ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය / க.பொ.த. (உயர் தர)ப் பரீட்சை - 2022 (2023)

විෂය අංකය பாட இலக்கம்	20

විෂය
பாடம்

Information and Communication Technology

ලකුණු දීමේ පටිපාටිය / புள்ளி வழங்கும் திட்டம்

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

⊙ විශේෂ උපදෙස් / விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට / ஒரு சரியான விடைக்கு ලකුණු 01 බැගින් / புள்ளி வீதம்

මුළු ලකුණු / மொத்தப் புள்ளிகள்   1 X 50

1   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.   **[2]**

0.5 marks each for rows 1, 2, 3 and 4

Designation	Contact Telephone Numbers
Principal	061-2223211
	067-5557772
Vice Principal	061-5557771
Common Phone Number: 019-2233445	

Row 1: **0.5 marks**
Row 2: **0.5 marks**
Row 3: **0.5 marks**
Row 4: **0.5 marks**

NOTES:

▼ Row 1 content has to be in boldface.

★ Ignore minor spelling mistakes.

★ Ignore case and alignment defects.

★ Border in the table not essential.

★▼ The phone numbers need not be exact but must contain ten digits.

(b) | Rewrite the HTML code by applying internal CSS with grouping selectors. | **[2]**

```
<html>
  <head>
    <title>Cascading Style Sheets</title>

    <style>
      h1,h2 {color:blue;}   A: 0.5 marks
      h1   {text-align:center;}  B: 0.5 marks
    </style>

  </head>
  <body>
    <h1> Introduction to Cascading Style Sheets </h1>  C: 0.5 marks
    <h2> CSS can be applied to html documents in three different ways.</h2>
  </body>
</html>
```

D: 0.5 marks

ALTERNATIVE:

```
<html>
  <head>
    <title>Cascading Style Sheets</title>

    <style>
      h1 {color:blue; text-align:center;}
      h2 {color:blue;}
    </style>

  </head>
  <body>
    <h1> Introduction to Cascading Style Sheets </h1>  C: 0.5 marks
    <h2> CSS can be applied to html documents in three different ways.</h2>
  </body>
</html>
```

A,B: 0.5 marks

D: 0.5 marks

NOTES:

▼ For either A or B to be given credit, each must be included within <style> and </style> which in turn must be within <head> and </head>.

▼ For either C or D to be given credit, each must be included within <body> and </body>.

▼ Reduce a maximum of **0.5 marks** for all other mistakes.

(c) | Fill the blanks in the HTML code to get the required output. | **[4]**

```html
<html>
<head>Registration Form</head>
<body>
<h3> Registration for Examination </h3>

<form action="process.php" method="post">   A: 0.5 marks

<div> Student Name <input type ='text' name="name"> </div>  B:0.5 marks

<p>

  <div>
  Select Examination Module: <p>

  <input type='checkbox' name="module[]" value="ICT" /> ICT <br>
  <input type='checkbox' name="module[]" value="English" /> English <br>  C: 1 mark
  <input type='checkbox' name="module[]" value="IQ" /> IQ <br>
  </div>
  <br>
  <div>

  Preferred Medium:
                                                        E:0.5 marks
  <input type='radio' name="language" value="Sinhala" checked/> Sinhala
  <input type='radio' name="language" value="Tamil" /> Tamil
  <input type='radio' name="language" value="English" /> English
  </div>
  <div>
  <br>
  Select Test Center: D:0.5 marks

  <select name="Center">
    <option value="Colombo" selected>Colombo</option>
    <option value="Matara">Matara</option>
    <option value="Jaffna">Jaffna</option>
  </select>
                                                        G:0.5 marks
  </div>        F:0.5 marks
  <br>
  <input type="submit" name="submit" value="submit">
</form>
</body>
</html>
```

NOTES:

▼ Exact spelling required for **all** answers.

▼ In addition, exact case is required for the following:

- Student Name (in B)
- ICT, English, IQ (in C)
- Colombo, Matara, Jaffna (in G)

(d) | Fill the blanks in the PHP code. | **[2]**

```php
<?php

if ($_SERVER["REQUEST_METHOD"] == "POST") {
        $name = $_POST["name"];
        $medium = $_POST["language"];
        $center = $_POST["Center"];
}

echo "<h2> Your Input:</h2>";
echo $name; echo "<br>";
echo $medium; echo "<br>";
echo $center; echo "<br>";
?>
```

1 mark

1 mark

NOTE:

▼ Exact case and spelling required.

2. **(a)** **(i)** | ...if they did not skip the ... | **[1]**

preliminary investigation

(ii) | solution developed by students lacks ... | **[1]**

economic feasibility

(iii) | ...the library staff says they will only accept the solution only if ... | **[1]**

operational feasibility

NOTES:
▼ For all **i, ii, iii above**, ignore *minor* spelling mistakes.

(b) **(i)** | Write down most suitable terms for P, Q, R and S selecting from the given list. | **[4]**

1 mark for each:

P - Customer

Q - Copy of payment receipt / payment receipt

R - Item details / Inventory

S - Generate reports / Generate report

NOTES:
▼ Ignore case defects.
▼ Exact spelling needed.
▼ For P, Customer<u>s</u> is NOT acceptable.

(ii) | How many processes, external entities and data stores? | **[1]**

processes - 4   external entities - 2   data stores - 2

(c) (i) | Write down one difference between parallel and pilot deployment. | **[1]**

In parallel deployment, both the existing and the new systems are run simultaneously for some time covering the entire set of users.
In a pilot deployment, the system is implemented initially only for a selected set of users.

Provided the above key difference is mentioned, any **one** of the following differences is also acceptable:

Parallel	Pilot
Old and the new systems are run alongside each other for a period of time	Usually only the new system is run
Usually run covering the full set of users	Covers only a limited set of users
Cost is usually more as two systems need to be running	Cost is usually lesser
Comparatively quicker to implement	Takes longer to implement the entire system to cover the entire set of users
Duplication of effort to run both systems	Lesser duplication of effort
Less riskier as, if the new system fails, the old system still exists	More risky
No feedback from a pilot run	Feedback from the pilot run can be used in system improvement
More effort required for training users as there are no users with prior experience	The users involved in the pilot can help train the other users
Viability of the system not indicated before implementing for the whole set of users	Results from the pilot can help decide the viability of the system
If the new system does not work then big waste of money and effort	Relatively lesser money and effort wastage if the new system does not work
More difficult to manage as the implementation is on a larger scale	More easier to manage as the implementation is on a smaller scale
More cost involved in training as more staff need to be trained at once	Staff can be trained gradually from area to area
Users can can compare the output of the old system with the output of the new system, to ensure correctness	There is nothing to compare
Data could be different in the old and the new systems due to mistakes in data entry	No such risk
Scalability testing is automatically done	The system that works for a small area may not work for the entire area

**(ii)** Write down one advantage of COTS software. **[1]**

Any one from the following:

- convenience
- reduced implementation/development time
- faster/easier insertion of technology
- possibly <u>lower</u> comparative <u>cost</u>
- ongoing support/updates
- readily available training resources
- existing customer bases/communities
- availability of trial versions
- can access reviews/advice from existing users
- offer more functionality
- more configurable
- no/lower upgrade costs

3. **(a)** | Write down the content for the four flowchart components. | **[2]**
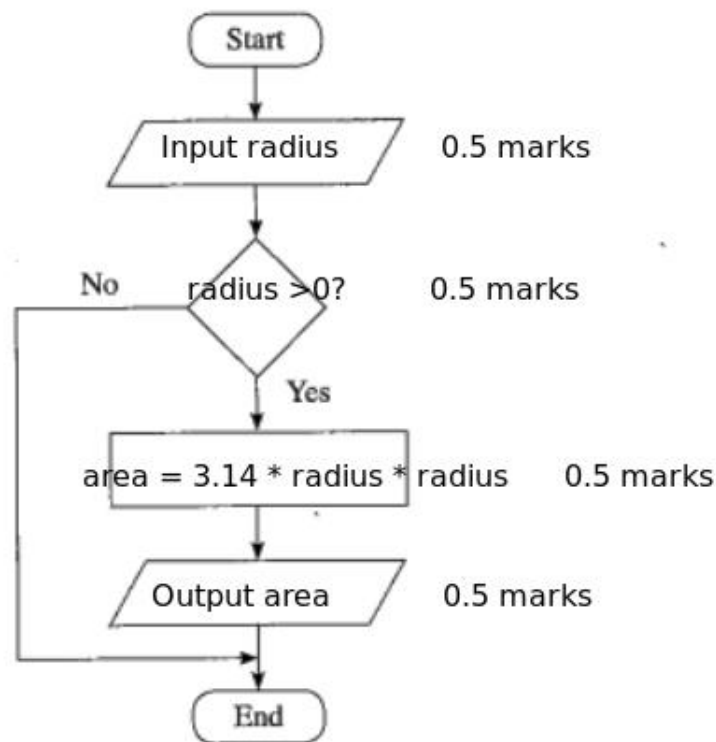
NOTES:

★ For "Input": any other word (or a programming language specific word) that conveys the meaning is acceptable. e.g., *get, read*

★ For "Output": any other word (or a programming language specific word) that conveys the meaning is acceptable. e.g., *display, print, show, write*

★ For condition: "Is <u>radius > 0</u>?" is also acceptable. For this mark scheme, the "?" in the condition can be considered as not essential. But in the future mark schemes it is likely for it to be considered essential as it increases the readability in a flowchart.

★ For computation: area = $\frac{22}{7} * radius^2$ is also acceptable.

★ Use of the π symbol is also acceptable.

★ Variable names: *radius* and *area* could be replaced with other variable names. But, they have to be correctly used in the rest of the flowchart.
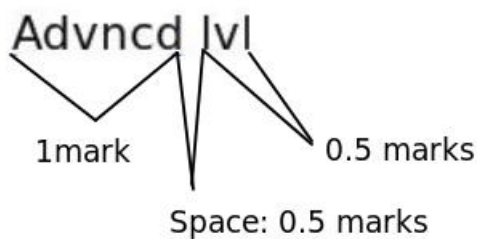
(b) | What is the output of the given Python code? | **[2]**

▼ Reduce 0.5 marks if the output is shown within quotes.

(c) | What code line(s) in Part (b) are to be removed to get "aeee" as the output? | **[2]**

Advncd lvl

1mark   0.5 marks

Space: 0.5 marks

```
pass
else:
```

NOTE:

▼ Exact output essential for the 2 marks. No partial marks allowed.

★ Give credit if students have indicated the above lines in any manner (e.g., through line numbers 5 and 6; through pointing using arrows etc.)

(d) | Fill the eight blank spaces in the Python code to copy the content of a text file to another file. | **[4]**

0.5 marks for each:

```
A = input("Enter the name of text file A")
B = input("Enter the name of text file B")

f1 = ..open.... (A, ..'r.'/'r+'.)

f2 = ..open... (B, 'w'/'a'/'r+')

for line in ...f1...... :

       f2.write (...line....)

f1.   close()

f2.   .close()..
```

NOTE:

★ To indicate file - opening mode, double quotes also acceptable.

4. **(a)** | Write down the most suitable items from the given list for the two blanks in the two sentences. | **[1]**

0.5 marks for each:

(i) online reverse auctions
(ii) e-marketplace

NOTE:

★ *Minor* spelling mistakes acceptable.

(b) **(i)** | What is the main disadvantage of purchasing computer hardware considering maximum demand? | **[1]**

then resources will be underutilized most of the time

(ii) | What is the alternative solution to overcome the disadvantage of b(i) but that still satisfies maximum resource demand? | **[1]**

introduce <u>cloud computing</u>

(c) | Select items from list for the two labels P and Q. | **[1]**

0.5 marks for each:

P - program counter   Q - functional unit

NOTE:

★ *Minor* spelling mistakes acceptable.

(d) **(i)** | Complete the truth table for the given circuit. | **[2.5]**

A	B	*X*	*Y*	Q
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	1

Marks allocated as follows:

A: **1 mark** for correct X column

B: **1 mark** for correct Y column

C: **0.5 marks** for correct Q column ($\leftarrow -- A, B$)

(ii) | What is the basic logic gate that has the above truth table (inputs: A,B and output:Q)? | **[0.5]**

<u>OR</u> gate

(e) | Write down the names of the layers indicated by P,Q,R,S,T and U. | **[3]**

0.5 marks for each:

P - <u>Application</u> layer
Q - <u>Network</u> layer
R - <u>Datalink</u> layer
S - <u>Application</u> layer
T - <u>Transport</u> layer
U - <u>Internet</u> layer / <u>Network</u> layer

NOTE:

★ Ignore minor spelling mistakes.

5. **(a)** **(i)** | Draw the complete truth table for the given circuit. | **[3]**

P	Q	R	Z
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

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 marks 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.

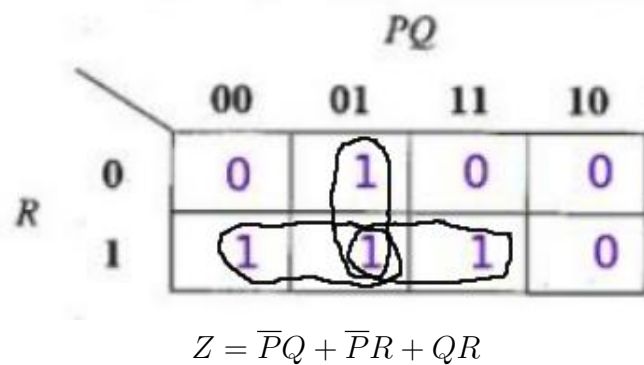**(ii)** | Complete the Karnaugh map according to the given format. | **[2]**

0.25 marks for each correct cell:

	PQ			
	00	01	11	10
R 0	0	1	0	0
1	1	1	1	0

(iii) | Using the K map, derive a simplified SOP expression for Z. | **[2]**

$$Z = \overline{P}Q + \overline{P}R + QR$$

Marks allocated as follows:

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

B: **0.5 marks** for correct, simplified final SOP expression as $Z = \overline{P}Q + \overline{P}R + QR$ ($\leftarrow$-- A)

NOTE:

★ Zero cells not being indicated on the Karnaugh Map is permissible as the student has already been penalized for it in part (ii).

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

(b) **(i)** | Using Boolean algebra, show that ... is equivalent to BC+AC+AB. | **[2]**

METHOD I:

$\overline{A}BC + A\overline{B}C + AB\overline{C} + ABC$

$BC(\overline{A} + A) + A\overline{B}C + AB\overline{C}$

$BC + A\overline{B}C + AB\overline{C}$ $(A + \overline{A} = 1$ / Complement Law) **1 mark**

$C(B + A\overline{B}) + AB\overline{C}$

$C(A + B) + AB\overline{C}$ $(A + \overline{A}B = A + B$ / Redundancy Law)

$CA + CB + AB\overline{C}$

$BC + A(C + B\overline{C})$

$BC + A(C + B)$ $(A + \overline{A}B = A + B$ / Redundancy Law) **1 mark**

$BC + AC + AB$

METHOD II:

$\overline{A}BC + A\overline{B}C + AB\overline{C} + ABC$

$\overline{A}BC + A\overline{B}C + AB\overline{C} + ABC + ABC + ABC$ $(A + A = A$ / Idempotent Law) **1 mark**

$BC(A + \overline{A}) + AB(C + \overline{C}) + AC(B + \overline{B})$ **1 mark**

$BC + AB + AC$ $(A + \overline{A} = 1$ / Complement Law)

NOTE:
★ Stating the relevant laws not essential.

(ii) | Draw a logic circuit for the above simplified expression by only using OR and AND gates. | **[3]**
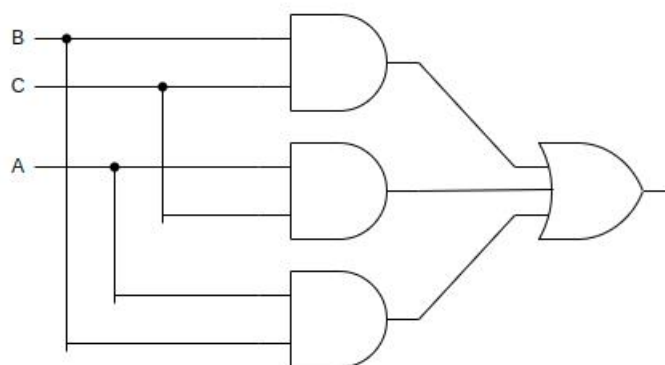
NOTE:

▼ If on a correct circuit, the wire connections are not clearly indicated, then give only a maximum of **2 marks**. The student can either indicate the connections using dark dots (as shown in the diagram) or can can use halfcircles/cuts to indicate non-connecting wires.

(iii) | Draw a logic circuit for the above simplified expression by only using NAND gates. | **[3]**
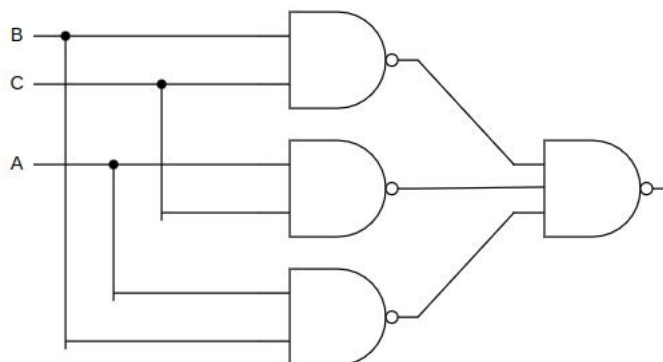
NOTES:

$$AB + BC + AC$$

$$= \overline{\overline{AB + BC + AC}} \qquad \text{(Double complement)}$$

$$= \overline{\overline{(AB)}\ \overline{(BC)}\ \overline{(AC)}} \qquad \text{(De Morgan's Law)}$$

▼ If on a correct circuit, the wire connections are not clearly indicated, then give only a maximum of **2 marks**. The student can either indicate the connections using dark dots (as shown in the diagram) or can can use halfcircles/cuts to indicate non-connecting wires.

ALTERNATIVE:

If the final circuit is as follows, give **only 2 marks**
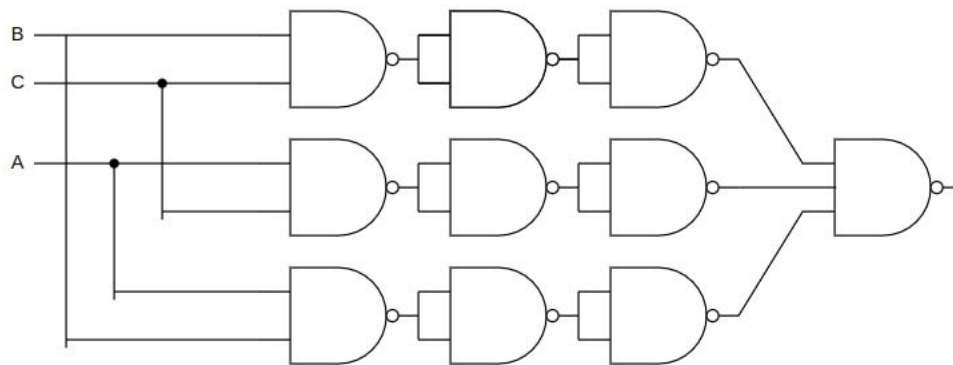
▼ If on the above diagram, the wire connections are not clearly indicated, then give only a maximum of **1 mark**. The student can either indicate the connections using dark dots (as shown in the diagram) or can can use halfcircles/cuts to indicate non-connecting wires.

6. **(a)** | Write suitable terms from P to U. | **[3]**

> **0.5 marks** for each:
> P - symmetric
> Q - common ("same"also acceptable although grammatically incorrect)
> R - asymmetric / public
>
> | S | public | private |
> |---|--------|---------|
> | T | private | public |
>
> U - cipher text
>
> NOTE:
>
> ★ Ignore *minor* spelling mistakes.

(b) **(i)** | Write the first and the last address in the given address block. | **[1]**

> **0.5 marks** for each:
> First address - 192.248.154.0
> Last address - 192.248.154.127
>
> NOTE:
>
> ABC Company received 192.248.154.0/25. Each department can have at most 32 IP addresses. There are four departments. Therefore two bits are enough to identify them. We can extend /25 to /27. Balance five bits (32-27) would be sufficient to assign 32 different IP addresses in each subnet.

(ii) | Write the subnet mask of the given address block in dotted decimal notation. | **[1]**

> 255.255.255.128

(iii) | How many host bits are needed to create the required number of subnets? | **[1]**

> 2 bits

(iv) | Fill the table. | **[4]**

Give **1 mark** for each row.

Subnet No	Network Address	Subnet Mask	First usable IP address	Last usable IP address	Broadcast address	
S001	192.248.154.0	255.255.255.224	192.248.154.1	192.248.154.30	192.248.154.31	1 mark
S002	192.248.154.32	255.255.255.224	192.248.154.33	192.248.154.62	192.248.154.63	1mark
S003	192.248.154.64	255.255.255.224	192.248.154.65	192.248.154.94	192.248.154.95	1 mark
S004	192.248.154.96	255.255.255.224	192.248.154.97	192.248.154.126	192.248.154.127	1 mark

(c) **(i)** | Write one difference between UDP and TCP. | **[1]**

Any **one** from the following:
- TCP offers reliability (uses sequence numbers, sequenced acknowledgements, re-transmissions) whereas UDP does not offer such
- TCP is a connection oriented transport protocol whereas UDP is connectionless
- TCP is a complex protocol (uses sequence numbers, sequenced acknowledgements, retransmissions) whereas UDP is a simple protocol
- TCP is suitable for client server type of communication and UDP is suitable for query based communications (DNS, SNMP)
- TCP guarantees ordered delivery whereas UDP does not
- TCP provides congestion control whereas UDP does not
- TCP is slower due to all added functionality whereas UDP is faster

(ii) | Write down two main functions of a router. | **[2]**

Any **two** from the following with **1 mark** for each:
- routing data from source to destination / forwarding data
- finding paths for arriving data/packets
- communicating and collaborating with other routers
- maintaining a table (routing table) of reachable destinations through them
- exchanging routing tables with other routers from time to time
- updating routing tables from the information received from other routers
- interconnecting different networks

(d) (i) | What is the functionality of a DNS server? | **[1]**

Any **one** from the following:
- Providing directory lookup service for given domain names and web addresses
- Providing services to the HTTP, SMTP protocols to identify matching web addresses to given URLs
- Domain name resolution
- Host name to IP address matching
- Reverse DNS lookup

(ii) | What is the functionality of a DHCP server? | **[1]**

Any **one** from the following:
- DHCP is a protocol used to automatically assign IP addresses to arriving hosts in a network/LAN
- Providing IP addresses for a specific period

7. **(a)** **(i)** | Match A,B,C. | **[3]**

1 mark for each:

A - Controller

B – Microcontroller/Arduino Board (with or without mentioning communication module)

C – Sensor

(ii) | Explain why arrow M is shown in a single direction. | **[1]**

Sensor can only feed data to the system/microcontroller

(b) | Write down X,Y and Z in the algorithm. | **[3]**

1 mark for each:
X - M_L < 8
Y - open tap
Z - close tap

(c) | What could be monitored in the warehouse using an LDR sensor? | **[1]**

Luminosity level / light intensity level

NOTE:

▼ Writing only "light" is **not** sufficient.

(d) (i) | Who are the self-autonomous agents? | **[1]**

0.5 marks for each:

Agent 2 and Search Agent

NOTE:
▼ **Zero marks** if all three agents are named.

(ii) | Explain Q and S interactions. | **[2]**

1 mark for each:

Q - Agent 1 triggers/activates Agent 2 to process images;
    Agent 2 informs Agent 1 if an anomaly is detected
S - Agent 2 triggers/activates Search Agent if necessary;
    Search Agent feeds the results of the search to Agent 2

(iii) | Main disadvantage of removing search agent. | **[1]**

The system gets isolated from the latest updates of the
relevant information/
system becomes an outdated knowledge repository/
static data

(e) (i) | One advantage of limiting sales to the nearby community. | **[1]**

Answer could be any **one** of the following:
- Easy management of perishable products
- Reduced delivery costs
- Easier to maintain produce quality/freshness

(ii) | Alternative payment method until an online payment facility is setup. | **[1]**

Any **one** of the following:
- Cash on delivery (preferred answer)
- bank transfer

- account deposit / an equivalent method that results in an account deposit

(iii) Give one advantage of this value addition to his e-business. **[1]**

Any **one** of the following:
- Extended perishability/shelf life of the product
  (related to this answer ability to reach far away customers)
- Better delivery and logistical use
- Gain more control over market demand and supply situations

8. **(a)** **(i)** | What is the output of the Python script if 1002 is given as the input? | **[2]**

   3

(ii) | The modification required for the B = B + C code line if the reverse of a given positive number is to be printed? | **[2]**

   B= B*10 + C

(b) | Write a Python function called *Party()* that takes the student name and name of the food item as parameters. The function should return *True* or *False* depending on whether the student is allowed to bring that food item or not. | **[5]**

METHOD 1:
```
def Party(studentName, foodItem):
      if ((studentName[0]==foodItem[0]) and
              (studentName[len(studentName)-1] == foodItem[len(foodItem)-1])):
          return "True"
      else:
          return "False"
```

METHOD 2:
```
def Party(name, food):
      if name[0] ==food[0] and name[-1] == food[-1]:
          a = "True"
      else:
          a = "False"
      return  a
```

METHOD 3:
```
def Party(name, food):
      a = "False"
      if name[0] ==food[0]:
          if name[-1] == food[-1]:
              a = "True"
      return  a
```

Methods 4 and 5 have been added.

METHOD 4:

```
def Party(studentName, foodItem):

    return studentName[0] == foodItem[0] and
            studentName[len(studentName)-1] == foodItem[len(foodItem)-1]:
```

METHOD 5:

```
def Party(studentName, foodItem):

    return studentName[0] == foodItem[0] and
            studentName[-1] == foodItem[-1]:
```

Allocate marks as follows:

A: **1 mark** for def Party(studentName, foodItem):

B: **1 mark** for the *first letter check* (within *if* for methods 1-3) ($\leftarrow\!-\!-$ A)

C: **1 mark** for the *last letter check* (within *if* for methods 1-3) ($\leftarrow\!-\!-$ A)

D: **1 mark** for correct:

    logic (e.g., *and* in the if statement)

    use of *:* (at relevant places)

    indentation

  ($\leftarrow\!-\!-$ B, C)

E: **1 mark** for correct *return/print* statement ($\leftarrow\!-\!-$ D)

NOTE:

★ Following are acceptable:

  • For METHOD 1: instead of the two *return* statements, the use of print("True") [or print(True)] and print("False") [or print(False)] respectively

  • For METHOD 2 and METHOD 3: instead of the *return a* statement, the use of *print(a)*

★ Ignore the case of *True, False* in methods 1-3.

★▼ *True, False* can also be returned without quotation marks as in *return True*, *return False*. Then, however, the exact case of *True, False* are important.

(c) | Write down A-H statements in the flowchart to calculate the factorial of a given positive integer. | **[6]**

METHOD 1:

Label	Answer	Marks
A	Start / Begin	**0.5**
B	Read / Input / Get n	**0.5**
C	$i = 1 \quad fac = 1$	**1**
D	$i <= n$?	**1**
E	$fac = fac * i$ (in Yes branch)	**1**
F	$i = i + 1$	**1**
G	Print / Display / Write /Show fac (in No branch)	**0.5**
H	Stop / End / Finish	**0.5**

METHOD 2:

Label	Answer	Marks
A	Start / Begin	**0.5**
B	Read / Input / Get n	**0.5**
C	$fac = 1$	**1**
D	$n > 0$?	**1**
E	$fac = fac * n$ (in Yes branch)	**1**
F	$n = n - 1$	**1**
G	Print / Display / Write /Show fac (in No branch)	**0.5**
H	Stop / End / Finish	**0.5**

METHOD 3:

Label	Answer	Marks
A	Start / Begin	**0.5**
B	Read / Input / Get n	**0.5**
C	$i = 1 \quad fac = 1$	**1**
D	$i > n$?	**1**
E	$fac = fac * i$ (in No branch)	**1**
F	$i = i + 1$	**1**
G	Print / Display / Write /Show fac (in Yes branch)	**0.5**
H	Stop / End / Finish	**0.5**

METHOD 4:

Label	Answer	Marks
A	Start / Begin	**0.5**
B	Read / Input / Get n	**0.5**
C	$fac = 1$	**1**
D	$n <= 0$?	**1**
E	$fac = fac * n$ (in No branch)	**1**
F	$n = n - 1$	**1**
G	Print / Display / Write /Show fac (in Yes branch)	**0.5**
H	Stop / End / Finish	**0.5**

9. **(a)** Draw the ER diagram for the given scenario. [8]

A sample answer for ER diagram:
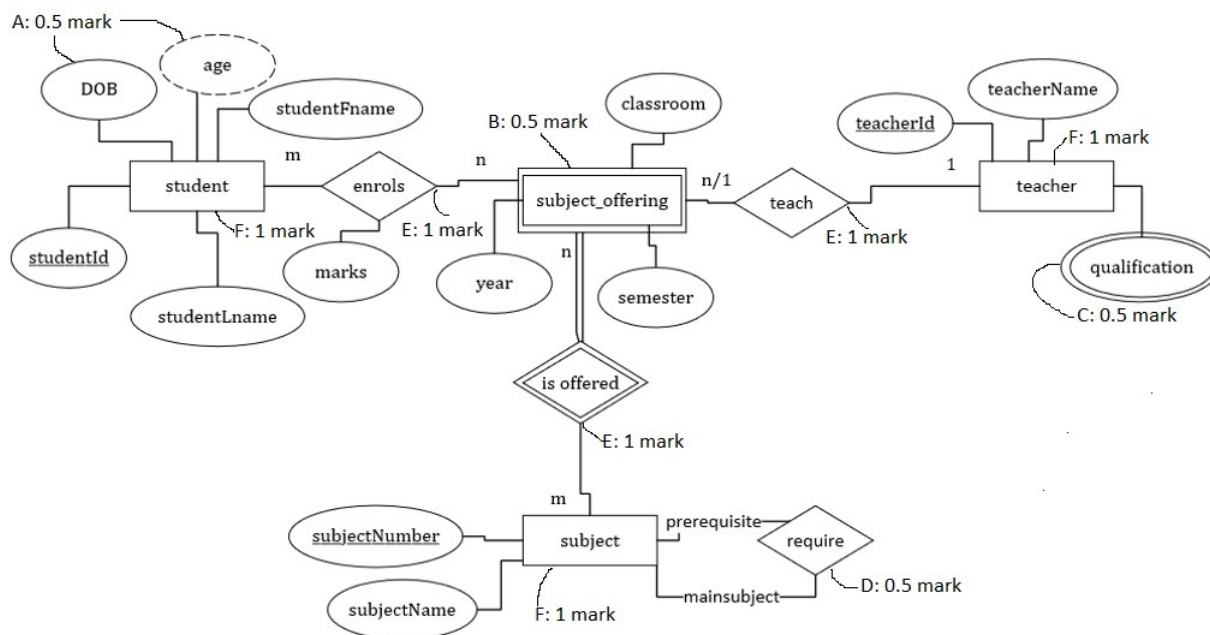
Marks allocated as follows:

A: **0.5 marks** for identifying *DOB* as an attribute and *age* as a derived attribute of *student* entity

B: **0.5 marks** for *subject_offering* as a weak entity

C: **0.5 marks** for *qualification* as a multi-valued attribute

D: **0.5 marks** for identifying correctly the prerequisite subject relationship

E: **3 marks** for identifying relationships with correct cardinality (**1 mark** for each relationship)

F: **3 marks** for identifying entities with correct sets of attributes (at least 2 or more attributes for *student*, *teacher* and *subject* entity)

NOTE:

★ studentFname and studentLname can connect to studentName attribute for the latter to be represented as a composite attribute.

(b) **(i)** | Write down the output of the given SQL statement. | [1]

FullName	Salary
Upul Fernando	44000
Sunil Perera	115000
Kamala Gamage	52000
Upul Fernando	44000
Saman Perera	140000
Kamala Gamage	52000

NOTE:

▼ Rows and order of the records important.

★ Ignore minor spelling defects.

(ii) | Write an SQL statement to display the names of employees who are assigned to project P04. | [2]

SELECT Employee.FullName
FROM Employee, Assign_Project
WHERE Employee.EmployeeId = Assign_Project.EmployeeId AND ProjectId = ' P04';

OR

SELECT Employee.FullName
FROM Employee INNER JOIN Assign_Project ON Employee.EmployeeId =
Assign_Project.Employee_Id
WHERE Assign_Project.Project_Id="P04";

OR
SELECT E.FullName
FROM Employee as E INNER JOIN Assign_Project as A ON E.EmployeeId = A.Employee_Id
WHERE A.Project_Id="P04";

Marks allocated as follows:
   A: **1 mark** for correct SELECT and FROM clauses
   B: **1 mark** for correct WHERE clause

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

First normal form / 1 NF

(iv) | What needs to be done to convert the **Assign_Project** table into its next normal form? Justify answer. | **[1]**

Answer	Marks
Need to remove *PName* and *Description* attributes along with *ProjectId* attribute	0.5
Because these attributes are partially dependent on the primary key	0.5

ALTERNATIVE:

Answer	Marks
Remove partial dependencies	0.5
PName and *Description* attributes depend on *ProjectId* attribute	0.5

(v) | Give an example query where the update anomaly can occur in the Assign_Project table. | **[2]**

The following examples have been amended:

```
UPDATE Employee
SET EmployeeId = 'E003'
WHERE EmployeeId = 'E002';
```

Note: EmployeeId can be any valid EmployeeId from the Employee table.

OR

Update only some rows in the Assign_Project table, that leads to the inconsistency of the table

```
UPDATE Assign_Project
SET PName = 'SalesSys'
WHERE EmployeeId = 'E008';
```

OR

```
UPDATE Assign_Project
SET Description = 'Inventory System'
WHERE EmployeeId = 'E008';
```

Note: Different EmployeeId values can be considered based on the values given in the Assign_Project table.

Marks allocated as follows:

A: **1 mark** for correct UPDATE and SET clauses

B: **1 mark** for correct WHERE clause

10. **(a)** | Write down the important work that OS does with respect to P_w and P_T during the time period O. | **[4]**

Marks allocated as follows:

A: **2 marks** for any **one** of the following:

- Interrupt P_w / Stop P_w
- Save the processor state with respect to P_w into its PCB
- Change P_w's state to READY

B: **2 marks** for any **one** of the following:

- Start P_T
- Allocate a PCB for P_T / Load state of P_T from its PCB
- Load the relevant page of P_T into memory
- Set the state of P_T to RUNNING

If the student had written just "context switch" then give a total of **2 marks**.

(b) | Why is W less than Q? | **[1]**

P_w is blocked for an event (e.g., Input/output)

(c) | If virtual address 0001 0000 0000 0011 is present in physical memory, then write down its 15 bit physical address. | **[4]**

Marks given as follows:

If answer is "Yes": 101 0000 0000 0011 **4 marks**

The marks allocated as follows:
A: **1 mark** for "Yes"
B: **3 marks** for the correct address

If answer is "No": **2 marks** for an answer containing the following:

(i) The OS picks either:
- a free frame or
- a little used page frame and writes its contents back to disk (if needed)

(ii) fetches the page just referenced into the page frame just freed

(iii) changes the page table

(iv) restarts the instruction

The 2 marks for a "No" answer are allocated as follows:

A: **0.5 marks** for picking a free frame (or making one free)

B: **0.5 marks** for fetching the required page

C: **0.5 marks** for changing the page table

D: **0.5 marks** for restarting the instruction

(d) | Give two reasons for a process page to be not in memory. | **[2]**

1 mark for each:

- page is called in the program for the very first time
- page was in physical memory before but has been taken off to make room for another page / the page has been <u>swapped out</u>
- the process has finished execution

(e) | Explain how OS finds the blocks in a file. | **[4]**

(i) contiguous allocation: **2 marks**
   Marks allocated as follows:
   A: **1 mark** - The directory entry contains the starting block of the file
   B: **1 mark** - The blocks are contiguous / Directory entry also contains the number of blocks in file

(ii) indexed allocation: **2 marks**
   Marks allocated as follows:
   A: **1 mark** - The directory entry contains the address of the index block.
   B: **1 mark** - This block contains the addresses of all other blocks.