(20) Information & Communication Technology

Structure of the Question Paper

Paper I - **Time : 02 hours**
This paper consists of **50** multiple choice questions with 5 options each.
All question should be answered. **02 marks** for each question and the total is **100**.

Paper II - **Time : 03 hours** (In addition, 10 minutes for reading)
This paper consists of **two** parts : **Structured essay** and **essay**.
Part A – **Four** structured essay type questions. **All** question to be answered.
10 marks for each question and total is **40**.
Part B – **Six** essay type questions. **Four** questions to be answered. **15** marks for each question and total is **60**.

Total marks of Paper II = 100

Calculation of the final mark :   Paper I   =   100
Paper II   =   100
Final mark   =   200 ÷ 2 = <u>100</u>

Paper I

Important :

∗ Answer **all** questions.
∗ Select the **correct or most appropriate** answer. (A multiple choice answer sheet would be provided at the examination)

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1. Who invented the Analytical Engine?
    (1) Alan Turing   (2) Charles Babbage   (3) Bill Gates
    (4) Von Neumann   (5) John Vincent Atanasoff

2. Which of the following statement is true about computers developed during the past?
    (1) Transistors are used in the first generation computers.
    (2) Assembly languages are used as the programming language in the first generation computers.
    (3) Vacuum tubes are used in the second generation computers.
    (4) Integrated circuits are used in the third generation computers.
    (5) Assembly language programs cannot be executed on the third generation computers.

3. What is the two's complement representation of the decimal 86, if an integer is represented by 8 bits?
    (1) 01010110   (2) 01110110   (3) 01010010
    (4) 00010110   (5) 01001110

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4. Which of the following decimal number is equivalent to the two's complement binary number 11000110?
    (1)   −85   (2)   −58   (3)   −56
    (4)   −78   (5)   −68

5. $7E_{16} + 101101_2$ is equal to,
    (1) 011101011_2 (2) 175_{10} (3) AA_{16}
    (4) 173_{10} (5) AB_{16}

6. Consider the following truth table:

A	B	A AND B	A XOR B	NOT A	NOT A AND ((A AND B) OR (A XOR B))
0	0	0	0	1	P
0	1	0	1	1	Q
1	0	0	1	0	R
1	1	1	0	0	S

    Which of the followings correctly specifies the truth values of P, Q, R and S in that order?
    (1)   1, 0,0,0   (2)   1,1,0,0   (3)   1,0,0,1
    (4)   0,0,1,0   (5)   0,1,0,0

7. Assume that two bits A and B are given to a half adder. Which of the following statement is correct with respect to the output of the half adder?
    (1)   It always produces 00 as the output.
    (2)   Output becomes 0 when both A and B are set to 1.
    (3)   When A is 1 and B is 0, it gives 0 as the output.
    (4)   When the values of A and B are set to 0 it produces 10_2 as the output.
    (5)   When the values of A and B are set to 1 it produces 10_2 as the output.

8. A circuit is developed by connecting a full adder to a half adder to add three bits. Overflow (carry out) of the full adder is given to the half adder as an input. Which of the following is correct?
    (1)   The circuit produces correct results when the most significant bit is zero.
    (2)   It gives correct results when the most significant bit is 1.
    (3)   It always produces correct results.
    (4)   Information given is not enough to determine its output.
    (5)   The most significant bit has no influence on its output.

9. Which of the following statements about the seven-state process transition diagram is true?
    (1)   A process in **running** state will change its status to the **ready** state when it generates an I/O event.
    (2)   The processes in the **Blocked/Suspended** state are in the main memory.
    (3)   The status of a process in the **blocked** state should change to **running** after completion of the blocked event.
    (4)   The status of a process in the **running** state can be changed either to **exit** or **ready** states only.
    (5)   When a process is created its status should be **running**.

10. Consider the following statements about operating systems :

A – An operating system is a program.

B – An operating system is loaded to the main memory during the booting process.

C – In desktop computers Operating systems are stored in ROM.

Which of the above is/are correct?

(1) A only   (2) B only   (3) C only

(4) A and B only   (5) All A, B and C

11. Consider the following functions :

A – Loading a program from the secondary storage to the main memory.

B – Managing the hard disk space.

C – Finding the number of characters in a text file.

Which of the above is/ are the main function(s) of an operating system?

(1) A only   (2) B only   (3) C only

(4) A and B only   (5) All A, B and C

12. Which of the following is correct with respect to the off-the-shelf software?

(1) They always satisfies all user requirements.

(2) Their prices are always very high.

(3) The cost for the development of an off-the-shelf product is effectively split across numerous buyers.

(4) They are designed for individual client's requirements.

(5) The risk of failure is very high.

13. Which of the following is correct regarding system deployment?

(1) User training is part of system deployment.

(2) It is a process of testing system at the developer's location.

(3) Unit testing is one of the main activities in system deployment.

(4) Integration testing is done in system deployment.

(5) It is the act of copying ONLY the software developed from developer's location to client's location.

14. Which of the following characteristics of a good test case binds system requirements to a test case?

(1) Accuracy   (2) Economy   (3) Traceability

(4) Repeatability   (5) Reusablility

15. Consider the following components :

A – Input controls

B – Navigational components

C – Informational components

D – Containers

Which of the above are components of an user interface?

(1) A and B only   (2) B and D only

(3) A, B and C only   (4) B, C and D only

(5) All A, B, C and D

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16. Consider the following :
    A – System boundary
    B – External entities
    C – Major information flows between the entities and the system.
    D – Flow of data between external entities and the processes.
    Which of the above are components of a context diagram?
    (1) A and B only   (2) B and D only
    (3) A, B and C only   (4) B, C and D only
    (5) All A, B, C and D

17. Which of the followings is correct with respect to non functional requirements of a system?
    (1) They define what a system is supposed to do.
    (2) They define how a system is supposed to be.
    (3) They are specific behaviors of a system.
    (4) They are usually in the form of "system shall do <requirement>".
    (5) They represent system functions.

18. Economic feasibility of a system ………………
    (1) involves with cost/benefit analysis.
    (2) evaluates hardware and software.
    (3) determines whether the organization's needs can be met by implementing the proposed system.
    (4) estimates the time required for the completion of the project.
    (5) determines the technical resources required for the project.

19. Which of the following is correct with respect to a Web Portal?
    (1) Web portal is a specially designed email server.
    (2) It is a specially designed web site that brings information from diverse sources.
    (3) Search engines are web portals.
    (4) It is a hardware device which is used to get internet connection.
    (5) Web portal is a single web page.

20. Which of the following is an essential item of the World Wide Web (WWW)?
    (1) Email server   (2) Styles
    (3) Uniform Resource Locator (URL)   (4) Search engine
    (5) Database server

21. Which of the following CSS rules can be used to change the colour of a link to green when clicked?
    (1) a:link{color: green}   (2) a.link{color: green}
    (3) a:visited {color: green}   (4) a.visited {color: green}
    (5) a {color: green}

22. Which of the following statements could be used to change the style of a paragraph in a document?
    (1) < p style = "color : red ; font - style : italic" >
    (2) < p style = {color : red ; font - style : italic" } >
    (3) < style > p {color : red ; font - style : italic ; } < /style >
    (4) < style > p "{color : red ; font - style : italic ; }" >
    (5) < p style = color : red ; font - style : italic >

- Consider the following HTML script to answer questions 23 and 24. Assume that the name of this script is index. php

```
<!DOCTYPE html>
<html lang="en">
<head>
<title>Record Data </title>
</head>
<body>
 <form action="index.php" method="POST">
 Index number:<br>
 <input type="text" name="index">
 <br>
 Name:<br>
 <input type="text" name="name">
 <br>
 <input type="submit" name="submit" value="Submit">
</form>
 <?php
 if(isset($_POST['submit'])){
  $conn = new mysqli('localhost', 'root', 'root@1234','school');
  if ($conn->connect_error) {
  die("Connection failed: " . $conn->connect_error);
  }
  $sql = "insert into student(id,name) values('".$_POST['index']."','".$_POST['name']."');";
  if ($conn->query($sql) == TRUE) {
    echo "New record inserted successfully";
  } else {
   echo "Error: " . $sql . "<br>" . $conn->error;
  }
 $conn->close();
  }
  ?>
  </body>
  </html>
```

23. Which of the following will happen when this script is renderd?
    (1) There would be only one input box and a button with the label "submit" on the screen.
    (2) There would be only two input boxes on the screen.
    (3) There would be only two input boxes and a button with the label "submit" on the screen.
    (4) There would be only a button with the label "submit" on the screen.
    (5) There would be some text, two input boxes and a button on the screen.

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24. Which of the following would happen when a user clicks the button on the screen that is displayed when the script is rendered?
(1) The form data is displayed on the screen.
(2) A script named "index html" is executed.
(3) A database connection to a database named "localhost" is created.
(4) A new record is inserted to a database.
(5) The message "New record inserted successfully" may be displayed.

25. Consider the following statements about flowcharts :
A – Flowcharts can be used to communicate the logic of a solution for a problem with your friends.
B – Before developing a flowchart, it is required to know the programming language to be used to implement the flowchart.
C – Every flowchart should have at least one selection symbol.
Which of the above statements is/are true?
(1) A only   (2) B only   (3) C only
(4) A and B only   (5) B and C only

26. Consider the following flowchart and the statements:
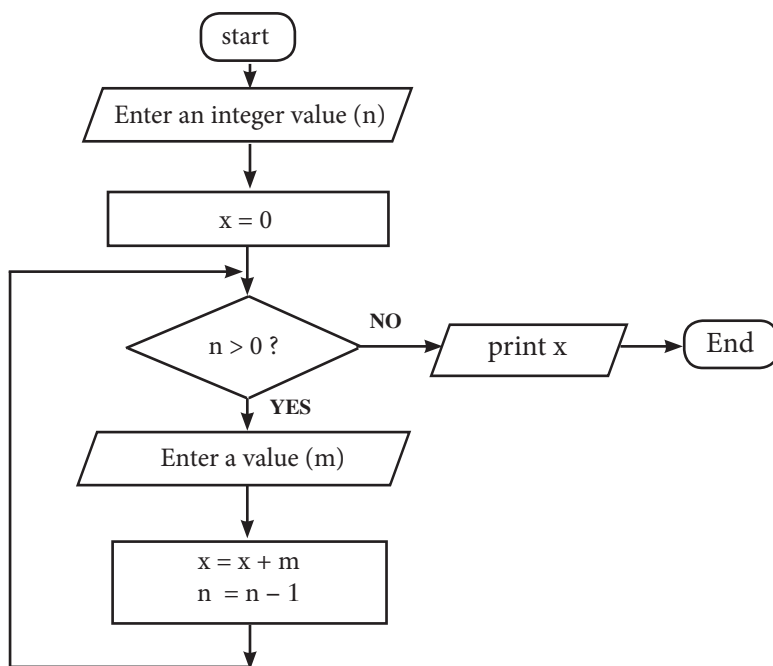
A – When n =0, the output value would be 0.
B – The algorithm does not produce any output for negative values of n.
C – When n = 2, the algorithm expects three input values.

Which of the above statements is/are correct?
(1) A only   (2) B only   (3) C only
(4) A and B only   (5) B and C only

•   Consider the following relations to answer question 27 to 30 :
teacher (teacher_id, teacher_name, date_of_birth, author_id)
book(book_id, book_name)
author (author_id, author_name, email_address)
authorOfbook(author_id, book_id)

publisher(publisher_id, publisher_name, contact_number, email)
publisherOfbook(publisher_id, book_id)

Where teacher_id, book_id, author_id and publisher_id are unique attributes in the relations teacher, book, author and publisher respectively.

27. Which of the following statement is correct with respect to the above relations?
    (1) teacher_id is a part of the primary key in teacher relation
    (2) author_id in teacher relation can take NULL value
    (3) author_id and book_id in authorOfbook relation can take NULL value
    (4) book_id is a candidate key of publisherOfbook relation
    (5) author_name in author relation is a candidate key

28. Which of the following Entity Relationship (ER) diagrams would generate the above relations?

    (1)

    (2)

    (3)

    (4)

    (5)
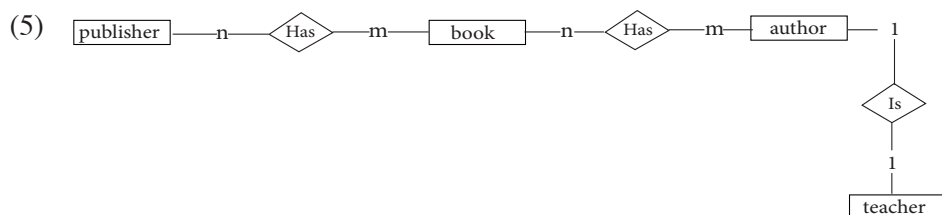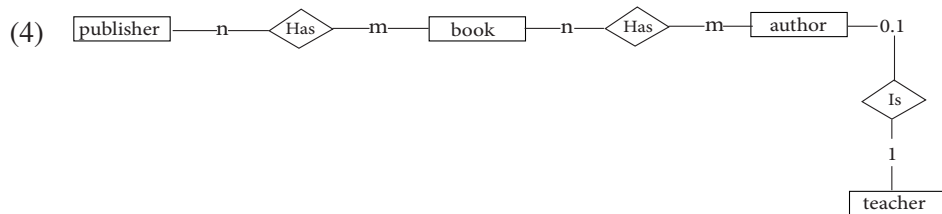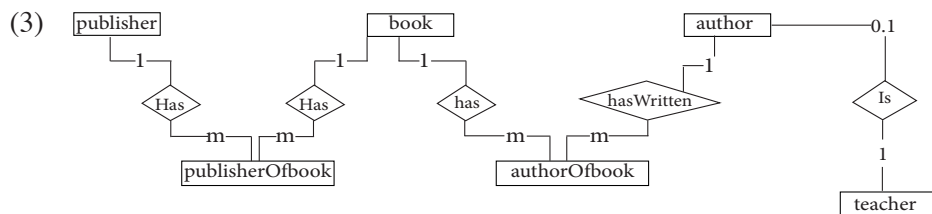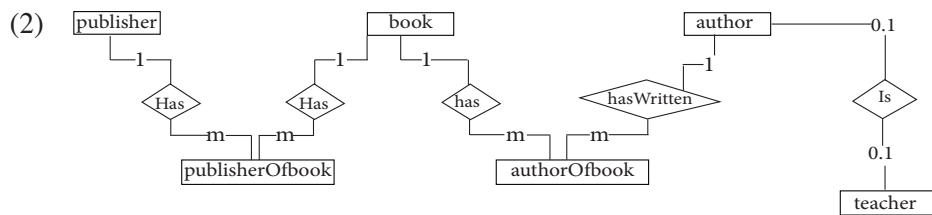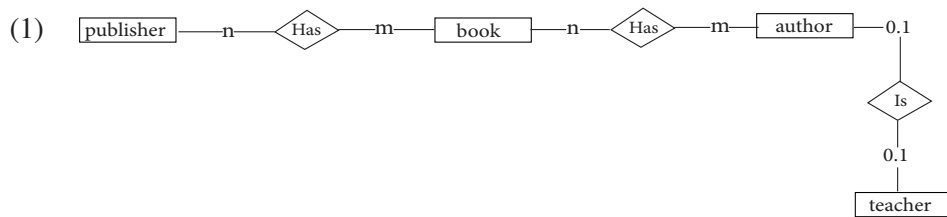
29. Assume that the above relations are converted into tables in a relational database. The following SQL query is executed on the database :

SELECT* FROM teacher WHERE author_id is NOT NULL

Which of the following statement is correct regarding the output of the above SQL query?

(1) It cannot be an empty table.

(2) The tables teacher and author are used to produce the output.

(3) The attribute author_name is in it.

(4) The attribute publisher_name is in it.

(5) All teacher records with a value in the author_id attribute of teacher table are in the output.

30. Consider the following statements regarding the Data Definition Language (DDL) used to create the table publisherOfbook while maintaining data integrity.

A – It has a foreign key constraint

B – It has a primary key constraint

C – It has a domain constraint

Which of the above statement(s) is/are correct?

(1) A only   (2) A and B only   (3) A and C only

(4) B and C only   (5) All A, B and C

31. Consider the following relation :

Student (index_no, student_name, date_of_birth, hobbies)

Where index_ no is a uniqe attribute and hobbies is multivalued attribute with 2 values in maximum.

Which of the following relation/s represents the above Student relation in first normal form?

(1) Student(index_no, student_name, date_of_birth, hobby_1)

(2) Student(index_no, student_name, date_of_birth, hobby_1, hobby_2)

(3) Student(index_no, student_name, date_of_birth) and hobby(hobby_1, hobby_2)

(4) Student(index_no, student_name, date_of_birth) and hobby(hobby_id, hobby_1, hobby_2)

(5) Student(index_no, student_name, house_id), hobby(hobby_id, hobby_name) and student_hobby(index_no, hobby_id)

32. Suppose you have the following IP address 192.16.5.133/29. What are the number of bits needed to identify the network, and the number of bits needed to identify the host :

(1) 29 bits and 3 bits   (2) 28 bits and 3 bits

(3) 30 bits and 2 bits   (4) 28 bits and 4 bits

(5) 29 bits and 4 bits

33. In a communication network, when a message arrives at its destination, in order to deliver it to the correct application program running at the application layer, which of the following address must be consulted?

(1) MAC address   (2) IP address

(3) port address   (4) DNS address

(5) application address

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34. Which of the following packet field is updated, during normal IP packet forwarding in a router?

(1) Time To Live (TTL) value
(2) Source IP address
(3) Destination IP address
(4) Source MAC address
(5) Destination address

35. Which of the following statements about a TCP connection is correct?

A – Reliable data transfer
B – Connection oriented
C – Guaranteed delivery

(1) A only
(2) B only
(3) C only
(4) A and B only
(5) All A, B and C

36. Which of the following statements about fiber optic is correct?

A – The attenuation is extremely low
B – The bandwidth provided is high
C – Fiber optic is immune to electromagnetic interference

(1) A only
(2) B only
(3) C only
(4) A and B only
(5) All A, B and C

37. Which of the following statements is correct with respect to IOT?

(1) A device with or without a switch with on and off can be used in an IOT application.
(2) In an IOT application, only connected devices are available.
(3) In IOT, devices talk to each other.
(4) All IOT applications are highly secured systems.
(5) Privacy is always protected in IOT systems.

38. Which of the following is a benefit of ICT for the society?

(1) Student can access content at any time.
(2) Student can access content from anywhere .
(3) Provide equal educational opportunities for everyone.
(4) Supports collaborative learning.
(5) Allows anyone to publish anything.

39. What are the basic components of a computer systems?

(1) Input, Output, Processing unit
(2) Input, Output, Processing unit, Storage, users
(3) Input, Output, Processing unit, Storage
(4) Keyboard, Monitor, CPU, RAM
(5) Keyboard, Monitor, CPU, RAM, ROM

40. Which of the followings is correct with respect to big data?

(1) High volume is one of the features of big data.
(2) Big data is always structured.
(3) Data generated through social media such as Facebook cannot be considered as big data.
(4) A Management Information System (MIS) is always required to collect big data.
(5) Python is not a suitable programming language to manage big data.

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41. Which of the following is the most widely used requirement gathering method in a system development project?
    (1)   Observation
    (2)   Questionnaire
    (3)   Interviews
    (4)   Collecting information from documents
    (5)   Engage in real work

42. Consider the following activities :
    A – Determine whether a project is economically, socially, technologically and organizationally feasible.
    B – Find facts and ascertain the end user requirement of the system.
    C – Determine how the end users would operate a system.
    Which of the above activities are done during the system analysis stage in a systems development project?
    (1)   A only   (2)   A and B only
    (3)   A and C only   (4)   B and C only
    (5)   All A, B and C

43. Which of the following statements is true?
    (1)   YouTube is a content provider in a B2C service.
    (2)   Google.com is an example for a web portal in a B2C service.
    (3)   ebay.com is a example for a C2B service.
    (4)   e-banking service is information brokers under B2C service.
    (5)   doenets.lk an example for B2G service.

44. Consider the following statements :
    A – An Expert System is a Decision Support System.
    B – In an Expert System the reasons for an answer can be derived.
    C – Online Medical Support System is an example for Expert Systems.
    D – An Expert System has Inference Engine which updates its knowledge base.
    Which of the above statement/ s is/are correct regarding Expert Systems in Artifical Intelligence?
    (1)   A and D only   (2)   B and C only   (3)   A,B and C only
    (4)   A, B and D only   (5)   A, C and D only

45. Assume that the following Python statement is executed :
    D={1:'76', 2:'77', 3:'78' }
    Which of the following statements would generate an error?
    (1)   A = D[2];   (2)   D[1] = [1,2,3]   (3)   A= D['1']
    (4)   A = D.keys()   (5)   A = D.values()

46. Consider the following Python statements :
    A – a,b = (2,[3,4])
    B – a = 2,3,4
    C – a = b,c = (1,[2,3])
    Which of the above statements is/are valid?
    (1)   A only   (2)   B only   (3)   C only
    (4)   A and B only   (5)   All A, B and C

47. What is the output of the following Python statement?
    print("%s - %s"%(1,[2,3]))
    (1) 1,2,3   (2) 1,[2,3]   (3) 1 – [2,3]
    (4) 1 – 2,3   (5) 1 – 2 - 3

48. Which of the following Python programs writes data correctly into a file named "output.txt"?
    (1) f = open("output.txt", "r")
        print(1,2,3,file=f)
    (2) f = open("output.txt", "w")
        print(1,2,3,file=f)
    (3) f = open("output.txt", "r")
        print(1,2,3,file=f)
        close(f)
    (4) f = open("output.txt", "w")
        print(1,2,3,file=f)
        close(f)
    (5) f = open("output.txt", "w")
        print(1,2,3, f)
        close(f)

49. What would be the output of the following Python program when it is executed?
    x = ""
    for i in range(1,10):
        if i % 2 = 0:
            x = str(i)+x;
    print(x)
    (1) 12345678910   (2) 123456789   (3) 246810
    (4) 108642   (5) 8642

50. Consider the following Python function :
    def f1(x=0, y = 30):
        if x > y:
            return x
        else:
            return y
    Which of the following statement is correct regarding the above function?
    (1) The function call f1(20,30) returns the value 20.
    (2) The function call f1(y=20, x=10) would generate an error.
    (3) The function call f1(20) would generate an error.
    (4) The function call f1() would generate an error.
    (5) The function call f1(y = 40) would return the value 40.

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Paper II

Important :

∗ Answer **all** questions in Part A.

∗ Answer **four** questions from Part B.

Part A
Structured Essay

1. A company wishes to introduce a video-on-demand system to public over the Internet. A producer can produce a video and submit it to the company for acceptance. Once a video is received by the company for acceptance, the company appoints a panel of reviewers to review and accept the video for the video library. When a video is accepted, it will be added to the video library and inform the producer. It not, video will be rejected and inform to the producer with the reasons for rejection.

    Viewer can go through the list of videos available in the video library and subscribe. Subscribers can watch the videos at any time.

    At the end of each month, the company calculates the monthly payment of each subscriber and produces an invoice. These invoices should be sent to all subscribers by a delivery man employed by the company.

    Answer the following questions.

    (a)   What are the entities in the scenario?

        (i)   ....

        (ii) ....

        (iii) ....

        (iv) ....

    (b)   Draw a context diagram to represent the above scenario.

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(c)   List the processors in the scenario

(i)   ....

(ii)   ....

(iii)   ....

(iv)   ....

(v)   ....

(vi)   ....

(vii)   ....

(d)   What are the data storages required?

(i)   ....

(ii)   ....

(iii)   ....

(iv)   ....

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(e)   Draw level 1 DFD for the above scenario.

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2.(a) Give an example for each of the following concepts in operating systems.

    (i)   "Multi-processing" and "Multi-tasking"

....

....

....

....

    (ii)   "Realtime-processing" and "Online Processing"

....

....

....

....

(b) State the main usage of Registers inside a Central Processing Unit (CPU) during program execution.

....

....

....

....

(c) List the main components of an Internet Of Things (IOT) system.

....

....

....

....

....

....

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3. A web page has to be developed to enable individual students of a school to submit their personal details on-line to the server maintained at the school. The information required to capture are given in the first column of the following table. Fill the second column with the most appropriate input controls required to capture those information.

Complete the third column by providing your justification for selecting such controls.

(a)

1st Column	2nd Column	3rd Column
Information to be captured	**Most appropriate input control**	**Justification**
Name with initials		
Gender (Male/Female)		
Name of the Class Teacher (To be selected from a list)		
Sports(Cricket, Football, Netball, Swimming,Chess)		

(b) Consider the following CSS rules.

```
p {
   color : red;
}
. blue {
     color : blue; }
#green {
     color : green; }
. pink p {
     color : pink;
}
```

State the color of the text in the following paragraph. Give reasons for your answer.

HTML code segment	Color	Reason
< p > Piduruthalagala < / p>		
< p class = "blue" > Piduruthalagala < / p >		
< p class = "blue" id = "green" > Piduruthalagala < / p >		
< div class = "pink" > < p > Piduruthalagala < / p > < / div >		

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4. A database has to be created in a school to store the following information.

Registration number	Name	Gender	Class	Name of the class teacher	Sports
A0001	Saman K	Male	12A	Sumana B	Cricket, Swimming
A0002	Anura A B	Male	12A	Sumana B	Chess
A0003	Mohan T	Male	12B	Rukmalee P	
A0041	Malki M	Female	12D	Shehan T	Basket Ball, Chess
A0042	Subha D	Female	12D	Shehan T	Netball

(a) What are the main problems that might occur when the above data is entered to a single table of a relational database?

(i) ....

(ii) ....

(b) Propose a method that you can use to design a database to overcome problems stated in above (a).

....

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(c) Obtain relevant relations using the method that you have proposed in above (b).

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(d) Give DDL statements needed to create the table from given relations in above (c).

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Part B
Essay

1. In a fish tank, the health of goldfish depends on the pH value of the water, temperature and oxygen level of the water in the tank. A sensor based control system is to be developed to make a healthy environment for the survival of gold fish by maintaining appropriate levels of pH value, temperature and oxygen level of the water of the fish tank. For this purpose a pH sensor (A), a temperature sensor (B) and an oxygen sensor (C) are to be used to measure the pH level, temperature and oxygen level of the water respectively.
The following table shows the status of each sensor with the relevant binary values to be emitted by the sensors.

Sensor	Status	Binary values
A	pH value from 6 to 8 pH value not within 6 to 8	0 1
B	Temperature between 55 and 80 Fahrenheit Temperature not within 55 and 80 F	0 1
C	Oxygen is less than a given value Oxygen is greater than or equal to given value	0 1

The binary value '0' indicates the appropriate condition for the goldfish.

An automatic waterfall is connected to the fish tank. The waterfall starts automatically when the temperature is not within the range or the oxygen level is less than the given value. The waterfall stops automatically to save the power consumption when the temperature is at the range and the oxygen level is high. When the pH value of the water is out of the given range, a bulb in the tank is lighted.

The start and stop states of the waterfall are represented by the binary values "1" and "0" respectively.

Construct a logic circuit to implement the function of the waterfall. Give the truth table and boolean expression.

2. A new computer lab has to be established with 23 computers. Public IP address 192.150.100.2 is given for this lab to access the Internet. You are requested to propose a network diagram with a subnet mask for this network and assign suitable IP address for each device attached to it. The network should be secured from the threats coming from outside.

Identifying the required devices, draw a network diagram with the relavant IP addressess for the proposed network.

3. A Hotel Management School in Sri Lanka has decided to computerize its course management to offer an efficient service to its local and overseas candidates. A candidate can access the website of the Hotel Management School and find the his/ her eligibility for the courses provided by the Hotel Management School. Then the candidate is allowed to select a course and enroll for the eligible course by providing his/her personal and educational qualifications. A candidate can apply for maximum of three courses. The registrar of the Hotel Management School views all the applications and decides whether to accept or reject an application. Once accepted, the candidate should enroll for the selected course by paying 1/3 of the course fee plus Rs.1,000/= as processing fee within three months of selection through the payment gateway attached to the system.

(a) Draw the Business Activity Model (BAM) and define the system boundary giving reasons.

(b) The school administration decided to extend the above computerized system by introducing an assistance system to find the suitable courses according to students' career objectives, personal interest, etc.

Propose a suitable Artificial Intelligence (AI) based solution to implement the above assistance system. List down key components in the above AI based System.

4. A school awards 4 types of medals at its annual prize giving ceremony by considering the average marks obtained by each student at the end of year examination. The medal type is decided by using the following table.

Medal Type	Gold	Silver	Bronze	Merit
Average Mark	100-90	89-85	84-80	79 - 75

In addition to above medals, special awards are given for the students who have obtained the highest average mark.

Your class teacher has requested you to develop an application to print the admission number and medal types of all students eligible for medals and also the admission numbers of students eligible for the special awards after entering the admission numbers and average marks of all students. Develop an algorithm for this application. Encode your algorithm by using the Python programming language.

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5. A student who sits for G.C.E.(A/L.) examination can apply for any 3 subjects in English, Sinhala or Tamil medium. School candidates should submit their applications to the principals of respective schools. Upon receiving applications, principals should forward applications to the Department of Examinations. The private candidates should directly submit their applications to the Department of Examinations. The Department of Examinations sends admissions to the applicant directly.

   Prepare an Entity- Relationship (ER) diagram to represent this scenario.

6. A phone company wishes to build an on-line application for its customers to see the payment he/she has made for a given month in a year in the past. Assume that the amount paid by each customer is saved in a table named "usage" in a MySQL database. The relation corresponding to the "usage" table is usage(telephone_number, year, month, amount_paid_ for_the_month). Give an HTML script and a back-end php program needed for this application.

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