

தொழிற்சாலை மற்றும் தொழிற்சாலை துறை தொழிற்சாலை மற்றும் தொழிற்சாலை துறை	III
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## Part B

\* Answer any four questions only.

1. A switch (A), a temperature sensor (B) and a timer (C) of an air-conditioner determine turned on and turned off states of the air-conditioner. Turned on and turned off states of the air-conditioner as well as the 'ON' and 'OFF' states of the switch, temperature sensor and the timer are represented by the logical values 1 and 0, respectively.

The air-conditioner can be turned on or off manually by setting the switch to its 'ON' or 'OFF' states, respectively.

The temperature sensor detects the temperature in the room. The temperature sensor sets its state as 'ON' or 'OFF' when the detected temperature is respectively higher or lower than a pre-defined temperature value. The air-conditioner is automatically turned on or off when the detected temperature is respectively higher or lower than the pre-defined temperature value.

The timer sets its state as 'OFF' until it reaches a preset time value and sets the state as 'ON' once it reached. The air-conditioner is automatically turned off when the timer reaches the preset time value.

(a) Construct a logic circuit using only NOR gates to control the air-conditioner. Clearly show truth table, Boolean expression and Boolean algebraic rules used for simplification. Assume that the electricity is always supplied to the air-conditioner.

(b) The user of the air-conditioner says that the switch is not required for the operation of the air-conditioner. Do you agree with this statement? Justify your answer.

2. A “Demilitarized Zone (DMZ)” is a subnet that contains and exposes an organization’s external-facing services such as web servers (public IP addresses) to the Internet while hiding away the rest of the network behind a firewall (using local IP addresses).

A network with a DMZ belonging to an organization has been assigned the public IP address range 123.45.67.0 with subnet mask 255.255.255.224. The DMZ contains the web server and the mail server. It has 4 additional subnets for internal use having the private IP address range 10.0.0.0 with the subnet mask 255.0.0.0. Computers in each subnet can access resources in all other subnets. The organization decided to connect the 4 subnets to the Internet through a proxy server. There is also an application server for its internal clients.

Identify the devices required to establish this network and draw a network diagram to show the logical arrangement of the organization's computer network. Show all the elements of the network with appropriate IP addresses. Clearly show all calculations stating assumptions you made.

Further, it is also required to explain the changes done to an IP packet released by a computer to a subnet by the proxy server when it travels to the Internet.

3. A state health authority decided to conduct an awareness program as an online service through Internet to reduce dengue infection by transmission of the virus through the mosquitoes. This service provides information on how to adopt dengue control approaches, such as cleaning the environment, destroying non-essential containers that provide larva habitats etc., in order to minimize mosquitoes' propagation.

- (a) To which e-commerce type does this service belong?
- (b) If the service is extended by allowing organizations to register their services targeting minimizing the spread, what is the e-commerce type of this extended service? Justify your answer.
- (c) Assume that a registered organization provides a service for itself to submit the details of the identified dengue breeding places to the state authority online. Why is this service **not** rightly considered as B2B? What is the correct e-commerce type of this service?

(d) An expert system is proposed to develop policies to fine the owners of the locations where dengue mosquitoes have been detected. Accordingly, experts in Attorney General's Department and epidemiology units are consulted. State key contributions that are expected from each expert to develop the Knowledge base of the expert system. (Hint: The contribution of one expert should be an input to the decision making process of the other expert).

4. The consumption of electricity at houses is charged based on the number of units consumed. The first 64 units are charged at Rs. 5.00 per unit, and the rest at Rs. 10.00 per unit.

- Draw a flowchart to represent an algorithm that can be used to compute the total amount to be charged from a householder when the household number and present and the previous readings of the electricity meter are given.
- Encode the algorithm given in the (a) above in Python programming language. State all valid assumptions, if any.
- Develop a function in Python to write household number, meter readings and the total amount to be charged at the end of an existing text file named "deb.txt".

5. The candidates who have been selected for university entrance should register for the given academic year with the university given to them. Candidates who do not register before the 'Last date' announced by each university will lose their university entrance. Once a candidate registers with the given university, the candidate becomes a registered student of that university. Registered students can apply for financial support, such as Mahapola scholarships and Bursary, separately. These financial supports could be either full or partial. All registered students will receive a laptop. However, its ownership cannot be transferred to another student. The user requirements of the above system are listed below. A user shall be able to obtain:

- a list of students registered for a given academic year with a given university.
- information (such as model, serial number and warranty period) about the laptops given to each student.
- list of students who applied for financial support.

Draw an Entity Relationship (ER) diagram required to design a database to represent the above system description and to satisfy the user requirements. State all your assumptions clearly.

6. Environmental Institute of Colombo intends to develop a website to provide information on an art competition for students. A web page from this website and another web page with the entry form to register for the competition are shown in the Figure 6.1 and Figure 6.2 respectively.

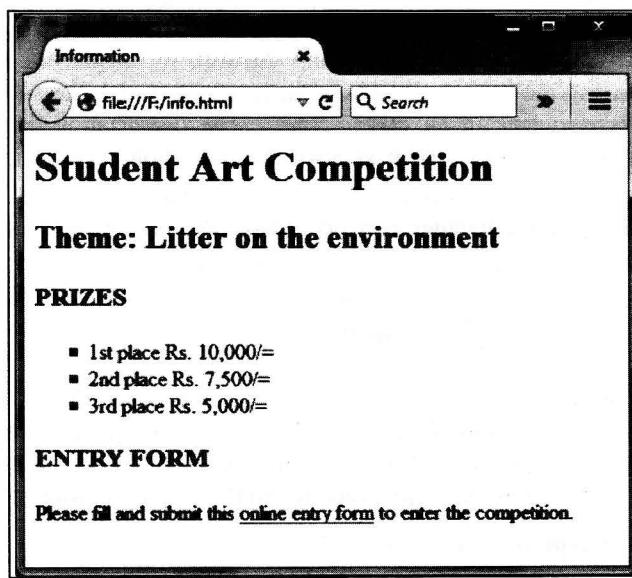


Figure 6.1: A web page of the website

- Using appropriate HTML tags, create an HTML file required to render the web page as shown in Figure 6.1. Your code should satisfy the following requirements.

It is required to format the text of the list in 'Calibri' font, 14 points high, in red color. The list should be bulleted with squares. Format the list by using internal or external style sheets only.

Further, when a user clicks on the hypertext 'online entry form' on the web page, the entry form given in Figure 6.2 should be rendered on a new tab/page. Assume that the name of the HTML file of the web page with the entry form is 'form.html'.

**Art Competition Online Entry Form 2017**

**Theme: Litter on the environment**

Name:

Gender:  Male  Female

Grade Category

Art media:

Water Colours  
 Colour Pencils  
 Crayon  
 Chalk

Figure 6.2: Entry form

(b) Using appropriate HTML tags, create an HTML file to render the entry form given in Figure 6.2. The options for 'Grade Category' are given in the Figure 6.3. Your code should satisfy the following requirements. When the 'Clear your Entries' button is clicked, all the entries of the form should be cleared. Similarly, when the 'Submit' button is clicked, the form should be submitted to the server.

Grade Category

Grade 1 - 2
Grade 3 - 6
Grade 7 - 10
Grade 11 - 13

Figure 6.3: Options for Grade Category

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