අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2023 (2024)
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2023 (2024)
General Certificate of Education (Adv. Level) Examination, 2023 (2024)

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 those 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 statements are correct?

A – Word processors and spreadsheet software belong to the category of *utility software*.
B – A *compiler* is an example for a program translator.
C – It is illegal to use a proprietary software without obtaining its license.

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

2. Personal information of students and their exam marks are input to a Student Information System. Marks for a subject range from 0 to 100. A student has to study a collection of compulsory and optional subjects and sit for the relevant examinations.
Which of the following are suitable data validations for the above system?

A – A *presence check* for the marks of all subjects taken/not taken by the student
B – A *range check* to check whether an input exam mark is within the range 0 and 100
C – A *data type check* to ensure that the input made for the telephone number of the student contains only digits

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

3. The existing book management system in a school library is used with a computer, a monitor, a keyboard and a mouse. The school management wants to minimize the time taken presently for book lending/returning. Which of the following is most suitable for this purpose?

(1) Using a digitizer (2) Using an external hard disk
(3) Using a touch screen (4) Using a magnetic stripe reader
(5) Using bar code technology

4. Listed below are some phrases about the internal operation of three printers:

A – a moving print head striking an ink ribbon against the paper
B – toner attracting to what is printed on a cylinder which is then transferred to paper
C – nozzles spraying ink onto paper

Which of the following correctly matches *dot matrix, inkjet* and *laser* printers to the above phrases?

(1) *A* – dot matrix, *B* – laser, *C* – inkjet
(2) *A* – dot matrix, *B* – inkjet, *C* – laser
(3) *A* – inkjet, *B* – dot matrix, *C* – laser
(4) *A* – laser, *B* – dot matrix, *C* – inkjet
(5) *A* – laser, *B* – inkjet, *C* – dot matrix

[*See page two*

5. Which of the following will cause the CPU to execute a different set of instructions?
A – a context switch
B – an interrupt
C – user selecting the shutdown option in the computer
(1) *A* only (2) *B* only (3) *C* only
(4) *A* and *B* only (5) All *A*, *B* and *C*

6. A program runs fastest when the data it requires are in the
(1) hard disk. (2) L1 cache. (3) L2 cache.
(4) magnetic tape. (5) main memory.

7. What is the correct binary equivalent of decimal 13.125_{10}?
(1) 1100.001 (2) 1100.100 (3) 1101.001 (4) 1101.100 (5) 1101.101

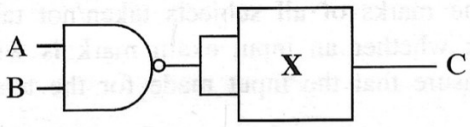
8. Which of the following are equivalent to octal 674_8?
A – $110\ 111\ 100_2$
B – 444_{10}
C – $2BC_{16}$
(1) *A* only (2) *A* and *B* only (3) *A* and *C* only
(4) *B* and *C* only (5) All *A*, *B* and *C*

9. The address of an instruction was shown as 5A1 in hexadecimal. What is that address in decimal?
(1) 41 (2) 1441 (3) 1457 (4) 2641 (5) 23056

10. A document contains 2048 characters including spaces and line-breaks. How many bits are needed to encode this document in ASCII also using the parity bits?
(1) 2048 (2) 2048 × 2 (3) 2048 × 7 (4) 2048 × 8 (5) 2048 / 8

11. What is the correct 2's complement binary representation of decimal -49_{10} using 8-bits?
(1) 00110001 (2) 01100010 (3) 10011110 (4) 11001111 (5) 11100010

12. Consider the following logic circuit in which **X** indicates a two-input logic gate.



Which of the following should **X** be so that when A = 0 and B = 1, the output C would be 0?
I – a NAND gate
II – a NOR gate
III – an XOR gate
(1) I only (2) I and II only (3) I and III only
(4) II and III only (5) All I, II and III

13. Which of the following is the simplified form of the Boolean expression $X(\overline{X}+Y)$?
(1) X (2) Y (3) XY (4) $\overline{X}Y$ (5) X+Y

14. A program in execution in a computer is called a *process*. Which of the following is a possible state transition sequence of such a process?
(1) New → Ready → Running → Terminated
(2) New → Blocked → Terminated
(3) New → Ready → Blocked → Running → Terminated
(4) New → Running → Ready → Running → Terminated
(5) New → Blocked → Ready → Running → Terminated

[*See page three*

15. Amara powers on the computer and starts a spreadsheet application. Then he also opens a web browser. Which of the following are possible execution sequences on the processor of his computer?

(1) BIOS → OS → spreadsheet process → OS → web browser process → OS → ...
(2) BIOS → spreadsheet process → OS → web browser process → OS → spreadsheet process → ...
(3) BIOS → spreadsheet process → web browser process → OS → ...
(4) BIOS → OS → spreadsheet process → web browser process → OS → ...
(5) BIOS → OS → spreadsheet process → web browser process → spreadsheet process → web browser process → ...

16. Which of the following statements are true?

A – A *firewall* acts as a packet filter inspecting all the packets entering a network.
B – A malware that misleads the users by disguising itelf as a standard program is termed a Trojan Horse.
C – A strong password should have a combination of uppercase and lowercase letters, numbers and symbols of sufficient length.

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

17. Which of the following statements are true?

A – One of the uses of encryption is to ensure confidentiality of transmitted data.
B – Every user needs to have a pair of dissimilar keys when using Asymmetric Key Encryption.
C – Users must share a common key when exchanging information using Symmetric Key Encryption.

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

18. Which of the following is considered as an erroneously received byte in an *even parity system*?

(1) 01010101 (2) 10010011 (3) 10110010
(4) 11011001 (5) 11010111

19. Match the **Devices** labelled from **A** to **E** to the corresponding **Descriptions** labelled from **1** to **5**.

Device
A. Client
B. Hub
C. Router
D. Server
E. Switch

Description
1 – stores network programs and data files for the users to access
2 – a connecting device between Local Area Networks (LAN) and Wide Area Networks (WAN)
3 – when a message is received, this transmits it only on the port to which the destination computer is attached
4 – requests services and content from other computers
5 – when a message is received, this broadcasts it on all ports to all attached hosts

(1) **A** – 1, **B** – 5, **C** – 4, **D** – 2, **E** – 3
(2) **A** – 2, **B** – 4, **C** – 3, **D** – 5, **E** – 1
(3) **A** – 3, **B** – 2, **C** – 1, **D** – 4, **E** – 5
(4) **A** – 4, **B** – 5, **C** – 2, **D** – 1, **E** – 3
(5) **A** – 5, **B** – 1, **C** – 2, **D** – 3, **E** – 4

[See page four

20. Select the answer containing the correct replacements for Ⓐ and Ⓑ in the following paragraph:

In the Internet, a host is identified by its IP address. In IPv4, each IP address consists of _____Ⓐ_____ bits to identify a host. The newer version named IPv6 consists of _____Ⓑ_____ bits in an IP address.

(1) Ⓐ = 32, Ⓑ = 48 (2) Ⓐ = 32, Ⓑ = 128 (3) Ⓐ = 48, Ⓑ = 32
(4) Ⓐ = 48, Ⓑ = 128 (5) Ⓐ = 128, Ⓑ = 32

21. Which of the following statements regarding DNS (Domain Name System) are correct?

A – It maps web addresses to IP addresses and vice versa.
B – HTTP uses the services provided by the DNS.
C – DNS maintains a hierarchy of domain names.

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

22. Which of the following statements regarding IP addresses are correct?

A – In class C networks, first octet value ranges from 192 through 223.
B – IPv4 can assign addresses up to 4 million devices.
C – 192.168.0.0 – 192.168.255.255 is a private IP address range.

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

23. If Suresh wants to send an encrypted message to be read only by Amara using *asymmetric key encryption*, then

(1) Suresh should encrypt his message using his public key.
(2) Suresh should encrypt his message using his private key.
(3) Suresh should encrypt his message using Amara's public key.
(4) Suresh should encrypt his message using Amara's private key.
(5) Suresh should encrypt his message using both private and public keys of Amara.

24. Choose the option containing most suitable deployment types for the following systems:

A – A new system to replace an existing air traffic control system at an airport
B – A system for the customers of an island-wide supermarket chain to order goods online
C – A system for the public to enter comments regarding the service experienced by them at an office

(1) *A* – direct, *B* – direct, *C* – parallel
(2) *A* – direct, *B* – pilot, *C* – parallel
(3) *A* – parallel, *B* – pilot, *C* – direct
(4) *A* – parallel, *B* – parallel, *C* – parallel
(5) *A* – parallel, *B* – parallel, *C* – pilot

25. Which of the following is a *non-functional requirement* for an e-commerce site?

(1) Being able to add items to the shopping cart
(2) Being able to make payments online
(3) Being able to view the items based on item category
(4) Each item to be shown with a small image and a description
(5) The e-commerce site to be accessible through popular web browsers

26. During which of the following is an application tested by its developers in a setting that closely resembles its intended deployment hardware, software, and network configuration environment?

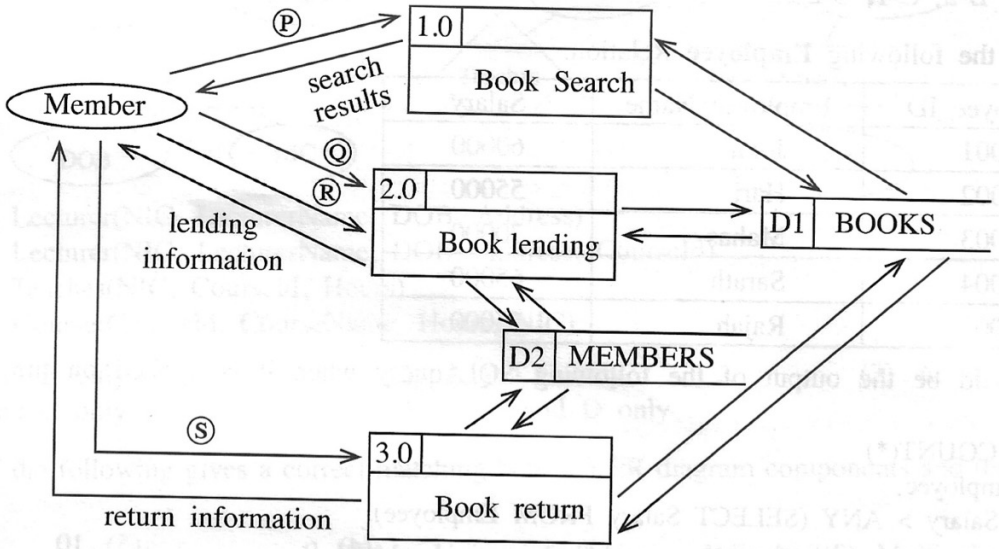
(1) Acceptance testing (2) Integration testing (3) Parallel testing
(4) System testing (5) Unit testing

[*See page five*

27. A company considers developing a new software application for its use. The application is expected to re-engineer internal processes, improve collaboration, and enhance productivity. However, during the feasibility analysis, it was identified that the new software may face some resistance from employees who are accustomed to the existing processes. Which component of the feasibility study would have helped to get that information?

(1) economic feasibility
(2) legal feasibility
(3) operational feasibility
(4) schedule feasibility
(5) technical feasibility

28. Select the option which includes most suitable replacements for the labels Ⓟ to Ⓢ in the following Data Flow Diagram of a library management system.



(1) Ⓟ – keyword, Ⓠ – member ID, Ⓡ – book details, Ⓢ – book details
(2) Ⓟ – keyword, Ⓠ – keyword, Ⓡ – book details, Ⓢ – member ID
(3) Ⓟ – keyword, Ⓠ – keyword, Ⓡ – book details, Ⓢ – keyword
(4) Ⓟ – member ID, Ⓠ – keyword, Ⓡ – member ID, Ⓢ – member ID
(5) Ⓟ – member ID, Ⓠ – member ID, Ⓡ – book details, Ⓢ – book details

29. Which of the following is **incorrect** about the waterfall model of software development?

(1) It allows developers to collect and implement requirements throughout the project.
(2) It is not an iterative model.
(3) It is suitable for software with well defined requirements.
(4) It is easy to estimate the resources needed for a project.
(5) No working product is available until the latter stages of the project.

30. In addition to the required features, which of the following should also be considered when a government institution selects a Commercial Off-The-Shelf (COTS) software to be implemented island wide?

A – cost to deploy, maintain, upgrade and modify
B – ease of integration with existing systems
C – after sales service from the vendor

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

[See page six

31. Match the given **entity attributes** labelled from **A** to **D** to the corresponding **descriptions** labelled from **1** to **4**.

	Entity attribute
A	Composite attribute
B	Simple attribute
C	Multivalued attribute
D	Derived attribute

	Description
1	an attribute that cannot be broken down into smaller components
2	an attribute that can be broken down into component parts
3	an attribute whose values can be calculated from related attribute values
4	an attribute that may take more than one value

(1) A-2, B-1, C-3, D-4 (2) A-2, B-1, C-4, D-3
(3) A-3, B-4, C-2, D-1 (4) A-4, B-2, C-3, D-1
(5) A-4, B-3, C-1, D-2

32. Consider the following **Employee** Relation:

Employee_ID	Employee_Name	Salary
1001	John	60000
1002	Hari	55000
1003	Mahas	70000
1004	Sarath	65000
1005	Rajah	75000

What would be the output of the following SQL query when it is applied on the **Employee** relation?

```
SELECT COUNT(*)
FROM Employee
WHERE Salary > ANY (SELECT Salary FROM Employee);
```

(1) 3 (2) 4 (3) 5 (4) 6 (5) 10

33. Consider the given SQL statements to create two database tables named **LENDING** and **STUDENT**:

```
CREATE TABLE LENDING
 (BOOK_NUMBER VARCHAR(10) NOTNULL,
  BOOK_NAME VARCHAR(20) NOTNULL,
  AUTHOR VARCHAR(25) NOTNULL,
  DESCRIPTION VARCHAR(75) NOTNULL,
  ISSUED_DATE DATE,
  STUDENT_ID CHAR(5) NOTNULL,
  PRIMARY KEY(BOOK_NUMBER));

CREATE TABLE STUDENT
 (STUDENT_ID CHAR(5) NOTNULL,
  NAME VARCHAR(25) NOTNULL,
  BIRTHDAY DATE NOTNULL,
  ADDRESS VARCHAR(25) NOTNULL,
  PROVINCE CHAR(10),
  PRIMARY KEY(STUDENT_ID));
```

Which of the following statements are correct?

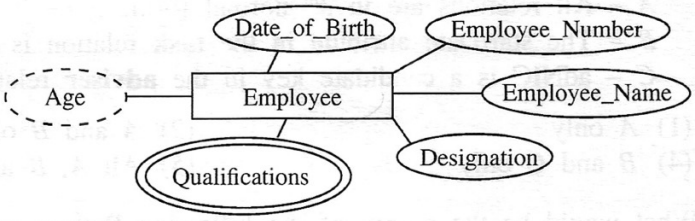
A – STUDENT_ID is a foreign key in the LENDING table.
B – It is compulsory to input data to the DATE data type fields in both tables.
C – STUDENT_ID can contain only five English letters.

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

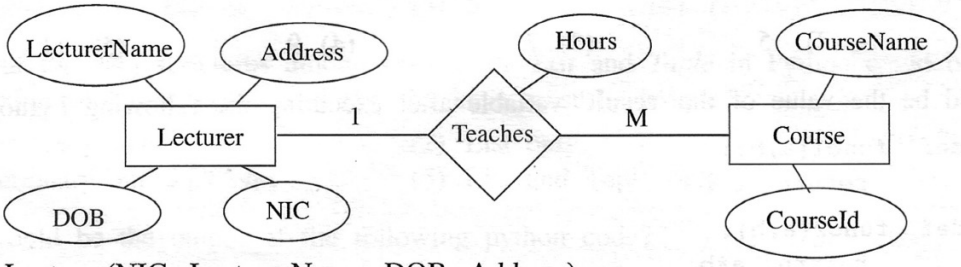
[See page seven

34. When the **Employee** entity of the following diagram is represented in a database which of the following should **not** be included?

(1) Date_of_Birth
(2) Designation
(3) Employee_Name
(4) Employee_Number
(5) Qualifications



35. Which of the listed relations will be obtained if the following ER diagram is correctly mapped into the relational model?



A – Lecturer(NIC, LecturerName, DOB, Address)
B – Lecturer(NIC, LecturerName, DOB, Address, CourseId)
C – Teaches(NIC, CourseId, Hours)
D – Course(CourseId, CourseName, Hours, NIC)

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

36. Which of the following gives a correct matching between ER diagram components and the relational model?

(1) Entity ⟶ Field, Attribute ⟶ Table, Unique attribute ⟶ Primary key, Multivalued attribute ⟶ Table
(2) Entity ⟶ Table, Attribute ⟶ Field, Unique attribute ⟶ Primary key, Multivalued attribute ⟶ Table
(3) Entity ⟶ Table, Attribute ⟶ Field, Unique attribute ⟶ Table, Multivalued attribute ⟶ Primary key
(4) Entity ⟶ Table, Attribute ⟶ Primary key, Unique attribute ⟶ Primary key, Multivalued attribute ⟶ Table
(5) Entity ⟶ Table, Attribute ⟶ Table, Unique attribute ⟶ Primary key, Multivalued attribute ⟶ Primary key

● Consider the following relations to answer questions **37** and **38**.

adviser (<u>adId</u>, adName, adGender, adNIC, adPhone)
farmer (<u>farmerId</u>, farmerName, farmerAddress, farmerPhone)

task (<u>taskId</u>, taskName, farmerId, startDate, endDate)
advises (<u>adId</u>, <u>taskId</u>, startDate, endDate)

Note: adNIC – The National Identity Card number of an adviser

37. Which of the following statements are correct?

A – One farmer can have many tasks.
B – One adviser can advise many tasks.
C – For one task, a farmer can have many advisers.

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

[*See page eight*

38. Which of the following statements are correct with respect to the given relations?

A – All relations are in 3rd normal form.
B – The startDate attribute in the **task** relation is a derived attribute.
C – adNIC is a candidate key in the **adviser** relation.

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

39. What would be the output of the following Python code, if a = 10, b = 4, and c = 7?

```
ans=a%b+c//(a-b)
print(ans)
```

(1) 3 (2) 5 (3) 7 (4) 9 (5) 11

40. What would be the value of the '**result**' variable after executing the following Python code?

```
def  func1(a,b):
       return  a+b
def  func2(a,b):
       return  a*b
result  =  func1(3,func2(2,4))
```

(1) 11 (2) 12 (3) 14 (4) 15 (5) 20

41. What would be the output of the following Python code, when it gets executed?

```
def  modify_string(input_string):
       input_string+="  World"
text="Hello"
modify_string(text)
print(text)
```

(1) Hello (2) Hello Hello
(3) Hello World (4) World
(5) World Hello

42. What would be the output of the following Python code?

```
original_list=[1,2,3,4,5]
new_list=original_list.copy()
new_list.clear()
original_list.append(6)
print(original_list)
print(new_list)
```

(1) [ ]
[ ]

(2) [6]
[ ]

(3) [6]
[6]

(4) [1, 2, 3, 4, 5, 6]
[ ]

(5) [ ]
[1, 2, 3, 4, 5, 6]

[See page nine

43. How many '*'s does this program output?

```
i=7
while  i>0:
  i-=3
  print('*')
  if  i<=2:
       break
  else:
    print('*')
```

(1) 1 (2) 3 (3) 5 (4) 7 (5) 9

44. Which of the data structures among *Dictionary, List* and *Tuple* in Python could be used to store a collection of key-value pairs where the keys must be unique?

(1) Dictionary only (2) List only (3) Tuple only
(4) Dictionary and List only (5) List and Tuple only

45. What would be the output of the following python code?

```
for i in range(1, 4):
    for j in range(1, i + 1):
        print(j * i, end=' ')
    print()
```

(1)
1
2 2
3 3 3

(2)
1
2 4
3 6

(3)
1
2 4
3 6 9

(4)
1 2 3
2 4 6
3 6 9

(5)
1 2
2 4 6
3 6 9 12

46. Consider the following code fragment in an HTML file:

```
<style>
    body {
        color: yellow;
        font-family: Arial,  Cambria;
    }
    .highlight {
        color: red;
    }
</style>
```

What happens if one applies the class 'highlight' to a element within <html> and </html> tags in the above file?

(1) The element's text will turn red.
(2) The element's text will turn yellow.
(3) The element's font size will increase.
(4) The element's font type will change to Cambria.
(5) The element's border colour will change to red.

47. Which of the following statements regarding Search Engine Optimization (SEO) are correct?

A – Meta tags on web pages help SEO.
B – It increases the visibility of a web page in search engines.
C – Powerful computers should be used to create SEO friendly web pages.

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

[*See page ten*

48. Consider the following HTML code line related to a form:

```
<form  method="post"  action="process.php">
```

The "action" attribute in it

(1) specifies the data type of the form.
(2) specifies the server file that handles the data in the form.
(3) controls the form's alignment on the web page.
(4) declares the form as a PHP script.
(5) shows the process.php file on the screen.

49. Saman's father is a carpenter. He wants to showcase his father's work on a website. Which of the following hosting options should Saman use in order to do it with a price that he can afford?

(1) Hosting it on a server that presents other websites also (shared hosting)
(2) Hosting it on a Virtual Private Server (VPS)
(3) Hosting it on a server dedicated to Saman (dedicated hosting)
(4) Using an e-Commerce website
(5) Using the services of a well known cloud service provider

50. What is the primary role of a sensor in an IoT device?

(1) To provide outputs and change a state of the environment
(2) To ensure interoperability of devices
(3) To detect a state change in the environment
(4) To make decisions based on predetermined rules
(5) To generate graphics for the user interface

* * *

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2023 (2024)
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General Certificate of Education (Adv. Level) Examination, 2023 (2024)

තොරතුරු හා සන්නිවේදන තාක්ෂණය II தகவல், தொடர்பாடல் தொழிநுட்பவியல் II Information & Communication Technology II	20	E II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

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மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index No. : .....

Important:

- *This question paper consists of* **13** *pages.*
- *This question paper comprises of two parts,* **Part A** *and* **Part B**. *The time allotted for both parts is three hours.*
- *Use of calculators is not allowed.*

PART A — Structured Essay:
(pages 2 - 7)

- *Answer all the questions on this paper itself. Write your answers in the space provided for each question. Note that the space provided is sufficient for your answers and that extensive answers are not expected.*

PART B — Essay:
(pages 8 - 13)

- *This part contains* **six** *questions, of which, four are to be answered. Use the papers supplied for this purpose.*
- *At the end of the time allotted for this paper, tie the two parts together so that* **Part A** *is on top of* **Part B** *before handing them over to the Supervisor.*
- *You are permitted to remove only* **Part B** *of the question paper from the Examination Hall.*

For Examiners' Use Only

For the Second Paper		
Part	**Question No.**	**Marks**
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
	8	
	9	
	10	
Total		

Final Marks

In numbers	
In words	

Code Number

Marking Examiner 1	
Marking Examiner 2	
Marks checked by:	
Supervised by:	

[see page two

Part A – Structured Essay

Answer all four questions on this paper itself.

Do not write in this column

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

```
<html>
<body>
<ul  style="list-style-type:none;">
      <li>Cricket</li>
      <li>Football</li>
      <li>Hockey</li>
</ul>
<html>
<body>
```

Note: Consider the following dotted line box as the display area of the browser.

(*b*) A registration form for a speech competition and its labeled HTML source are given in Figures 1.1 and 1.2 respectively.

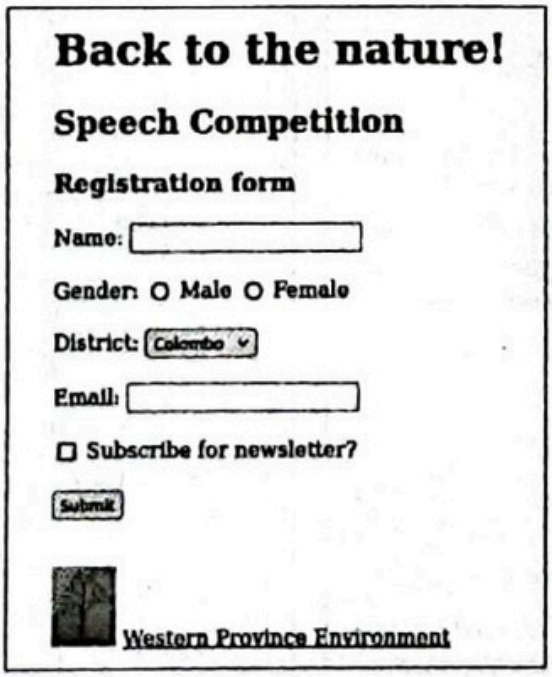


Figure 1.1

[see page three

Index No.: .....

Do not write in this column

```
<html>
<Ⓐ>Back to the nature!</Ⓐ>
<Ⓑ>Speech Competition</Ⓑ>
<h3>Registration form</h3>

<form method="Ⓒ"          Ⓓ="./action_page.php">
      <label for="name">Name:</label>
      <input type="Ⓔ" name="name"><br><br>

      <label for="gender">Gender:</label>
      <input type="Ⓕ" name="gender" id="male" value="male">
      <label for="male">Male</label>
      <input type="Ⓕ" name="gender" id="female" value="female">
      <label for="female">Female</label> <br><br>

      <label for="Ⓖ">District: </label>
      <Ⓗ name="district" id="district">
            <option value="colombo">Colombo</option>
            <option value="gampaha">Gampaha</option>
            <option value="kalutara">Kalutara</option>
      </Ⓗ><br><br>
      <label for="email">Email:</label>
      <input type="email" name="email"><br><br>

      <input type="Ⓘ" name="newsletter" id="newsletter">
      <label for="newsletter">Subscribe for newsletter?</label><br><br>

      <input type="Ⓙ" value="Submit">
</form>
<br>
  <Ⓚ="wpeLogo.jpg" alt="Ⓛ" width="50" height="60">
  <Ⓜ="https://www.wpe.lk" title="Ⓝ">Western Province Environment</a>
</html>
```

Figure 1.2

For each of the labels Ⓐ to Ⓝ in the HTML code in Figure 1.2, choose a suitable replacement from the given list. In the answer table, write down the **number** of the replacement for each label.

List:

1: action	2: a href	3: caption	4: checkbox	5: district
6: font	7: h1	8: h2	9: h3	10: head
11: img src	12: More details	13: name	14: post	15: radio
16: select	17: submit	18: text	19: th	20: WPE logo

Answer table:

Ⓐ :	Ⓑ :	Ⓒ :	Ⓓ :	Ⓔ :	Ⓕ :	Ⓖ :
Ⓗ :	Ⓘ :	Ⓙ :	Ⓚ :	Ⓛ :	Ⓜ :	Ⓝ :

[see page four

(c) The action_page.php file mentioned in the given code of Figure 1.2 is shown below.

Do not write in this column

```
<?php
$servername = "localhost";   $username = "root";   $password = "";
$dbname = "environment";
// Create a connection
$conn = new mysqli($servername, $username, $password, $dbname);

// Section P
$name = $_POST['name']; $gender = $_POST['gender']; $district = $_
POST['district']; $email = $_POST['email']; $newsletter = $_POST['news-
letter'];
// section P end
// Section Q
$sql = "INSERT INTO applicants (name, gender, district, email,
newsletter) VALUES ('$name', '$gender', '$district', '$email',
'$newsletter')";
// section Q end

if ($conn->query($sql) === TRUE) {
        echo "Data inserted successfully!";
} else {
        echo "Error: " . $sql . "<br>" . $conn->error;
}

// Close the connection
mysqli_close($conn);
?>
```

Write down the purpose of section **P** and the purpose of section **Q**.

P : .....

Q : .....

2. (a) A simple and high-level view of the data lifecycle consists of three steps. Write the 2nd and the 3rd steps of the data life cycle.

- 1st step is the creation of data
- 2nd step is .....
- 3rd step is .....

(b) (i) Modern Artificial Intelligence relies on large amounts of data, which are often managed with cloud-based storage solutions. What is the cloud computing service model used here?

.....

(ii) Quantum computers, although seen as a promising type of computing machines for the future, are still expensive to own, operate and maintain. Suggest a technical approach to make the computing power of the quantum computers accessible to the public users as per their needs, at an affordable price.

.....

.....

(c) For the box in each of the following statements, select a suitable replacement from the given list and write the number of the selected replacement in the box.

List : {**1** - B2B, **2** - C2B, **3** - G2C, **4** - a payment gateway, **5** - a reverse auction, **6** - a virtual storefront, **7** - a web portal, **8** - an online auction, **9** - an online marketplace}

[see page five

Do not write in this column

(i) A web-based platform that provides a single point of access to a range of information from different sources, is known as ☐.

(ii) When one requests to renew his/her vehicle revenue license and pays online for it through the official website, he/she is performing an e-commerce transaction of ☐ type.

(iii) The ABC e-commerce company does not allow buyers to explore competitor products from other sellers within its website. ABC website operates as ☐.

(iv) In ☐ buyers bid for the prices at which they are willing to buy a given product or service.

(v) An online shopping website is suitable to be connected to ☐.

(d) (i) Your friend thinks the digital divide is a tool used for arithmetic division. Briefly explain to your friend what the digital divide is.

.....

.....

.....

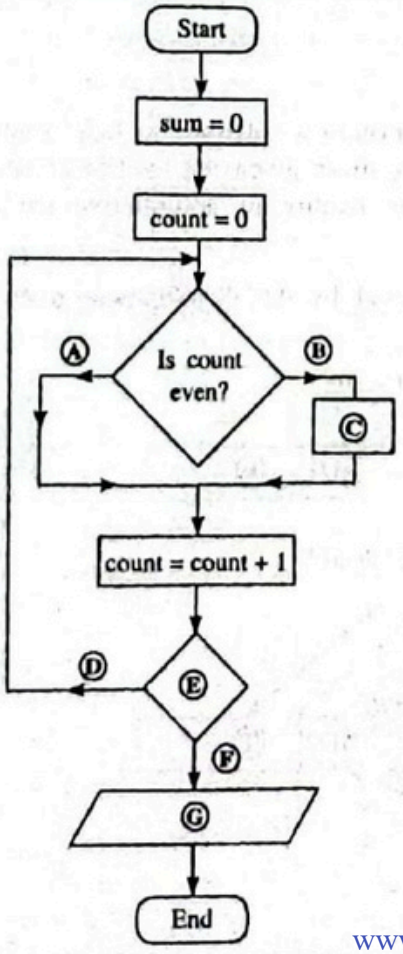
(ii) E-waste is becoming a major environmental problem in Sri Lanka. Suggest a step that we can take to reduce the environmental impact of our e-waste.

.....

.....

.....

3. (a) Write down the most suitable replacements for labels Ⓐ to Ⓖ in the following flowchart which is drawn to calculate and display the sum of first ten even numbers.



Ⓐ : .....

Ⓑ : .....

Ⓒ : .....

Ⓓ : .....

Ⓔ : .....

Ⓕ : .....

Ⓖ : .....

[see page six

Do not write in this column

(b) (i) What is the output of the following Python code?

```
def func(n):
    MyNumber=[]
    for i in range(4,n+1):
        if i%2==0:
            MyNumber.append(i)
    print(MyNumber)
func(30)
```

.....

(ii) Write down the output in the above Python code when the condition `if i%2==0:` is changed to `if i%2 != 0:`

.....

(c) Write down the replacements for the labels of the following Python code which has been written to find the largest of a set of integers.

```
def findlargest(myList):
    largest = Ⓐ
    for i in Ⓑ:
        if i>Ⓒ
            largest = Ⓓ
    print("largest value is",Ⓔ)
list1=[4,6,24,12,8,94,22]
findlargest(Ⓕ)
```

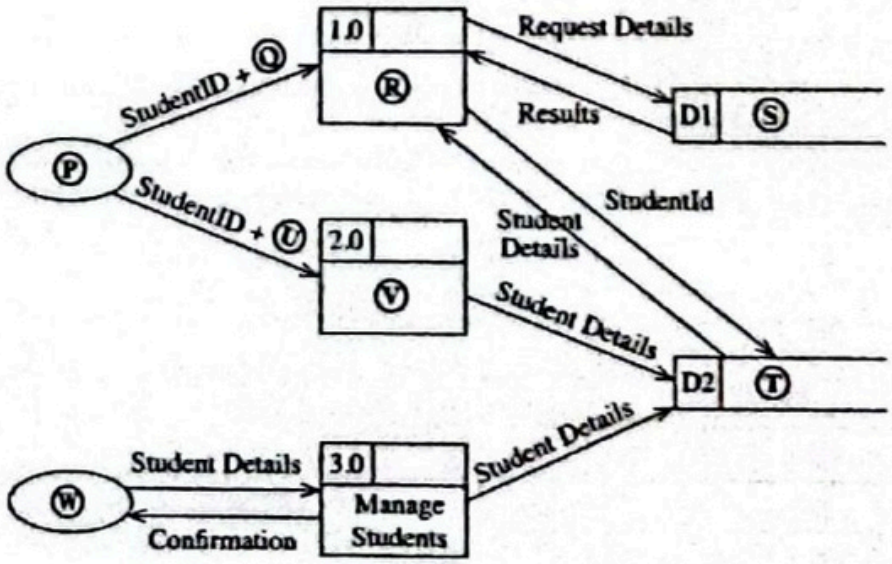
Ⓐ – ..... Ⓑ – .....

Ⓒ – ..... Ⓓ – .....

Ⓔ – ..... Ⓕ – .....

4. A team in the school IT society has been requested to develop a software to help students reserve computers in the school laboratory. The students are to be given the facility to update their information. The administrator should be given the facility to add/remove students to/from the system.

(a) The following is the data flow diagram (DFD) prepared by the development team for the above system.



[see page seven

A numbered list of replacements for the labels Ⓟ to Ⓦ are given below. Write down in the relevant box the number of the most suitable replacement for each of the labels given in the DFD.

Do not write in this column

List: {1 – Administrator, 2 – Handle request, 3 – Reservations, 4 – Request details, 5 – Student, 6 – Students, 7 – Student details, 8 – Update student details}

Ⓟ – ☐ Ⓠ – ☐ Ⓡ – ☐ Ⓢ – ☐

Ⓣ – ☐ Ⓤ – ☐ Ⓥ – ☐ Ⓦ – ☐

(*b*) The computers are to be made available for students only for 30-minute slots between 8 am – 5 pm on weekends. However a student is allowed to reserve only a maximum of two 30-minute slots per weekend.

Write down **one** functional requirement with respect to computer reservations.

.....

.....

(*c*) Give **one** technical aspect that the development team should check when conducting the technical feasibility study of this project.

.....

.....

(*d*) The *waterfall model* is suggested for the above development. Why is a proper requirement analysis critical in this project to ensure its timely completion?

.....

.....

(*e*) Three students are to develop the *reservation*, *update student details* and *manage students* modules separately. The IT teacher had taught different types of software testing. What is meant by "integration testing" in this system?

.....

.....

(*f*) The IT teacher suggests the team doing a *direct deployment* of this software. Give **one** reason as to why the teacher did not suggest a *parallel deployment*.

.....

.....

(*g*) One member of the IT society wants a COTS (Commercial-Off-The-Shelf) software to be considered for this system instead of developing it. Give **one** reason as to why the team should reject it.

.....

.....

* *

[see page eight

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கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2023 (2024)
General Certificate of Education (Adv. Level) Examination, 2023 (2024)

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

20 E II

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Part B

* *Answer any* ***four*** *questions only.*

5. (a) A circuit with three inputs (A, B, C) and one output (Z) is to be designed. The output should be equal to 1 when the binary value combination of the three inputs is either 1, 3 or 6. The output should be 0 for other cases.

(i) Draw the complete truth table for the above circuit.

(ii) Complete the Karnaugh map relevant to the above circuit according to the following format:

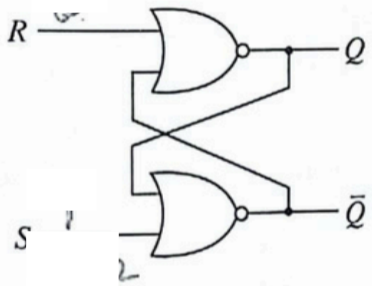
C \ AB	00	01	11	10
0				
1				

(iii) Using the Karnaugh map, derive the most simplified product-of-sums (POS) expression for the output Z. Show the loops clearly on the Karnaugh map.

(iv) Draw a logic circuit for the **simplified** expression derived in (iii) by only using NOR gates assuming that the complemented inputs $\bar{A}$, $\bar{B}$ and $\bar{C}$ are also available.

(b) Using Boolean Algebra show that $\bar{A}C+\bar{A}B+A\bar{B}C+BC$ is equivalent to $C+\bar{A}B$.

(c) Consider the flip flop circuit shown on the right.



(i) Assume that the S input is 1 and the R input is 0. What will be the output at Q?

(ii) What will be the output at Q if the S input is now made 0?

(iii) What will be the output at Q when the R input is now made 1?

6. (a) Draw a sketch to show how a file server (FS), a printer (P) (S) a ters (C1 and C2) should be connected in a *star topology*.

(b) A port number is also used along with an IP address in a network communication. Why?

(c) Consider a subnet with the network address 192.168.56.128/26.

(i) Write an example IP address that can be assigned to a host attached to this subnet (in dotted decimal notation).

(ii) Write the first and the last usable host addresses in this network (in dotted decimal notation).

(iii) How many host addresses are available for use in this subnet?

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(*d*) Suppose an Internet Service Provider owns the 192.168.56.32/26 IP address block. Assume that the provider wants to create four subnets namely, Subnet A, Subnet B, Subnet C and Subnet D from this address block with each subnet having the same number of IP addresses.

(i) Write the subnet mask of the above given IP address block in dotted decimal notation.

(ii) Write the number of host bits needed to create the required number of subnets.

(iii) Once subnetting is done, fill in the following table.

Subnet	Network address	First usable IP address	Last usable IP address	Broadcast address
Subnet A				
Subnet B				
Subnet C				
Subnet D				

(*e*) (i) Write **two** functions of a proxy server in a computer network.

(ii) Write **two** properties of MAC addresses assigned to devices connected to a network.

7. (*a*) Assume that you are given an Arduino UNO board (Figure 7.1) along with the following items:

- Passive Infrared Sensor (PIR) for motion detection (Figure 7.2)
- Sensor for ambient light detection
- LEDs, Resistors, and a Power supply

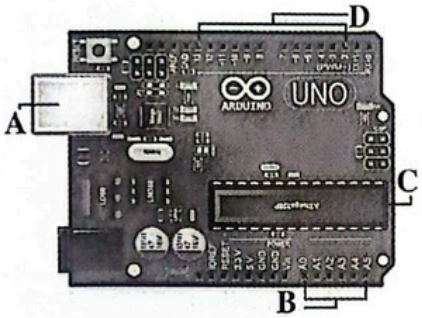

Figure 7.1

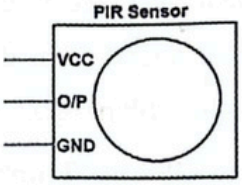

Figure 7.2

(i) Identify the parts marked as **A**, **B**, **C**, and **D** in Figure 7.1 and briefly explain each of their functionalities.

(ii) Assume that you want to build an IoT setup that switches an LED light on when motion is detected. It is further required to switch on this LED only during night time. Draw a schematic diagram connecting the Arduino board and the items given above as necessary in order to build this setup.

(*b*) An e-commerce warehouse automation system includes a set of agent-based robots which move ordered goods to their respective dispatch areas to start relevant shipments.

The Figure 7.3 shows the latter part of this system. A Quality Control (QC) Officer inspects the goods of each order as it passes on a conveyor belt and confirms to a software system (Delivery Handler Agent) that the order has passed QC. The Delivery Handler Agent directs the package to a mobile robot at the loading area. The robot agent reads the package barcode to determine the appropriate dispatch area. It then navigates the robot to the relevant dispatch area, scanning the path and avoiding obstacles while on the move. The Dispatch Handler Agent, another software, validates each package at the dispatch areas and informs the Dispatch Officer to confirm its decision. The Dispatch Officer can override Dispatch Handler decisions if needed and directs the confirmed packages to the postal division.

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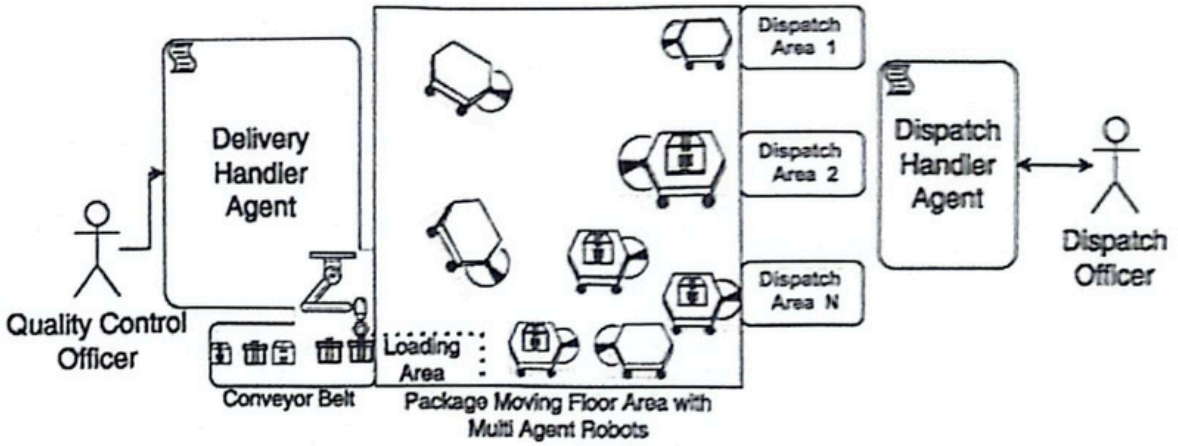

Figure 7.3

(i) Software Agents demonstrate certain characteristics which make their behaviour unique. Briefly explain the following two characteristics of a software agent:
(a) autonomous
(b) cooperative

(ii) Name a self-autonomous agent and a user agent in the given example.

(iii) If the set of multi-agent robots behave satisfying only the autonomous characteristic but fails to cooperate, write down one of the most likely observations that will be seen during their operation.

(iv) If this system is redesigned by replacing the multi-agent behaviour with centralized control and a broker agent for communication, identify **one** main change that will be seen with respect to each of the following:
(a) Control of the robot mobility
(b) Decision making process (relevant to moving packages from loading area to dispatch areas)

(v) Draw a *box and arrow diagram* for the new solution with centralized control, mentioned in (iv), above.
(**Note:** A box and arrow diagram uses boxes to show system components and arrows to show connections between those components)

8. (*a*) Write the output of the Python code given in Figure 8.1.

```
def function1(str):
   newstr = ''''
   for character in str:
         if character in 'aeiouAEIOU':
               newstr += '*'
         else:
               newstr += character
   return newstr
str1 = "LibrAry"
str2 = function1(str1)
print(str2)
```

Figure 8.1

(*b*) The function in Figure 8.2 uses the bubblesort algorithm to sort a given list of numbers into ascending order. Write down the suitable replacements for the labels P-U to complete the code.

```
def bubbleSort(nList):
   for pNumber in range(P,Q,R):
         S:
            if nList[i]>nList[i+1]:
               temp = nList[i]
               T
               U
```

Figure 8.2

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(c) An estate owner wants a program to determine the **minimum** currency note combination needed to make the pay of each employee. (E.g., Rs. 40,000 should be paid using eight notes of Rs. 5000 and not four hundred notes of Rs. 100). The program should also output the currency requirement for all employees. The program should use the **employees.txt** file which contains employee pay details. Each line in it contains an employee's name and net pay.
A Python program written for this purpose is shown in Figure 8.3. A sample **employees.txt** file and the program's output for that file are shown in Figure 8.4.

(i) Write down the suitable replacements for the **ten** labels **A-J** in the program given in Figure 8.3.

```
# currency notes used in Sri Lanka
notes = [5000,1000,500,100,50,20]
# total notes required from each currency note type
totals = [0,0,0,0,0,0]

file = A('employees.txt','r')

while True:
  required = [0,0,0,0,0,0] # notes required for employee

  line = file.readline()
  if B line:
    C

  empDetails = line.split()
  netpay = int(float(D))
  if netpay < 0:
    continue

  print("\n")
  print(empDetails[0]," Net pay =",netpay)
  topay = netpay
  i = 0
  while topay > 0:
    required[i] = E
    totals[i] = totals[i] + F
    topay = G
    H

  # print employee netpay breakdown
  for i in range(0, len(required)):
    print("Rs.",notes[i],":", I)
J

print("\nTOTAL REQUIREMENT:")
for i in range(0, len(totals)):
  print("Rs.",notes[i],":",totals[i])
```

Figure 8.3

Example 'employees.txt' file:

```
Raj 40120
Niranjala 51670
```

Program's output for that file:

```
Raj  Net pay = 40120
Rs. 5000 : 8
Rs. 1000 : 0
Rs. 500 : 0
Rs. 100 : 1
Rs. 50 : 0
Rs. 20 : 1


Niranjala  Net pay = 51670
Rs. 5000 : 10
Rs. 1000 : 1
Rs. 500 : 1
Rs. 100 : 1
Rs. 50 : 1
Rs. 20 : 1

TOTAL REQUIREMENT:
Rs. 5000 : 18
Rs. 1000 : 1
Rs. 500 : 1
Rs. 100 : 2
Rs. 50 : 1
Rs. 20 : 2
```

Figure 8.4

(ii) The net pay of employees in this estate, does not contain cents. However, what practical problem with respect to the net pay inputs exists in this code? What modifications will you do to fix that problem?

9. (a) Consider the following requirements relevant to a database that is expected to manage divisions, officers and tasks in an office.

The office consists of a number of divisions. Each division has a unique name. The division may have several locations. A division handles a number of tasks each of which has a unique number, a name and a date in which the task was assigned to the division. Each officer's name (consisting of a first name and a surname), NIC (National Identity Card) number, address and phone number is to be stored. An officer is assigned to one division but may work on several tasks which may not be controlled by the same division. Each division is managed by one of its officers and the starting date in which the officer started managing the division is stored. Draw an ER digram for this application showing the entities, attributes and relationships. Underline primary keys.

(b) Write **two** advantages of converting a database table into a normal form.

(c) Consider the following **Show** table related to theatres and the movies that they screen.

Theatre	Movie	Day	Time	Screen	Year
Sarasi	MI - 4	Wednesday	10:00	S_1	2022
Sarasi	MI - 4	Wednesday	15:00	S_1	2022
Palazzo	Spider man	Friday	10:00	S_2	2019
Palazzo	Avengers	Friday	10:00	S_1	2019
Vega	Iron man	Thursday	10:00	S_1	2020

Note:

- A theatre can screen more than one movie at the same time on different screens.
- *Year* field gives the year in which the relevant film was released.

(i) ... which normal form does the **Show** table exist? Justify your answer.

(ii) Convert the **Show** table to its next normal form.

(d) Consider the following **Employee** table:

Emp_ID	Emp_Name	DoB	Department	Designation	DoJ	Salary
E110	Saman	15/10/1970	Bio Technology	Professor	12/04/2001	145000
E111	Kumar	25/05/1980	Mechanical	Assistant Professor	02/05/2006	100000
E115	Raja	10/08/1982	Engineering	Assistant Professor	05/05/2001	98000
E114	Jennifer	11/09/1975	Engineering	Assistant Professor	03/06/2001	107000
E117	Ismail	15/05/1979	Civil	Assistant Professor	10/05/2005	103000

(i) Write the most suitable SQL statement to create the **Employee** table with a suitable primary key.

(ii) Write the required SQL statement to insert the record for the following employee:
Emp_ID = E119, Emp_Name = "John", DoB = "15/06/1971", Department = "IT", Designation = "Professor", DoJ = "15/07/2001", Salary = 107000

(iii) Write the output obtained by applying the following SQL query:

```
SELECT Emp_ID, Emp_Name
FROM Employee
WHERE Salary>103000;
```

(iv) Write the appropriate SQL query to find the names of all employees who work in the "Civil" department.

[see page thirteen

10. (*a*) (i) What is the repeating cycle that a processor in a computer is involved in since the computer is started till it is shutdown?

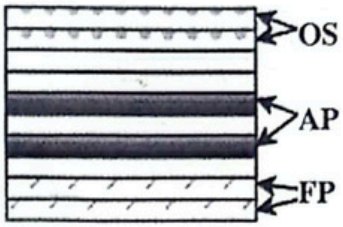
(ii) Which program's instructions get executed in the processor of a computer during a *context switch*?

(iii) A *register* is a group of binary cells suitable for holding binary information and is constituted by a collection of flip-flops. How many flip-flops are needed to make an n-bit register?

(*b*) A user runs the following Python codes on a computer. The code on left prints the lines of a file on the screen while the other code does an average computation.

fileReader.py	average.py

A = input ("Enter filename")
f1 = open(A, "r")
for line in f1:
  print(line)
f1.close()
	total = 0
	for num in range (10000):
	  total += num
	average = total / 10000
	print(average)



Memory

Figure 10.1

The computer's memory at a particular time is shown in the figure 10.1. The memory frames occupied by the *operating system*, the *fileReader process* and the *average process* are indicated on it by OS, FP and AP respectively.

Selecting from OS, AP and FP, write down the most likely place where each of the following is stored.

(i) content of variable A of the *fileReader process*

(ii) the Process Control Block (PCB) of the *average process*

(*c*) Of the above two python processes, one of them will go through the RUNNING → BLOCKED state transition more than the other. Which process is that? Give the reason for it.

(*d*) Assume that when the *fileReader process* of (b) above is in progress a context switch occurs and a different process is run. When the *fileReader process* is given the chance to run again, the file is read from where it stopped. Which data structure facilitates that feature?

(*e*) A computer uses 32-bit virtual addresses. This computer has a 1 GB (2^{30} bytes) physical memory and a 4 KB page size.

(i) Write down the number of frames in physical memory as a power of 2.

(ii) Assume that **in addition to** memory frame information, each page table entry for a virtual page in this computer contains some additional information consisting of a total of **four bits**. If the total size of the page table required for each process on this computer assuming that all virtual pages are in use is given as $2^p \times q$ bits, write down the values of p and q.

(iii) If the virtual address 4097 of a particular process is mapped to *Frame* 2 of physical memory, write down in **decimal** form, the physical address corresponding to the virtual address 4097. (Assume that page numbers, frame numbers and addresses begin from 0)

(*f*) The *test.py* file is stored on blocks 218 and 220 respectively in a disk that uses a File Allocation Table (FAT) to manage its storage. The disk uses 4 KB blocks.

(i) Write down an important number in the *directory entry* for the *test.py* file that will help the operating system to find the blocks of the file.

(ii) Give an example size for *test.py* that will result in *internal fragmentation*.

(iii) Assume that block 219 is also to be added for the *test.py* file. Show in a diagram the FAT entries for the *test.py* file after this addition.
(–1 indicates last block)