AL/2019/20/E-I (NEW)

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NEW

இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ற்
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තොරතුරු හා සන්නිවේදන තාක්ෂණය I தகவல், தொடர்பாடல் தொழினுட்பவியல் I **Information & Communication Technology I**	**20 E I**	පැය දෙකයි இரண்டு மணித்தியாலம் ***Two hours***

Instructions:

- *Answer **all** the questions.*
- *Write your **Index Number** in the space provided in the answer sheet.*
- *Instructions are also given on the back of the answer sheet. Follow them carefully.*
- *In each of the questions **1** to **50**, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct or most appropriate** and **mark your response on the answer sheet with a cross (×) in accordance with the instructions given on the back of the answer sheet.***
- *Use of calculators is **not allowed**.*

1. Which of the following is a hardware device that maps *virtual addresses* to *physical* addresses?

(1) bus (2) cache memory (3) control unit
(4) memory management unit (5) register

2. Which of the following represents the bitwise AND operation of the two binary numbers 01010101 and 10101010?

(1) 00000000 (2) 00001111 (3) 11001100 (4) 11110000 (5) 11111111

3. Use of public key and private key in *encryption* and *decryption* processes is called

(1) asymmetric encryption. (2) digital encryption. (3) hybrid encryption.
(4) private key encryption. (5) symmetric encryption.

4. In a particular network, each node is connected directly to a central network device. This topology is referred to as a

(1) bus. (2) hybrid. (3) mesh. (4) ring. (5) star.

5. Consider the following activities related to e-commerce:

A – online purchase of a pair of shoes
B – online purchase of an e-book of your favourite novel
C – online booking of a taxi to the airport from your home

Which of the above activities represent/s the *pure-click* type business model?

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

6. Which of the following shows the correct order of *software testing*?

(1) acceptance testing ⟶ system testing ⟶ integration testing ⟶ unit testing
(2) unit testing ⟶ acceptance testing ⟶ system testing ⟶ integration testing
(3) unit testing ⟶ integration testing ⟶ acceptance testing ⟶ system testing
(4) unit testing ⟶ integration testing ⟶ system testing ⟶ acceptance testing
(5) white-box testing ⟶ black-box testing ⟶ system testing ⟶ unit testing

[See page two

7. A software development company identifies that their new system development project has complex requirements and has a *medium* to *high* risk level. Further, an evaluation is needed to clear the requirements and significant changes are expected during system development.

What is the most suitable software development process model for this project?

(1) agile
(2) prototyping
(3) rapid application development
(4) spiral
(5) waterfall

8. Which of the following made a significant contribution to the growth of **Information and Communication** Technology (ICT) usage?

A - exponential progress of the semiconductor technology paving the way for low cost hardware
B - introduction of user-friendly software and interfaces to computers
C - merge of computer and communication technologies to produce smart and mobile devices

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

9. Which of the following is the correct statement to connect to "login.php" from an HTML form?

(1) <form action ="GET" method ="/login.php">
(2) <form action ="/login.php" method ="GET">
(3) <form submit ="GET" method="/login.php">
(4) <form submit="/login.php" method="GET">
(5) <form target"=/login.php" method="GET">

10. Which of the following HTML code lines is correct to create a hyperlink to the words "Department of Examinations" using the URL: http://www.doe.index.html?

(1) http://www.doe.index.html
(2) Department of Examinations
(3)
(4) http://www.doc.index.html
(5) Department of Examinations

11. On his single processor computer, a user starts a spreadsheet application and creates a new spreadsheet. To get some information required for the spreadsheet he opens a **large** database using his Database Management System (DBMS). After completing his spreadsheet he saves it.
Which of the following operating system features has/have being used by the above user?

A - context switching
B - file management
C - virtual memory

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

12. A smart environment can be created by having an interconnected network of hardware devices, sensors, connectivity and required software, which is often referred to as the *Internet of Things* (*IoT*). Which of the following statements is correct about IoT?

(1) Every IoT device or item must be connected using UTP cables.
(2) If any item of the IoT setup fails to operate the entire IoT setup will be shutdown.
(3) IoT environments cannot be monitored and controlled remotely.
(4) Modern smart mobile phones cannot be connected to an IoT setup.
(5) The Internet connectivity is not essential for an IoT setup to function.

13. Which of the following indicates a *non-functional* requirement?

A – A user shall be allowed to upload an image to the system to be used as his/her profile picture.

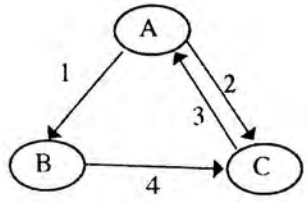
B – The correct invoice value should be calculated including applicable tax rates at the check-out.

C – The system must satisfy 99.9% availability of service.

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

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

14. Consider the process transition diagram in the figure:



If the transitions shown are as follows:

1 – Process blocks for input/output

2 – Scheduler picks another process

3 – Scheduler picks this process

4 – Input/output is completed

then what are the states indicated by the labels A, B and C respectively?

(1) A: Blocked B: New C: Ready

(2) A: New B: Ready C: Running

(3) A: Ready B: Running C: Blocked

(4) A: Running B: Blocked C: Ready

(5) A: Running B: New C: Blocked

- Consider the following database table to answer the questions **15** to **17**.

Student_Sport

Student_Id	Event_Id	Event_Name
10012	S-02	Carrom
10022	S-01	Basketball
10018	S-02	Carrom
10012	S-03	Volleyball
10025	S-04	Chess
10018	S-01	Basketball

15. In which normal form does the above table exist?

(1) BCNF (2) First normal form (3) Second normal form

(4) Third normal form (5) Zero normal form

16. Consider the following statements regarding the above table:

A - It has a composite primary key.

B - *Event_Name* attribute is fully dependent on the primary key of *Student_Sport* table.

C - *Event_Id* is a candidate key.

Which of the above statements is/are correct?

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

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

17. It is required to add a new field called ***Age*** to the *Student_Sport* table and the values of the new field must be greater than 10.

Which one is the correct SQL statement to implement the above requirement?

(1) Alter table *Student_Sport add check* (*Age*> 10);

(2) Alter table *Student_Sport add where* (*Age*> 10);

(3) Alter table *Student_Sport set check* (*Age*> 10);

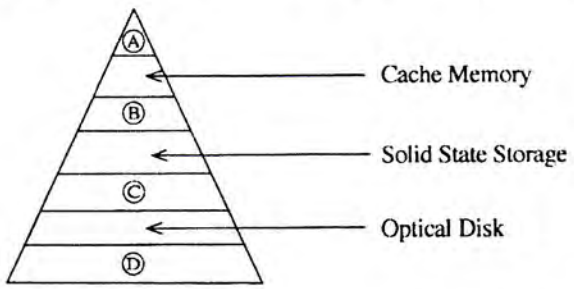
(4) Update table *Student_Sport add check* (*Age*> 10);

(5) Update table *Student_Sport add where* (*Age*> 10);

[See page four]

18. Which of the following SQL commands is **not** available in the Data Manipulation Language (DML)?
(1) CREATE (2) DELETE (3) INSERT (4) SELECT (5) UPDATE

19. In the memory hierarchy diagram given, which of the following represents Ⓐ, Ⓑ, Ⓒ and Ⓓ respectively?



(1) Magnetic Tape, Magnetic (Hard) Disk, Random Access Memory (RAM), Processor Registers
(2) Processor Registers, Magnetic (Hard) Disk, Random Access Memory (RAM), Magnetic Tape
(3) Processor Registers, Random Access Memory (RAM), Magnetic (Hard) Disk, Magnetic Tape
(4) Processor Registers, Random Access Memory (RAM), Magnetic Tape, Magnetic (Hard) Disk
(5) Random Access Memory (RAM), Processor Registers, Magnetic (Hard) Disk, Magnetic Tape

20. Which of the following represents the result of the binary arithmetic operation of 11001100 - 01010101?
(1) 00110011 (2) 01100110 (3) 01110111 (4) 10011001 (5) 10101010

21. Which of the following statements is/are correct about *two's complement*?
A - Subtraction is carried out as addition.
B - Calculations are more efficient.
C - It is possible to represent negative numbers within the two's complement.
(1) A only (2) B only (3) A and B only
(4) B and C only (5) All A, B and C

22. Which of the following statements correctly describe/describes *hackers*?
A - They are bored and lonely anti-social teenagers who attack computer systems as a challenge and sometimes for profit.
B - They are IT skilled people who attack computer systems of individuals and businesses as a form of competition.
C - They are organized crime groups that deploy highly automated and sometimes highly targeted attacks against computer systems of individuals and businesses for certain benefits.
(1) A only (2) B only (3) A and C only
(4) B and C only (5) All A, B and C

23. Which is the most suitable HTML form element input type in which the user can enter his credit card secret number?
(1) textarea (2) type="checkbox" (3) type="hidden"
(4) type="password" (5) type="text"

24. Consider the following statements regarding the Extended Entity Relationship (EER) model.
A - EER model includes all the concepts of the original ER model.
B - EER model has additional concepts of specialization/generalization.
C - EER model includes a new concept to model the weak entities.
Which of the above statement/s is/are correct?
(1) A only (2) B only (3) A and B only
(4) A and C only (5) All A, B and C

25. Which of the following are the properties of a signal?
(1) Amplitude, Clock time, Frequency and Wavelength
(2) Amplitude, Frequency, Phase and Time
(3) Amplitude, Frequency, Phase and Wavelength
(4) Amplitude, Frequency, Time and Wavelength
(5) Amplitude, Impulse, Phase and Wavelength

26. Which of the following options contains only *guided media*?
(1) Coaxial, Fiber optics and Infrared
(2) Coaxial, Fiber optics and Microwave
(3) Coaxial, Fiber optics and Twisted pair
(4) Coaxial, Infrared and Twisted pair
(5) Fiber optics, Satellite communication and Twisted pair

27. The *frequency modulation* technique is used to change only
(1) the amplitude and frequency.
(2) the amplitude, frequency and phase.
(3) the amplitude and phase.
(4) the frequency.
(5) the frequency and phase.

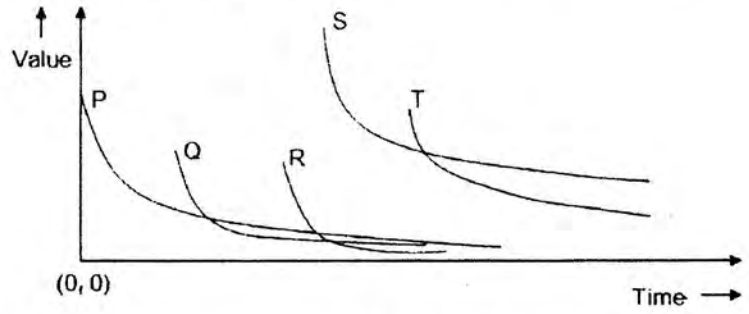
28. Which of the following is a valid example for a PHP variable name?
(1) *@class_name* (2) *&class_name* (3) *$class name*
(4) *$class_name* (5) *_class_name*

29. What is the binary equivalent to decimal 54.25 ?
(1) 00011111.11 (2) 00101010.01 (3) 00110110.01
(4) 00111011.1 (5) 00111110.1

30. Which of the following is a valid example for CSS **class** selectors?
(1) .myclass{color:blue;font-family:serif;}
(2) #myclass{color:blue;font-family:serif;}
(3) myclass{color:blue;font-family:serif;}
(4) myclass:{color:blue;font-family:serif;}
(5) myclass;{color:blue;font-family:serif;}

31. Which one of the following is **false** regarding the HTML form methods GET and POST?
(1) Both methods are used to transfer data from client side to the server.
(2) GET method is more efficient than the POST method.
(3) GET method is more suitable to send sensitive data.
(4) POST method does not have a limit on size of data.
(5) POST requests cannot be bookmarked.

32. The diagram shows the variation of value of information with time for five events of a single mission in the chronological order. Information about the entire mission especially about the occurrences of each event is made available on-line real time.



Consider the following statements related to the above mission:

A - Only the events P, Q and R comply with the Golden Rule of Information.

B - Event S has the highest demand and needs to be facilitated with the highest technical resources.

C - The value of an event can be determined reasonably using the demand for the information about the particular event.

Which of the above statements related to this mission is/are valid?

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

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

33. Consider the following statements related to *nature inspired computing*:

A – In *nature inspired computing* natural phenomena/scenario are observed and used to design and develop computing models to solve complex problems.

B – Artificial Intelligence can use *nature inspired computing* for improving its ability to understand and solve computationally challenging problems.

C – Computing models and algorithms developed under *nature inspired computing* can only be used in natural environments such as rain forests, oceans and wild-life sanctuaries.

Which of the above statements is/are **incorrect**?

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

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

34. What is the correct statement related to system deployment?

(1) Direct deployment is the most complex and the slowest form of deployment.

(2) In pilot deployment, all the users have the ability to use the system at the beginning.

(3) In parallel deployment old and new systems are used at the same time.

(4) Phased deployment do not allow users to develop skills required for new system gradually.

(5) Phased deployment means the entire system is used in one location.

35. Consider the following statements:

A – A *hub* connects only the networked computers but a *switch* connects multiple devices.

B – A *switch* manages the ports and the VLAN security settings.

C – In data transmission, a *hub* uses bits while a *switch* uses frames and packets.

D – The data transmission speed in a *hub* is higher than that in a *switch*.

Which of the above statements are correct?

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

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

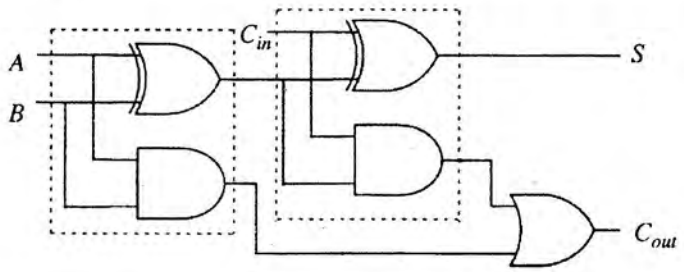
36. Consider the following statements about the *proxy server*:

A – It helps to hide the true IP address.
B – It is used to restrict the access of the website in the network.
C – It uses the cached data for the quick loading of regularly accessed websites.
D – It helps to detect the locations of the visitors and load web pages as per their needs.

Which of the above statements are correct?

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

- Consider the following logic circuit diagram to answer the questions **37** and **38**:



37. Which of the following statements is/are correct about the above circuit?

I - It implements a full adder.
II - The logic function of S can be stated as $S = A \oplus B \oplus C_{in}$.
III - The logic function of C_{out} can be stated as $C_{out} = AB + BC_{in} + AC_{in}$.

(1) I only (2) II only (3) I and II only
(4) II and III only (5) All I, II and III

38. Which of the following statements is/are correct about the part of the circuit within the area surrounded by the dotted line?

I - It implements a half adder.
II - It can be implemented using only AND and OR gates.
III - It can be implemented using only NAND gates.

(1) I only (2) II only (3) III only
(4) I and III only (5) All I, II and III

39. Consider the Karnaugh map shown below:

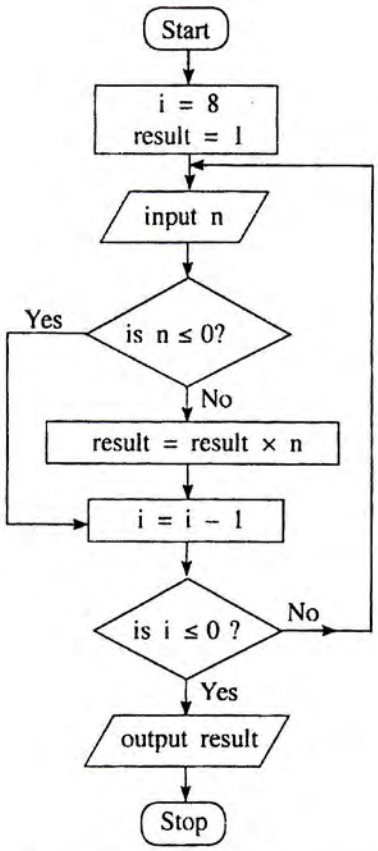
C \ AB	00	01	11	10
0	0	0	0	1
1	1	1	0	1

Which of the following is the correct logic expression that corresponds to the two marked segments on the Karnaugh map?

(1) $A\overline{B} + B\overline{C}$ (2) $\overline{A}\overline{C} + AB$ (3) $(\overline{A} + \overline{C})(A + B)$
(4) $(A + C)(\overline{A} + \overline{B})$ (5) $AC + \overline{A}\overline{B}$

[See page eight

- Consider the following flowchart to answer the questions **40** to **42**:



40. Which of the following statements is/are correct about the algorithm expressed by the flowchart?

A – It takes 8 inputs.
B – It outputs the product of the positive numbers in the input.
C – If every input is zero, then the output will be zero.

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

41. If the following is fed as the input to the algorithm, what will be the output?

3 2 -4 4 1 -9 5 -6 -1

(1) -25920 (2) -216 (3) 120 (4) 216 (5) 25920

42. Which of the following Python programs has/have the same functionality (i.e., the same output for a given input) as the algorithm in the flowchart above?

A –
```
i = 8
result = 1
while (i > 0):
    n = int(input())
    if (n > 0):
        result = result * n
    i = i-1
print (result)
```

B –
```
result = 1
for i in range(8):
    n = int(input())
    if (n > 0):
        result = result * n
print (result)
```

C –
```
result = 1
i = 8
while 1:
    n = int(input())
    if (not(n <= 0)):
        result = result * n
    i = i - 1
    if (i <= 0):
        break
print (result)
```

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

[*See page nine*

43. Which of the following statements is correct?

(1) A high level language program that is translated into machine code and executed on computer X will not execute on another computer having the same processor as X.

(2) A program in a high-level language must be first converted into assembly language code before converting into machine code.

(3) Interpreted programs run faster than compiled ones.

(4) Programs in some high-level languages are translated into a form called byte-code because such byte-codes execute faster than machine codes obtained by usual compilations.

(5) Some modern processors execute programs in high-level languages without translating them into machine code.

44. What is the value of the following Python expression?

```
(100 // 3) % 4 | 8
```

(1) 0 (2) 0.125 (3) 3 (4) 8 (5) 9

45. What will be the output if the following Python code is executed with "abcabc" as the input?

```
result = 1
s = input()
if (len(s) > 3):
    result = 2
if (len(s) < 6):
    result = 3
elif (len(s) > 6):
    result = 4
else:
    result = 5
print(result)
```

(1) 1 (2) 2 (3) 3 (4) 4 (5) 5

46. What will be the output of the following Python code?

```
x = 100
for i in range(1,5):
    x = x - i
print(x)
```

(1) 0 (2) 5 (3) 85 (4) 90 (5) 100

47. What will be the output of the following Python code segment?

```
L = [1,-2,4,3,2,-7,11,2,8,-1]
x = 0
for i in range(len(L)):
    if (L[i] < 0):
        continue
    if (L[i] > 10):
        break
    x = x + L[i]
print(x)
```

(1) 0 (2) 1 (3) 10 (4) 21 (5) 31

[See page for

48. What will be the result when the following Python code is executed?

```
x = 50
def func(y):
    x = 2
    y = 4
func(x)
print(x)
```

(1) 50 (2) 2 (3) 4 (4) syntax error (5) name error

49. Which of the following is **not** an information stored in a *Process Control Block* (*PCB*) of the operating system?

(1) free disk slots (free disk blocks that could be utilized by the process)
(2) memory management information for the process
(3) program counter (address of the next instruction to be executed for the process)
(4) process identification number (unique identifier for the process)
(5) process state (e.g., Blocked, Ready, etc.)

50. Consider the following SQL statement:

Update school set contact_person='Sripal W.' *where school_id*='04';

Which of the following is true when the above SQL statement is executed?

(1) It adds an additional field with the name *contact_person* and adds value into that new field as 'Sripal W.' only in the records having *school_id* = 04
(2) It adds an additional value to the *contact_person* as 'Sripal W.' only in the records having *school_id* = 04
(3) It changes the field name of *contact_person* as 'Sripal W.' when selecting the records with *school_id* = 04
(4) It changes the value of *contact_person* as 'Sripal W.' only in the records having *school_id* = 04
(5) It selects all the records having *school_id* = 04 and *contact_person* as 'Sripal W.'

* * *



Part A – Structured Essay

*Answer **all four** questions on this **paper itself**.*

Do not write in this column

1. (a) (i) Draw the expected output of the following HTML code segment when rendered by a web browser.

```
<html>
<body>
<!--Effects of Social Networking -->
<p>Social networking has <br> <u>advantages</u> and disadvantages </p>
</body>
</html>
```

(ii) Draw the expected output of the following HTML code segment when rendered by a web browser.

```
<html>
<body>
<table border="1">
<caption>Schedule</caption>
<tr><th>Time</th><th>Event</th></tr>
<tr><td>8 am</td><td>Drama</td></tr>
<tr><td>10 am</td><td>News</td></tr>
<tr><td colspan =2> Lunch</td></tr>
</table>
</body>
</html>
```

(b) (i) Write **two** advantages of using *external style sheets* when creating a web page.

(1) .....

(2) .....

Do not write in this column

(ii) Consider the following HTML elements require the styles as given in the table.

Element Name	Attribute	Attribute Value
p	*color* *font-family* *text-align*	*red* *Calibri* *justify*
h1	*color* *font-family*	*red* *Calibri*
h2	*color* *font-family* *text-align*	*red* *Calibri* *justify*

Write an *external style sheet* in the **most efficient way** to fulfil the above requirements using only the **CSS group selector** concept.

.....

.....

.....

.....

(c) The following PHP code is intended to add data into '**name**' and '**class**' fields of the table named '**student**' in the MYSQL database called '**school_db**'. User name and password to login to '**school_db**' are '**admin**' and '**A!2t***' respectively.

Complete the PHP code segment by filling the blanks.

```
<?php
  $conn = new mysqli('localhost', ..... . ..... , .....);
  if ($conn->connect_error) {
      die("Connection failed: " . $conn->connect_error);
  }

  $sql = "..... into ..... (..... , .....)
  values ('Piyal', '12-B')";

  if ($conn->query(.....) ==true) {
      echo "New record created successfully";
  } else {
      echo "Error: " . $sql . "<br>" . $conn->error;
  }

  $conn->close();
?>
```

(see page four

Do not write in this column

2. (a) Match each of the given phrases (i) - (vi) relating to commerce with the most suitable item from the list below:

List = {*advertising as a revenue model, credit-cards, Government e-Tendering service, Government to Citizen (G2C) service, group purchasing, harmful explosives, online marketplace, payment gateway, perishable goods, social commerce, subscription as a revenue model, traditional marketplace*}

Phrases:

(i) a place where buyers and sellers interact physically for exchanging goods and services for a price

(ii) these are usually prohibited to be sold or purchased through e-commerce systems

(iii) users pay a regular fee to have full access to a website of a business

(iv) a subset of e-commerce that involves using social media to assist in the online buying and selling of products and services

(v) facilitates a payment transaction by the transfer of information between the e-commerce application and the back-end financial service providers through secure means

(vi) the renewal of vehicle revenue licence using the Online Vehicle Revenue Licence Service offered by the relevant government office

Note: Write only the matching item against the phrase number.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

(vi) .....

(b) Consider the following Python program:

```
x = 0
n = int (input ( ))
while (n > 0):
    if n > x:
        x = n
    n = int (input ( ))
print (x)
```

(i) Write the output of the program if the input is 4 6 3 2 8 –1.

.....

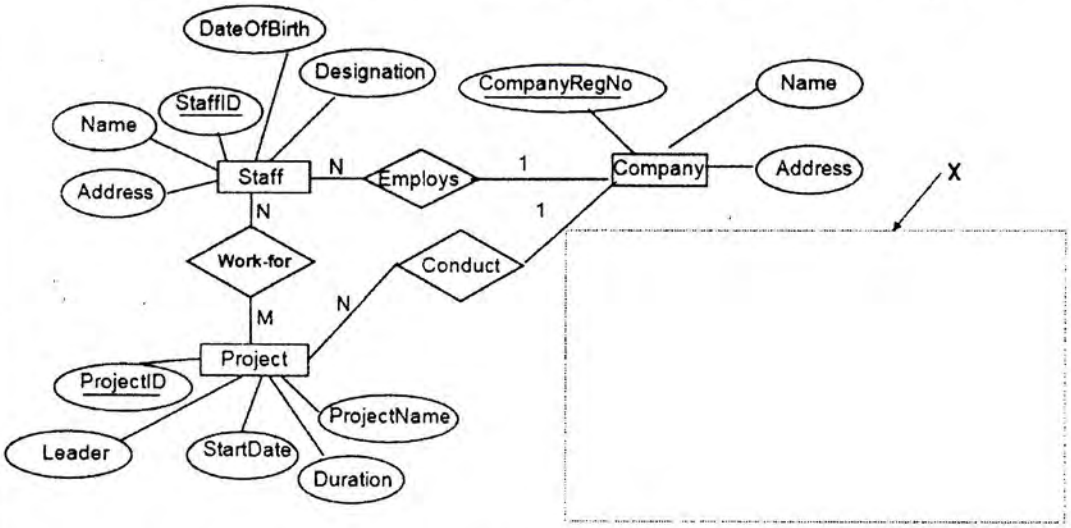
(ii) What is the purpose of this program?

.....

.....

3. (a) Consider the following Entity Relationship (ER) diagram which represents the information about projects conducted by staff attached to a software development company.

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(i) The number of hours (*NoOfHours*) that each staff member works on each project is recorded.
Draw the attribute *NoOfHours* in the relevant position of the ER diagram with the correct symbol and the label.

(ii) For each accepted project, a temporary location is rented for the staff, for the duration of the project. For each Location, the OwnerName, PhoneNo, Address, Rent, RentedDate and RentedPeriod are recorded. One project has only one location. A rented location is used for only one project. When a certain project is completed, the location rented for the project will be released and handed over to the owner.
Draw the Entity 'Location' with relevant attributes inside the area X in the diagram and link it to the existing ER diagram by indicating the cardinality.

(b) Write down the most appropriate term from the given list to fill the blank in each statement given below.

List = {*ALOHA, Application Layer, CIDR, DHCP, Domain Name System, Network Layer, Packet Switching, Parity Bit, Parity Byte, Proxy Server*}

(i) ..... provides IP addresses for the given URLs and web addresses.

(ii) File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP) and the Telnet service are implemented in the ..... .

(iii) With the ..... a device may get a different IP address every time it connects to the network.

(iv) ..... helps to effectively manage the available IP address space.

(v) In data transmission, for the process of error detection, a ..... is added to a binary string to ensure that the total number of 1-bits in the string is either even or odd.

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4. (a) An operating system uses *Process Control Blocks* (*PCBs*) to maintain important information about each process.

Read the following scenario and answer the given questions:

Rani starts a computational application on a single processor computer. While the relevant computations are in progress, she starts a web browser application as well, in order to search for some information.

Write down the content that will be stored in the following PCB fields of the ***computing process*** when the "*computing process* → *web browser process*" context switch is made.

(i) Program counter

.....

(ii) Process state (*Ready*, *Running* or *Blocked*?)

.....

(b) (i) What is meant by *contiguous file space allocation*?

.....

.....

.....

.....

(ii) Write down **one** drawback of *contiguous file space allocation.*

.....

.....

.....

(iii) However, contiguous allocation is feasible to store a set of files on a CD ROM. Why?

.....

.....

.....

(iv) In addition to the normal data items, write down **one** other information that will exist in a file block in the *linked file space allocation scheme*.

.....

(c) Assume that a 32 KB program is run on a computer having 32 KB of physical memory. The page size of the system is 4 KB. The page table of this process at a particular time is shown on the table below.

Notes:

- Only a few selected fields of each page table entry is shown.
- The *frame number* is indicated in binary.
- The virtual addresses on page 0 are from 0 to 4095 and on page 1 are from 4096 to 8191 and so on.
- The *Present/absent* bit indicates the validity of the entry. If this bit is 1, the entry is valid and can be used. If it is 0, then the relevant virtual page is not in physical memory.

Page number	Frame number	Present / absent
0	110	1
1	001	1
2	010	1
3	100	1
4	011	1
5	000	0
6	000	0
7	101	1

[see page seven

(i) Assume this program requires accessing virtual address 8200. To which physical address will it get transformed to?

.....

(ii) Write down **one** advantage that the use of page tables bring with respect to program sizes compared to the size of physical memory.

.....

.....

.....

.....

(iii) Give **one** reason as to why a particular page of a process could be absent in physical memory.

.....

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නව නිර්දේශය/புதிய பாடத்திட்டம்/New Syllabus

NEW ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2019

තොරතුරු හා සන්නිවේදන තාක්ෂණය II
தகவல், தொடர்பாடல் தொழினுட்பவியல் II
Information & Communication Technology II

20 E II

Part B

* *Answer any four questions only.*

1. The Boolean function known as the *majority function* takes n binary inputs and outputs 1 if a majority (at least half) of the inputs are 1, otherwise it outputs 0. Let us consider the case when n=3, which is the 3-input majority function, whose inputs are A, B and C and the output is Z.

(a) Give the truth table for the 3-input majority function.

(b) Using Karnaugh maps, derive a simplified Boolean expression for the output Z in the 3-input majority function.

(c) Construct a logic circuit for the 3-input majority function using NAND gates only.

2. Consider the following scenario:

A school has acquired the following resources to its *Administrative* (*Admin*), *Laboratory* (*Lab*) and *Library* (*Lib*) buildings:

Building	Resources
Admin	5 computers, 1 printer
Lab	40 computers, 1 printer
Lib	10 computers, 1 printer

A school computer network has to be created to fulfil the following requirements:

- Each building needs to have its own local area network (LAN) in order to share the printer.
- The above three networks are also to be interconnected so that the School Information System (SIS) which is running on one computer in the *Admin* building and the Library Information System (LIS) running on one computer in the *Lib* building are accessible from all computers.
- All computers are to be given efficient Internet connectivity as well. For this purpose, the school has subscribed to an Internet Service Provider (ISP) who is to supply the Internet connectivity to the *Lab* building. The *Lab* building is separated from the other two buildings by approximately 500m. One computer in the *Lab* building is to be used as the DNS server. Another computer in the *Lab* building is to be used as the proxy server.
- The entire network is to be protected through a firewall.

(a) The Principal has received the 192.248.16.0/24 IP address block for the school. The IP addresses for the computers are to be allocated after making three subnets from this address block for the three buildings.
Assuming such subnetting is done, write down the relevant network address, subnet mask and the allocated range of IP addresses for each building using the following table format to present your answer:

Building	Network Address	Subnet Mask	IP Address Range
Admin			
Lab			
Lib			

[see page nine

(b) Give **one** reason as to why a fully connected (all-to-all) network topology is not suitable for this school computer network.

(c) The Lab administrator who is responsible to setup the school computer network has requested for *switches* and a *router*.

Showing clearly the network connection topology and the devices, draw the network diagram to represent the logical arrangement for the school computer network that the Lab administrator can implement to fulfil the school requirements.

(d) Give **one** reason as to why TCP is preferred over UDP as the transport protocol for the school computer network.

3. (a) ABC Books (Pvt.) Ltd. specializes in buying and selling used secondhand books. At present the business operations are fully manual (*pure brick*).

(i) ABC Books (Pvt.) Ltd. starts a website and allows its customers to purchase books online. What is the revenue model (method of revenue) applicable in this scenario?

(ii) Moving from *pure brick* type to *brick and click* business model, what is the most significant challenge unique to ABC's business? Explain your answer.

Hint – Compare with the online sales of new books

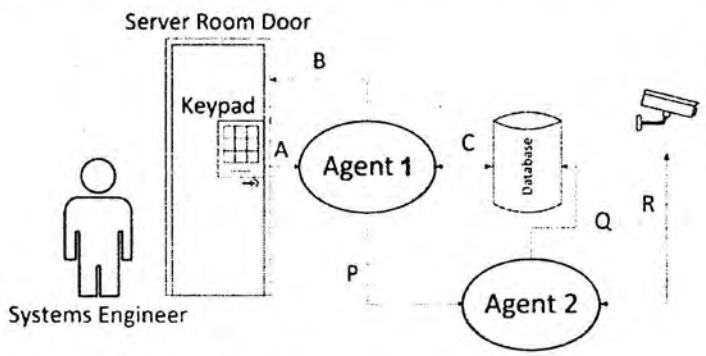
(iii) ABC Books (Pvt.) Ltd. has proposed to extend its website to an e-commerce marketplace for used books. This marketplace supports B2C, B2B and C2C business types and allows other businesses to participate as well. Explain briefly between whom the transactions in each of the business types B2C, B2B and C2C will take place in the proposed marketplace.

(iv) Other than the revenue model you mentioned in (i) above, identify another suitable revenue model to be followed by the ABC Books (Pvt.) Ltd. in their proposed e-commerce marketplace.

(v) Identify and write down a possible way to make payments within this e-commerce marketplace.

(vi) Briefly explain how book publishing companies can use the proposed e-commerce marketplace data for their businesses.

(b) Multi-agent systems can be useful when complex system interactions are implemented. The following diagram shows a simplified version of a multi-agent system that manages the secure access to the server room of a data-center.



A brief scenario of the usage is as follows:

All authorized system engineers must use their access code, which is a 6-digit number to enter the restricted server room.

When the access is granted to the server room, a set of movable CCTV cameras starts recording the server area.

The processed data of CCTV input are saved in the database. Interactions are shown using A, B, C, P, Q, and R arrows.

(i) Identify the agent with no user interactions (self-autonomous) in this setup.

(ii) Sense-Compute-Control is a widely used 3-step design style of agent-based system implementations.

From A, B and C interactions, separately identify and write down the most suitable interaction arrow to represent each step, i.e., Sense, Compute, and Control.

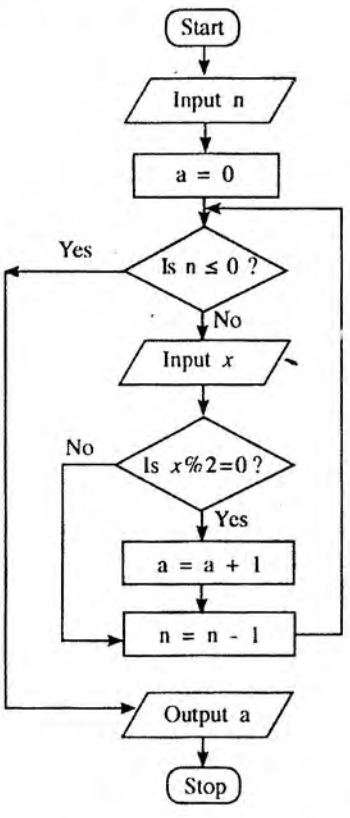
(iii) C and R interaction links are shown for two directions. Explain the reasons for the duplex links for both C and R interactions separately.

(iv) Interaction A can be seen as a *user-to-agent* interaction. Identify an *agent-to-agent* interaction and explain the operational use of that interaction.

(v) Give **one** reason as to why the CCTV inputs are sent to the database through the Agent 2 instead of sending directly.

4. (a) The ICT teacher in a school needs to process the marks obtained by all the students in a class for the ICT subject and compute the average mark for the class. Construct a flow chart to express an algorithm for this purpose. Assume that the first input is the number of students in the class, n. Next, the marks of n students will be input one-by-one.

(b) Consider the flow chart given below. Note that $x\%2$ represents (x mod 2).



(i) What would be the output if the first input (n) was 6 and the next inputs were 3, 6, 4, 12, 11, 9?

(ii) What is the purpose of this algorithm?

(iii) Develop a Python program to implement the algorithm expressed by the flow chart.

[see page eleven

5. A vehicle rental company has registered vehicle owners. Vehicles are obtained from the owners and rented to the customers. Consider the following relations regarding the vehicle rental company.

I. Customer (Customer_NIC, Customer_Name, City, Postal_Code)

II. Vehicle_Owner (Owner_Id, Owner_Name, Contact_No)

III. Vehicle(Vehicle_Reg_No, Description, Owner_Id)

- The Customer relation contains customer's national identity card number (NIC) which is unique, name, city where he/she is living and the postal code of the city. A customer lives in a single city and there are many customers in one city. The postal code depends on the city.
- The Vehicle_Owner relation contains the Owner_Id which is unique, owner's name and the contact number.
- The Vehicle relation contains the vehicle registration number which is unique, a description about the vehicle and the Owner_Id.

A customer can rent more than one vehicle. Also, it is possible to rent one vehicle to many customers at different instances. Each vehicle is owned by one owner and one owner can have more than one vehicle.

(a) In which *normal form* do the above relations given in I, II, III above exist? Justify your answer.

(b) Convert the above relations to the next *Normal Form* from the current *Normal Form* which you have stated in 5(a). (Present the contents relevant to the labels Ⓟ to Ⓤ indicated in the following table as your answer.)

Relation No.	Next Normal Form	Relation/s in Next Normal Form
I	Ⓟ	Ⓢ
II	Ⓠ	Ⓣ
III	Ⓡ	Ⓤ

(c) Draw an Entity Relationship (ER) diagram to depict the above relations by identifying the relationships, key attributes, other attributes and the cardinality.

(d) It is necessary for the company to keep the details of renting vehicles by customers. Create a relation called "Rent", including the details Rent_Date, Start_Time and End_Time.

(e) Write an SQL statement to select Owner_Id and Vehicle_Reg_No of all the vehicles owned by each vehicle owner.

6. (a) A blood testing centre has the following activities:

The patient hands over the test request slip to the receiving counter. Receiving counter issues an invoice to the patient and sends a copy to the cashier. The patient checks the invoice, approves it and hands it over to the cashier with the payment. Cashier issues a receipt to the patient and also sends a copy of the receipt to the laboratory. Patient hands over the receipt to the laboratory. The laboratory verifies the patient and conducts the blood test and returns the updated receipt marked as 'done' to the patient. The laboratory sends the report to the receiving counter. Later, the patient hands over the updated receipt to the receiving counter and the receiving counter hands over the report to the patient with the re-updated receipt marked as 'issued'.

(i) The *context diagram* for the above activities, with missing *data flows* Ⓟ, Ⓠ, Ⓡ, Ⓢ and Ⓣ, is given in Figure 1 below.

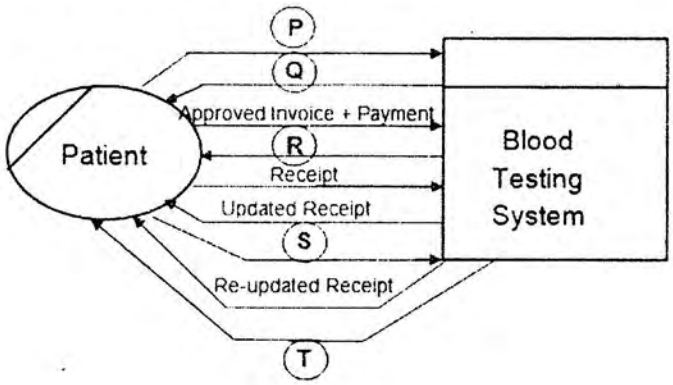


Figure 1

Identify the **five** missing *data flows* from the description given above and write them down.

(ii) Level 1 of the DFD for the above context diagram is shown in Figure 2.

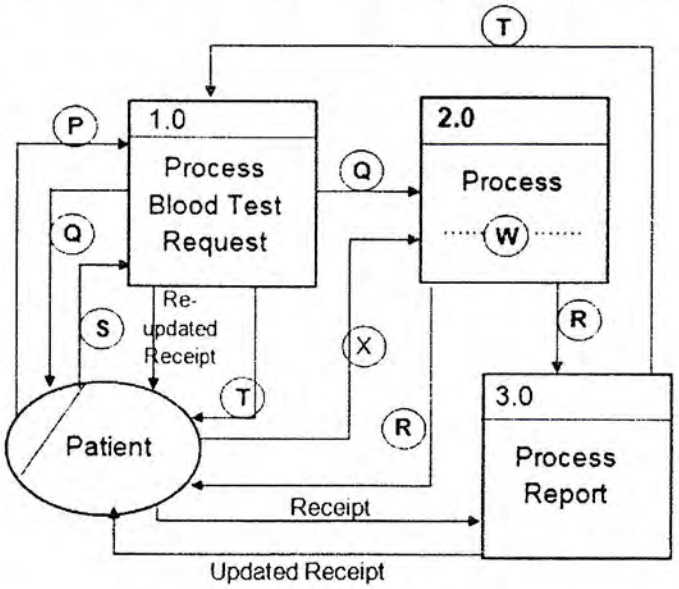


Figure 2

(A) Write a suitable term to replace the label Ⓦ in Process 2.0.

(B) Identify and write down the missing data flow labelled Ⓧ.

(b) (i) What is *requirement analysis*?

(ii) List **two** advantages of requirement analysis.

(iii) Give **one** method that can be used to verify whether a functional requirement is satisfied in a system.

(iv) The following list consists of some *functional*, *non-functional* and other requirements of a proposed school library management system where users can borrow and return books in addition to other usual tasks.

(A) The system should authenticate users through username and password.

(B) The system should enable users to search for books based on the *title*, *type*, *ISBN No.* or *publisher name*.

(C) The total cost for the library system should be less than Rs. 500 000.00.

(D) The system should be available 99% of the total time.

(E) The system development should be completed within 9 months.

(F) Book lending details should be preserved even if the system crashes during operation.

(G) The book database of the school library management system must be secured by preventing unauthorized access.

(H) Since the Past Pupils Association has indicated its willingness to develop the system, preference will be given to them.

From A to H, identify and write down the labels of **two** *functional* requirements and **two** *non-functional* requirements respectively.

* * *