

Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (ලුස්ස පෙළ) විභාගය, 2015 අගේස්තු කළුවිප් පොතුන් තුරාතුරුප් පත්තිර (෉ ය්‍ර තු)ප ප්‍ර්‍රිත්සේ, 2015 ඉකළුව් අධ්‍යාපන පොදු සහතික පත්‍ර (ලුස්ස පෙළ) විභාගය, 2015 අගේස්තු කළුවිප් පොතුන් තුරාතුරුප් පත්තිර (෉ ය්‍ර තු)ප ප්‍ර්‍රිත්සේ, 2015 ඉකළුව් General Certificate of Education (Adv. Level) Examination, August 2015

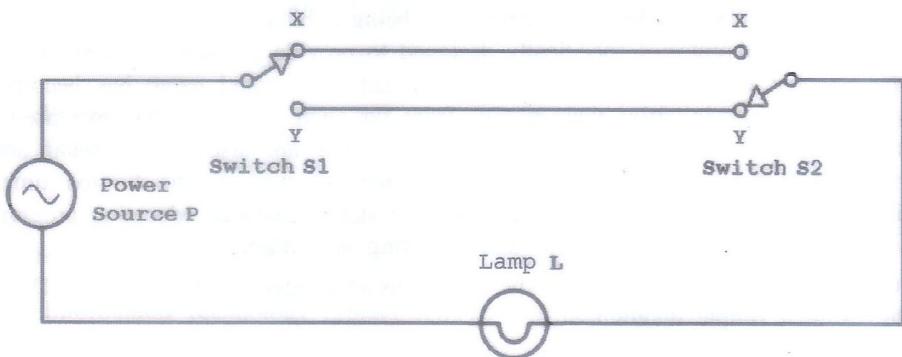
தொரந்து கூ சுங்கிலிவீடு தொகை ணைய	III
தகவல், தொடர்பாடல் தொழினுட்பவியல்	III
Information & Communication Technology	III

20 E II

Part B

* Answer any four questions only.

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.

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.

3. The National University of Information Technology is a well-recognized university. They offer both bachelors 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.

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.

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.

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.

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