery of the data to the receiver's interface. / A switch needs the MAC address to forward data.
- MAC address operates in the data link layer.
- MAC addresses cannot be found easily by a third party.

7. (a) (i) Identify the parts marked as A,B,C and D and briefly explain their functionalities. [4]

0.5 marks for naming and 0.5 marks for describing each function;
(0.5 × 2 × 4 = 8 marks)

A – USB Port -

The function could be any one of the following:

- Could be used to connect a computer to the Board
- Could be used to upload firmware into the micro-controller
- Could be used for data communication between the computer and the Board

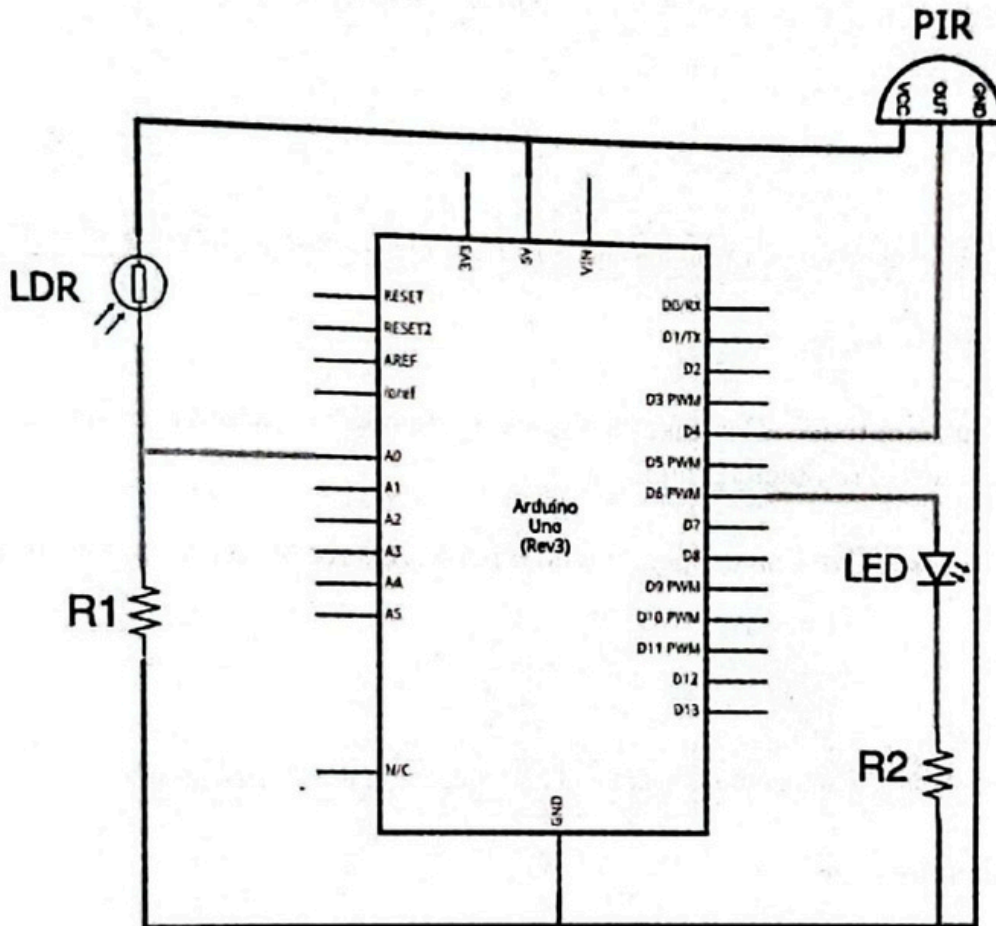
B – Analog input pins – Feed analog inputs to the micro-controller

C – Micro-controller – Any answer that clearly explains the task of processing inputs to Board and producing digital output based on the computations carried out

D – Digital input/output pins – Feed digital inputs as well as deliver digital outputs.

(ii) Draw a schematic diagram for the required IOT setup.

[3]



Allocate marks as follows:

- A: 1 mark for the use of resistors R1 and R2 and correct ground/5V connections
- B: 1 mark for correct LDR connection to analog pins and LED to a digital pin
- C: 1 mark for correct PIR sensor output to another digital pin

NOTE:

- ★▼ Complete pin details are not needed, yet connecting pins must be identified.
- ★ Connecting the output of the PIR to an analog pin is also acceptable.
- ★ LDR sensor can also be indicated as the "sensor for ambient light detection"
- ★ Switching the positions of LED and R2 is accepted.

- (b) (i) Briefly explain (a) autonomous and (b) cooperative characteristics of a software agent. [2]

1 mark for each:

(a) **Autonomous** – Can take decisions by themselves without being controlled by the others (users or other agents)

(b) **Cooperative** Can cooperate with other agents (or users) when performing tasks

- (ii) Identify a self-autonomous agent and a user agent in the given example. [2]

1 mark for each:

Self autonomous agent: multi-agent robots

User agent: either Delivery Handler Agent OR Dispatch Handler Agent

- (iii) Write down the most likely observation when the multi-agent robots satisfy only the autonomous characteristic but fail to cooperate. [1]

There will be competitive behaviour among multi agent robots to complete their tasks which they try to complete individually. E.g., Loading area will be congested by the competing robots to pick the next package. (or each multi agent robot will see all other multi agent robots as obstacles to their work)

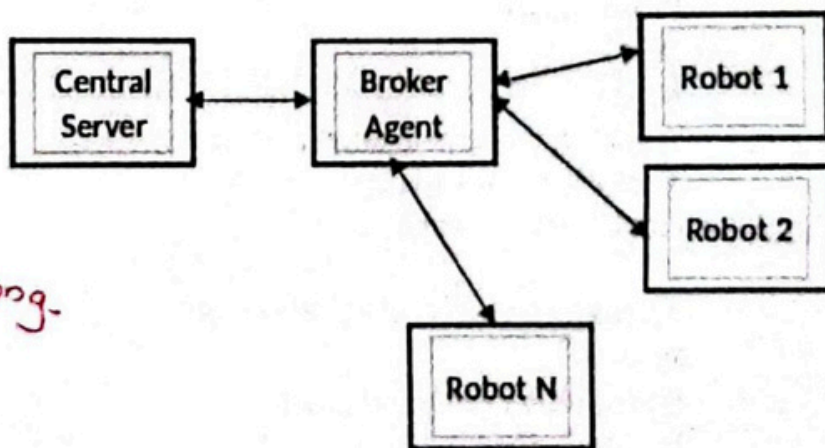
- (iv) It the system is redesigned by replacing the multi-agent behaviour with centralized control and a broker agent for communication, identify one main change with respect to (a) control of the robot mobility and (b) decision making process relevant to moving packages from loading to dispatch areas. [2]

1 mark for each:

(a) Each robot will only move based on the mobility instructions received from the central server.

(b) The central server receives data, processes them at the server and instructs the robots to pick up the packages, move through the package moving area with respect to their dispatch assignments. Communication is facilitated through the broker agent.

- (v) Draw a box and arrow diagram for the new solution with centralized control. [1]



single arrow head is wrong.

NOTE

Connecting components are acceptable. But each connector must contain 2 arrow heads. (Without arrow heads) if the arrows are used then

8. (a) Write down the output of the Python code of Figure 8.1.

L*br*ry

NOTE:

▼ Exact answer with proper case required.

ALTERNATIVE: If the student's answer is "error" due to quotes in code being misinterpreted, just give 1 mark.

If the question is wrong written give 2 marks [2]

- (b) Write down the suitable replacements for P-U in the bubbleSort function.

[3]

0.5 marks for each:

P: len(nList)-1

Q: 0

R: -1 (← P, Q)

S: for i in range(pNumber) (← R)

T: nList[i] = nList[i+1]

U: nList[i+1] = temp

ALTERNATIVE FOR P, Q, R AND S:

P: 0

Q: len(nList) OR len(nList)-1

R: 1 (← P, Q)

S:

for i in range(0, len(nList)-1) OR

for i in range(len(nList)-1) OR

for i in range(0, len(nList)-1-pNumber) (← R)

NOTE:

▼ Exact spelling and case required.

(c) (i) Write down the suitable replacements for the labels A-J of the Python code in Figure 8.3. [8]

A: 0.5 marks open

B: 0.5 marks not OR " " == OR ' ' ==(with no space between quotes)

C: 0.5 marks break

D: 1 mark empDetails[1]

E: 1 mark topay//notes[i]

F: 1 mark required[i] (←-- E)

G: 1 mark topay%notes[i] (←-- E) *topay - required [i] * notes [i]*

H: 1 mark i = i + 1

I: 1 mark required[i] (←-- E)

J: 0.5 marks file.close() (←-- ~~P, Q, R~~ *A*)

NOTE:

▼ Exact spelling and case required.

(ii) The problem in code with respect to net pay inputs? What will you do to fix that problem? [2]

1 mark for *problem* and 1 mark for *solution*:

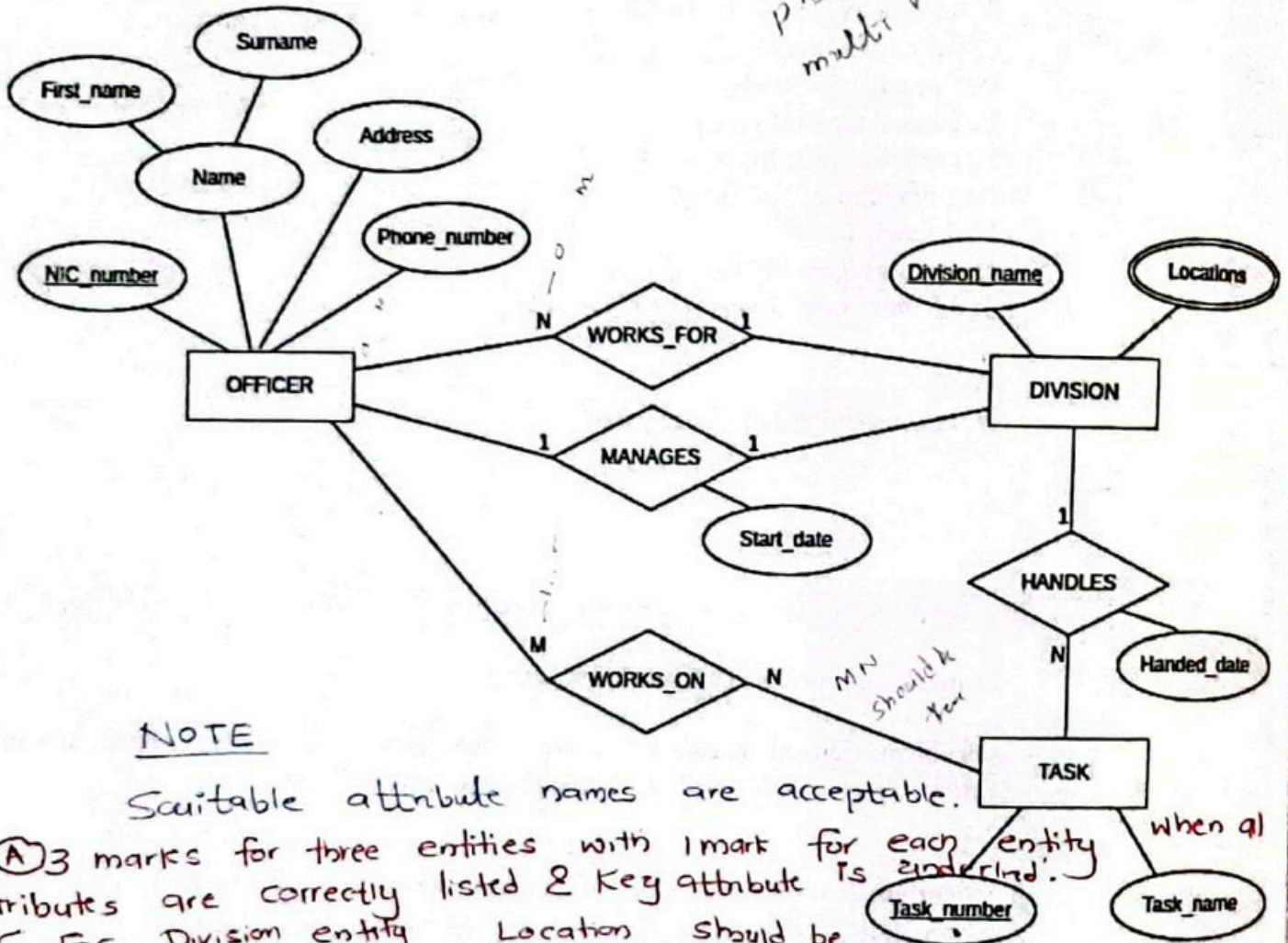
Problem: Can only handle net pay inputs that can be made with the notes in the notes array. E.g., It cannot handle a net pay input like 40001 or 40010.

Solution: Two solutions. Either one is acceptable.

- Do not process if a net pay input is not divisible by either 50 or 20.
- Increase the size of the arrays as follows:
 notes = [5000,1000,500,100,50,20,10,5,2,1]
 totals = [0,0,0,0,0,0,0,0,0,0]
 required = [0,0,0,0,0,0,0,0,0,0]

9. (a) Draw the ER diagram for the office database.

Phone num can be multi value + assumptions. (5) 8



NOTE

Scalable attribute names are acceptable.

(A) 3 marks for three entities with 1 mark for each entity attributes are correctly listed & key attribute is underlined. [for Division entity Location should be multivalued) when a

(B) 4 marks for the four relationships with 1 mark

Marks allocated as follows: (C) 1 mark for the two relationship attributes

A: 1 mark for the three entities (with the key attribute underlined) connected through (correct or incorrect) relationships

B: 1 mark for indicating the Locations multi-valued attribute (+-- A) connected properly

C: 1 mark for the four relationships with correct/incorrect cardinality (+-- A) for DIVISION

D: 1 mark for indicating correct cardinality (+-- C)

E: 1 mark for all attributes correctly being listed and connected properly (+-- D) A, C

(b) Write two advantages of converting a database into a normal form.

[1]

Any two from the following with 0.5 marks for each:

- minimizes the physical storage space required / reduces redundant data / reduces data duplication
- increases data integrity / provides data consistency / prevents data anomalies
- supports efficient query response
- provides for a more flexible database design
- increases database security
- provides better and quicker execution
- making updates to data is easier because it need not be done in multiple places / easy to maintain
- references to a record can be changed without removing the record
- reduces the risk of data entry errors

(c) (i) In which normal form does the Show table exist? Justify your answer.

[2]

0.5
1 mark for the normal form and 0.5
1 mark for justification:

Second Normal Form / 2nd / 2NF

Justification: (+-- Correct normal form [2NF])

Any one from the following:

- It is in 1NF and every field that is not part of the primary key is functionally dependent on the whole of the primary key.
- It is in 1NF and no partial dependencies. Therefore, 2NF.
- It is in 1NF and is not in 3NF due to the transitive dependency. Therefore, 2NF.

for each.

(0.5 for each)

(ii) Convert the Show table to its next normal form.

1
[2]

0.5

1 mark for each:

A: Show(Theatre, Day, Time, Screen, Movie)

B: Movie_Year(Movie, Year) (~~← A~~)

NOTE: 0.5

▼ Reduce 1 mark from total if primary keys not underlined / spelling defects / case defects.

★ Student can provide the relation names.

(d) (i) Write the SQL statement to create the Employee table with a suitable primary key.

[2]

```
CREATE TABLE Employee (
    Emp_ID VARCHAR(4) PRIMARY KEY,
    Emp_Name VARCHAR(50),
    DoB DATE,
    Department VARCHAR(50),
    Designation VARCHAR(50),
    DOJ DATE,
    Salary DECIMAL(10,2)
);
```

ignore ;

ALTERNATIVE:

```

CREATE TABLE Employee (
    Emp_ID VARCHAR(4),
    Emp_Name VARCHAR(50),
    DoB DATE,
    Department VARCHAR(50),
    Designation VARCHAR(50),
    DoJ DATE,
    Salary DECIMAL(10,2),
    PRIMARY KEY (Emp_ID)
);

```

Acceptable alternative data types:

Emp_ID CHAR(4)

Salary INT

Salary FLOAT(10,2)

Marks allocated as follows:

A: ⁰⁻⁵ 1 mark for correct CREATE TABLE Employee (Exact field names); (←-- The semi-colon, exact spelling and case of field names)

B: ⁰⁻⁵ 1 mark for choosing Emp_ID as the primary key AND the correct data type usage

(←--A)

(←--A)

NOTE:

★ Student can choose the field sizes.

(ii) Write the SQL statement to insert the given employee record.

[1]

```
INSERT INTO Employee (Emp_ID, Emp_Name, DoB, Department, Designation,
DoJ, Salary)
```

```
VALUES ('E119', 'John', '15-06-1971', 'IT', 'Professor', '15-07-2001', 107000);
```

ALTERNATIVE: Field names can be omitted but the values for all columns must be there as shown below:

```
INSERT INTO Employee VALUES ('E119', 'John', '15-06-1971', 'IT', 'Professor',
'15-07-2001', 107000);
```

** Do not ignore
"; "*

```
INSERT INTO employee (Emp-ID, Emp-Name, DOB,
Department, Designation, DOJ, Salary) VALUES ('0002', 'John
NOTE: '1971-06-15', 'IT', 'Developer', '2001-07-15', 7500);
```

▼ The semicolon, exact spelling and case of table name and the field names are required.

★ Ignore minor spelling mistakes of the inserted data values.

(iii) Write the output of the given SQL query.

[1]

Emp_ID	Emp_Name
E110	Saman
E114	Jennifer
E119	John

NOTE:

▼ Exact spelling and case of field names and values are required.

★ Writing only the entries for E110 and E114 (without the one for E119) is also acceptable.

- (iv) Write the SQL query to find the names of all employees who work in the "Civil" department. [1]

```
SELECT Emp_Name  
FROM Employee  
WHERE Department = 'Civil';
```

Alternative answer
SELECT Emp-Name
FROM Employee
WHERE Department LIKE
'Civil';

NOTE:

- ▼ The semicolon, exact spelling and case of field names and the text (Civil) are required.

* Double quotes are acceptable.

10. (a) (i) What is the repeating cycle that a processor in a computer is involved in? [1]
fetching instructions - decoding and executing them / Fetch-Decocde-Execute /
Fetch - execute
- (ii) Which program's instructions get executed during a *context switch*? [1]
the operating system's
- (iii) How many flip-flops are needed to create an n bit register? [1]
 n
- (b) (i) Where is the content of variable A in the *fileReader process* stored? [1]
FP FP area
- (ii) Where is the PCB of *average process* stored? [1]
OS

- (c) Which process goes through the RUNNING \rightarrow BLOCKED transition more than the other? Give the reason.

[2]

1 mark for each:

A fileReader

B As there is file reading in it (\leftarrow 2A).

As it is
Involved in I/O

- (d) Which data structure facilitates reading a file from its stopped position?

[1]

PCB of the fileReader process

if only (PCB) is not acceptable.

- (e) (i) Write down the number of frames in physical memory as a power of 2.

[1]

2^{18}

$$\frac{2^{30}}{\text{Pg size}} \checkmark \rightarrow \frac{2^{30}}{2^{12}} = 2^{18} //$$

- (ii) Write down the values of p and q.

[2]

1 mark for each:

p = 20

q = 22

- (iii) Write down in decimal the physical address corresponding to the virtual address 4097.

[1]

8193

- (f) (i) Write down an important number in the directory entry for *test.py* that will help the OS to find its blocks. [1]

218

- (ii) Give an example size for *test.py* that will result in *internal fragmentation*. [1]

Any size between 4 - 8 KB

4, 5, 7
5, 6, 7
↑

Any size with

219

- (iii) Show the FAT entries for *test.py* after block 19 is added. [1]

order need to be
there.

218	220
219	-1
220	219

NOTE:

- ▼ Blocks from 218 should be drawn in sequence.