This has been prepared for the use of marking examiners. Some changes would be made according to the views presented at the Chief Examiners' meeting.
<table>
<thead>
<tr>
<th>Question No</th>
<th>Part</th>
<th>Answer</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>a</td>
<td><code>&lt;h2&gt;Send Text Message&lt;/h2&gt;</code>&lt;p&gt;Fill in all the fields and click Send Message&lt;/p&gt; <code>&lt;form action=&quot;&quot; method=&quot;POST&quot;&gt;</code> <code>&lt;div class = &quot;a&quot;&gt;</code> <code>&lt;div class = &quot;l&quot;&gt;Phone No.:&lt;/div&gt;</code> <code>&lt;div class = &quot;r&quot;&gt;&lt;input type=&quot;text&quot; name=&quot;phone&quot; size=&quot;20&quot;&gt;&lt;/div&gt;</code> <code>&lt;/div&gt;</code> <code>&lt;div class = &quot;a&quot;&gt;</code> <code>&lt;div class = &quot;l&quot;&gt;Message:&lt;/div&gt;</code> <code>&lt;div class = &quot;r&quot;&gt;&lt;textarea name=&quot;message&quot; rows=&quot;7&quot; cols=&quot;30&quot;&gt;&lt;/textarea&gt;&lt;/div&gt;</code> <code>&lt;/div&gt;</code> <code>&lt;div class = &quot;a&quot;&gt;</code> <code>&lt;div class = &quot;r&quot;&gt;&lt;input type=&quot;submit&quot; value=&quot;Send your message&quot;&gt;&lt;/div&gt;</code> <code>&lt;/div&gt;</code> <code>&lt;/form&gt;</code></td>
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<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>Possible Answers:</th>
<th>mark *2</th>
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<tr>
<td>1.</td>
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<td>source link is incorrect.</td>
<td>2 Marks</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>browser does not support images</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Problem in downloading image</td>
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</tr>
<tr>
<td>4.</td>
<td></td>
<td>Image has been corrupted.</td>
<td></td>
</tr>
</tbody>
</table>

| c (i) | Incorrect | 1 |
| c (ii) | Incorrect | 1 |
|       | body{ color: red; or body{color: red;}
|       | background-color: yellow;} body{ background-color: yellow;}
|       | no consider only 'Correct' | 1 |
| c (iii) | Correct | 1 |

<p>| c (ii) | Correct | 1 |</p>
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<tbody>
<tr>
<td>2</td>
<td>a(i)</td>
<td>00001010</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>a(ii)</td>
<td>11100111</td>
<td>1</td>
</tr>
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</table>
|   | a(iii) | Add two numbers together  
11110001 (Optional) | 1 |
|   | a(iv) | Check the most significant bit.  
If it is 0, the sign is positive, just convert the number to decimal. (Optional)  
If it is 1, the sign is negative, perform the 2’s complement.  
<sup>not consider conversion must be added</sup> | 1 |
|   | b(i) | Possible answers  
<em>Security, Privacy, Reliability</em>  
<em>Hacking</em> | 1 Mark *  
2 = 2 Marks |
|   | b(ii) | Yes.  
<sup>Justification : B2C or Business to Consumer” is a business transaction where products and services are sold through the Internet for convenience of consumers. Internet banking is a B2C form of a service organization where banking services are offered to customers online.</sup> | 1 Mark |
|   | b(iii) | Yes.  
<sup>A bank usually evaluates certain conditions to screen loan applications before sending the application for further processing and approval. These conditions are domain specific and usually checked by a domain expert.</sup> | 1 Mark |
|   |   |   | 1 Mark |

Note: As the decision making process involves reasoning under uncertainty, lack of data etc. and can be implemented as a set of If-Else conditions, it could be automated as an expert system. That expert system could be used to provide a loan pre-processing interface for loan applicants to check their suitability to apply for a loan before submitting an application to the bank.
<table>
<thead>
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<th>3</th>
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<th>YES or closed</th>
<th>1</th>
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<tr>
<td>a(ii)</td>
<td>Energy cannot be created or destroyed</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Therefore no possibility of new energy coming from outside and destroyed energy going out.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>instituteCode + unitCode can be used</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b(ii)</td>
<td>NOT NULL,</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRIMARY KEY,</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FOREIGN KEY</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c(i)</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c(ii)</td>
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<td>1</td>
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<table>
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<th>Address size = 32 bits</th>
<th>1</th>
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<td>No. of unique addresses = $2^{32}$</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max no. of bytes uniquely addressable = $2^{32}$</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max no. of bytes usable = $2^{32} = 2^2 \times 2^{30}$</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max usable size of memory = 4GB</td>
<td>1</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>(b)</th>
<th>Current state</th>
<th>Next possible state</th>
<th>Condition for transition from the running state</th>
<th>1 Mark * 6 = 6 Marks</th>
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</thead>
<tbody>
<tr>
<td>Running</td>
<td>Exit</td>
<td>Terminated</td>
<td>Completion of the process</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ready</td>
<td>Waiting</td>
<td>Allowed time slice finished / Time out</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blocked</td>
<td>Event wait</td>
<td></td>
<td></td>
</tr>
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</table>
1. (a) Explain how to derive a Boolean expression from a given truth table.

(b) In residential electrical wiring, the following circuit has been used to operate a light in a staircase.

As in the above circuit, two switches S1 and S2 are installed at the bottom and the top of the staircase to operate the lamp L. The lamp turned on by using the switch S1 at the bottom of the staircase can be turned off by using the switch S2 at the top of the staircase. Further, the lamp turned on by using switch S2 at the top of the staircase can also be turned off by using the switch S1 at the bottom of the staircase. Moreover, the lamp L turned on by a switch can be turned off by the same switch.

Assume that the connections to positions X and Y of a switch in the above circuit are represented by the truth values 1 and 0 respectively and the turned on and turned off states of the lamp L are represented by the truth values 1 and 0 respectively.

(i) Construct a truth table to represent the functionality of the above circuit.

(ii) Derive a Boolean expression to represent the truth table obtained in section (i) above.

(iii) What is the logic gate which is equivalent to the functionality of the Boolean expression obtained in section (ii) above?

(iv) Construct a logic circuit for the Boolean expression obtained in section (ii) above with NOT, AND and OR gates only.

<table>
<thead>
<tr>
<th>Ques No</th>
<th>Part</th>
<th>Answer</th>
<th>Marks</th>
</tr>
</thead>
</table>
| 1)      | a    | Case 1: Logical truth value of output is 1  
Sum of products (SOP)  
Case 2: Logical truth value of output is 0  
Products of sums (POS)  
Any of the above cases, 3 mark | 3 |
| b) i)   |      | ![Truth Table](attachment:truth_table.png)  
= \text{OR} \ or \ \text{output, if NOT define output default 1}  
L & S_1 \cdot \overline{S_2} + S_1 \cdot S_2 = L  
\text{Complete statement}  
\overline{(S_1 + \overline{S_2}) \cdot (\overline{S_1} + S_2)} = L  
or \ \text{with or without } L | 4 |
| ii)     |      | S_1 \cdot \overline{S_2} + S_1 \cdot S_2 = L  
\text{XNOR Gate or}  
\overline{S_1} \ \overline{S_2} \ \overline{S_1} \ \overline{S_2}  
L | 3 |
| iii)    |      | ![XNOR Gate Diagram](attachment:xnor_gate.png)  
Complete diagram 3 marks (if not 0 mark) | 2 |
| iv)     |      | ![Logic Circuit](attachment/logic_circuit.png)  
Complete diagram 3 marks (if not 0 mark) | 3 |
2. (a) The IP address 125.214.169.218 is assigned to the server www.doenets.lk. The ping 125.214.169.218 command issued from the machine A reported a round trip time (RTT) of 20 ms. However, the ping www.doenets.lk command, issued some time later from the machine A, reported an error.

(i) Draw a network diagram to depict the server, machine A and any other required components to describe the above scenario.

(ii) Identify two possible causes for the above behaviour and explain them using the diagram developed in section (a) (i) above.

(b) An organization has only one public IP address, 192.248.17.1, allocated to it. The organization has decided to allow web browsing on the computers on its LAN with 100 computers. It also wants to optimize the usage of its Internet connection by reducing the traffic on the link as much as possible.

Draw a network diagram to satisfy the above requirements. Explain the major decisions you made.

Identify, two possible causes for the above behavior and explain using the diagram developed in section
* Not copy DNS server - failure
* Not configure DNS server - configuration problem
* Network down in second time - network problem.
The National University of Information Technology is a well-recognized university. They offer both bachelor's and post-graduate degree programmes, diplomas as well as short courses in information technology and business management. All teaching of the above courses is being conducted at their sophisticated classrooms and state-of-the-art computer laboratories specifically designed to provide a student-centred interactive learning experience. The management of the university has realized that their brand name has become well known in the country as the number of inquiries they receive from far away provinces has increased. Furthermore, a recent study has revealed that their short courses and diplomas are also very popular among working professionals despite the burdens of their busy work schedules as well as the limited time available to devote for education. Hence, the management has proposed to start a distance education programme with the objectives of providing new value-added services and capturing new markets.

(a) Propose an ICT based system to implement the above distance education programme. Describe its main components by using a simple diagram.

(b) Explain three advantages of the proposed system.

(c) Discuss three challenges of the proposed system.

(d) The management thinks that agent technology based techniques could be used to overcome some of the above challenges. Do you agree with this statement? Justify your answer.
3) a. Identification of “E learning system”/ “E education platform” (or similar)

Note: If Learning Support System is written as the answer, the environment needs to be mentioned as e-learning.

![E learning system diagram]

3) b. i. Learning at preferred times
   ii. No geographical barriers
   iii. Increase employment opportunities
   iv. Online testing
   v. Less operational costs
   vi. Learning at own pace

(1 mark for list of advantages and 1 mark for explanation)

3) c. i. How to facilitate active teacher student interactions
   ii. Getting students to interact with other students
   iii. Conducting practical examinations
   iv. Course material preparation
   v. Evaluation of the learning process and progress
   vi. Lack of ICT resources and infrastructure

3) d. Yes/No (if the challenges are not related to agent technology) (1 mark)

Explain including any two of the below (2 marks)

   i. Material preparation agent (locating materials from the web)
   ii. Learning process management agent (Appropriate learning sequence/lesson planning)
   iii. Learner support agent (Identification of weak performers, providing additional learning resources, etc.)
   iv. Collaboration support agent
   v. Assessment agent

4. a. Explain why compilers or interpreters are needed when using high level programming languages.

(b) Your teacher has requested you to write a Python program to record the marks obtained by students at the term test. Each student has sat for the same three papers and each mark was given as an integer value out of 100 marks. Each student is identified by a unique index member which is also an integer. You should record the marks of student in a text file named ‘marks.txt’ in the following format.

   Index_no_1,mark_11,mark_12,mark_13
   Index_no_2,mark_21,mark_22,mark_23
   ..........................................

Where

   Index_no_X : Index number of the Xth student; X = 1, .............., n
   mark_XY : Marks obtained by the Xth student for the Yth paper; Y = 1, 2, 3

Index numbers and marks of the students should be entered through the keyboard, one item at a time and the program should be terminated when -1 is entered as the index number.

   (i) Propose an algorithm by using a flowchart for the program.
   (ii) Write a Python program to implement your flowchart.
Programs written in high level languages cannot be understood by the processors of a computer. Thus Interpreters/Compilers are needed to convert the programs in high level languages to the language understood by the computer (Machine languages).

```
4) a

Start

Open the File

Read a index number (i)

i = -1 ?

Yes

No

Read the first mark (x)

Read the second mark (y)

Read the third mark (z)

Write i,x,y,z to the file

Close the File

End

b(i)

f = open("marks.txt","w")
index_no = int(input("Enter the next index no:"))
while (index_no != -1):
    x = input("Enter the first mark:")
    y = input("Enter the second mark:")
    z = input("Enter the third mark:")
    data = str(index_no)+","+x+"","+y+"","+z+"\n"
    f.write(data)
    index_no = int(input("Enter the next index no:"))
    f.close()
```

- **Correct open statement = 1 Mark** (Should have the left variable to = + open keyword + file name “marks.txt” in double quotation + “w” in double quotation;)
- **Correct close statement = 1 Mark**
- **Correct statement to read an index no = 1 Mark** (the result may be converted to int)
- **Correct loop statement = 1 Mark** (while keyword + correct comparison – index_no can be a string or an integer depending on how it is read)
- **Reading marks = 1 Mark** – if at least syntax of a single line is correct
- **Making the output string to write = 1 Mark** – f.write needs a string as its parameter
- **Writing to the file = 1 Mark**
5. A pharmacy named "DR Chemists" sells drugs to patients. A patient should produce a prescription to a pharmacist at the pharmacy to buy drugs. A prescription has one or more drugs prescribed by a doctor. A doctor can issue more than one prescription for a patient. However, a prescription is issued by one doctor. Pharmacist prepares a bill for each prescription and gives it to the patient. Five (05) pharmacists at the pharmacy handle all prescriptions.

A pharmacist handles more than one prescription while one prescription is handled only by one pharmacist. The upper part of the prescription contains the patient information such as name, age, address and telephone number. The middle part of the prescription consists of one or more drug names, quantities to be issued and the dosages. At the bottom part name, address and telephone number of the hospital and the name of the doctor are available.

The owner of the pharmacy wants to keep the necessary information to prepare the following list of reports.

1. Number of prescriptions handled by each pharmacist.
2. Number of prescriptions issued by each doctor.
3. List of information about doctors, their hospitals and drugs prescribed by them.
4. List of daily cash collection of the pharmacy.

Prepare an ER diagram to model the data required to produce the above reports. State clearly all your assumptions, if any.

| 1 mark – each entity (1 x 8 entities) |
| 1 mark – each relationship (except relationships with Pharmacy entity) (1 x 5 relationships) |
| 2 mark – Correct attributes attached to Hospital and Doctor entities |
6. Draw a context diagram to show the overview of the library system described below. Clearly indicate external entities and data flows of your diagram and state any acceptable assumptions that you have made.

The National Information Technology Library (NITL) provides e-books to its users through an online system named “Library Information Processing System (LIPS)”.

A person should submit an application to NITL to become a member of the LIPS. The NITL evaluates the application and enters it to the LIPS, if it is approved. After entering the application data, LIPS issues an activation code to NITL which in turn passes it to the relevant person. Once the activation code is received the person becomes a member of LIPS. A member can obtain his/her username and password by providing the activation code to the LIPS. A member can subsequently access e-books by entering his/her username and the password to the LIPS.

![Context Diagram](image)

Strictly follow standard notations.
Data flows between External Entities should be specified with dotted lines.

***

Part I

<table>
<thead>
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<th>Answer</th>
<th>Q. No</th>
<th>Answer</th>
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