General Certificate of Education (Adv. Level) Examination 2024

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Information & Communication Technology   II

20 **E** **II**

*Duration: **Three hours***
*Additional reading time: **10 mins.***

For Examiner's Use Only		
Part	**Question No. s**	**Marks**
A	**1**	
	2	
	3	
	4	
B	**1**	
	2	
	3	
	4	
	5	
	6	
	7	
	Total	

Important:

✓ This question paper comprises of two parts, **Part A** and **Part B**. The allocated for both parts is two hours.
✓ Use of calculators is not allowed.

PART A – Structured Essay

✓ 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

✓ 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.

Part A – Structured Essay
*Answer **all** questions on this **paper itself**.*

1. (a) Write the output rendered by the web browser for the given HTML code segment. Show the output in the space provided below.

```
<h1 align="center">ICT syllabus</h1>
<h1>Practical Lessons </h1>
<ol start="7">
       <li>python </li>
       <ol type="A">
              <li>loops </li>
                     <ol type="I">
                            <li>for Loop</li>
                            <li>while Loop</li>
                     </ol>
              <li>if </li>
              <oL>
                     <li>basic if</li>
                     <ul>
                            <li>if</li>
                            <li>if with else</li>
                     </ul>
                     <li>multiple if</li>
                     <li>nested if</li>
              </oL>
                 <li>SQL</li>
       <li>HTML</li>
       <li> Arduino </li>
</ol>
```

(b) Consider the following web page. The page displayed is called register.html and the folder structure of the files or pages relevant to the website is shown is figure (A).

Each hyperlink displayed on the web page namely Python, SQL and Home must redirect the user to the relevant web pages python.html, sql.html and home.html respectively.
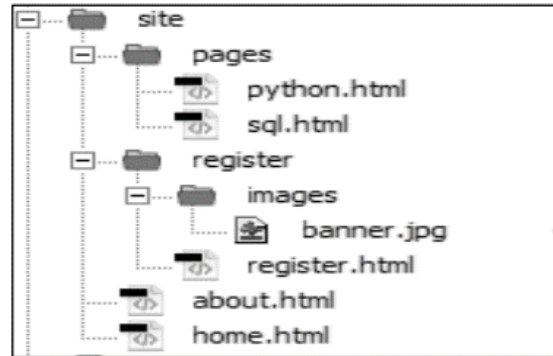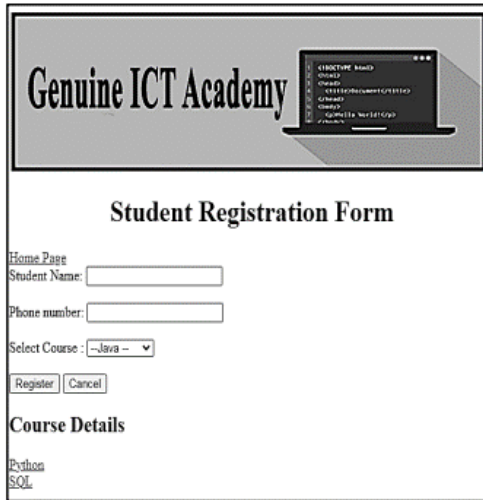
(A)

The incomplete HTML code to render the above web page is given below. Fill in the blanks.

```html
<html> <body>
<img src="............................................." />
<h1 align="center"> Student Registration Form </h1>
<a href="...................................."> Home Page </a>   <br>
<form name= "stu_reg" action= "register.php" method="post">
      Student Name:     <input type="........." name="f_name"/>
<p>Phone number:  <input type="........." name="p_no"/> </p>
<p>Select Course :<.............. name="course" >
                  <.............. value="c1"> --Java --</............>
                  <.............. value="c2"> --Python --</............>
                  <.............. value="c3"> --SQL --</............>
                  </............>
</p>
<p>
      <input type="submit"  ............="............" />
      <input type="reset"  ............="............" />
</p>
</form>
<h2> Course Details </h2>
<p>   <a href=".................................."> Python </a>  <br>
      <a href=".................................."> SQL </a>
</p>
</body></html>
```

(c)

(i) The default colour of a hyperlink is blue. Write the CSS declaration to specify the hyperlink colour as blue when hovering the mouse pointer over the hyperlink.

………

………

(ii) Write the CSS declaration to change the colour of the heading Student Registration Form to #00FFAA.

………

………

(d)

(i) Complete the given PHP code.

```php
<?php
//connect to database
$con=mysqli_connect("localhost", "root", "", "school");

//check connection
if ($con->connect_error){
die("Database connection failed: " . $con->connect_error);
}
//SQL Query
$sql = "select * from customers";

//get result
$result = mysqli_query(……………………..,   …………………………);

//print output
while ($row = mysqli_fetch_array(…………………………))
{
print( . ……………….. ['name'] . " " . ………………..['age']. " " . .
……………….. ['address']. "<br>");
}
mysqli_close($con);
?>
```

(ii) If the above code is executed after completion, what would be the expected output?

………

………

2. In any Sri Lankan state university, it is mandatory for students and lecturers to maintain 80% attendance. But, due to various reasons, most students do not attend lectures. It was found that friends of absent students sign on behalf of them to mark their attendance. Therefore, it takes a considerable amount of time to verify the signatures in the attendance sheet. The university has identified that students who fail to attend the lectures, do fail in their examinations which leads to students not completing their degrees. The university management has decided to design a system to mark attendance of students.

In order to implement this system, the university has planned to display a QR code in each lecture hall where the student would scan the code to enter the system. This would help mark attendance of students and also help the management retrieve necessary student information from the Student Management system. The students cannot log in to this system remotely but can only log in to this system via the local area network. This makes the system cost effective but it also helps to maintain the integrity of the attendance system. This system is set to be established for a specific time period for lectures pertaining to one particular subject. The management also decided that once the system initiates, marking attendance on a physical sheet will be completely stopped. Although this system is proposed, it was found that it may take a toll on the students who do not have a smartphone.

(a)

   (i) Write a functional requirement of the above system.

   ……

   ……

   (ii) Write two non-functional requirements of the above system.

   ……

   ……

   ……

   ……

   (iii) When developing a system it is important to check its feasibility in terms of technical, economical and operational feasibility. Based on the scenario given above specify the feasibility studies conducted and not conducted, giving an example for each.

     • Feasibility conducted: ……………………………………………………………………….

      Example: ……………………………………………………………………….

     • Feasibility not conducted: …………………………………………………………………...

      Example: ……………………………………………………………………….

(iv) What deployment method(s) will be used to implement the above system?

…………………………………………………………………………………………..

…………………………………………………………………………………………..

(b) (i) The Data flow diagram pertaining to a student attending a lecture is given below. Identify and write the appropriate terms to complete the diagram using the list given below.

[**List:** Admin, Student attendance, Create user, Student details, User name/ password, Index number & time, Authenticating student details, Account log in]

A - …………………………………………...   B - ……………………………………………………

C - …………………………………………...   D - ……………………………………………………

(ii) Draw a Context diagram for the above system.

(c)

(i) Specify a similarity and a dissimilarity between Spiral and Agile development models.

(ii) Prototyping can be used in both spiral and agile models. Do you agree? Justify your answer.

3. (a) In order to get enrolled to the Information Systems degree program conducted by the University of Colombo School of Computing (UCSC), a student has to obtain marks more than 60 from the aptitude test.

The test has 50 questions and each question carries 02 marks. If a student does not know the answer to a question he/she can leave the question without answering. But if a student answers a question incorrectly, each incorrect answer receives -1 marks.

Draw a flowchart to output the total marks received by a student and the status (selected or not selected) when the attempted questions and no. of correct answers are entered in to the system

(b) Write a Python code for the above flowchart.

(c) What would be the output of the given python code if 20, 16, 8, 12, -5 is entered as inputs?
      What is the purpose of this python code?

```python
L = []
n=int(input())
while(n>0):
    L.append(n)
    n=int(input())
m = min(L)
F = False
while(m>=1 and not F):
    for k in L:
        if k%m == 0:
            F = True
        else:
            F = False
        if not F:break
    m-=1
print(m+1)
```

[See page nine

(d) The incomplete code to rearrange (descending order) values of a given list using bubble sort technique is given below. Complete it.

```
def bubbleSort(lst):
    for i in lst:
        i = 0
        while ..................................... :
            if(.....................................):
                ..................., .................. = ..................., ..................
            i+=1
    return lst
```

4. (a) Select the most suitable term from the list given below.

[**List:** E-marketplace, Virtual store, Information broker, Virtual community, Content provider]

(i) ………………………………………. is a business website. Customers can inquire, order and purchase products via this platform.

(ii) ………………………………………. are individuals or entities that share ideas, experiences and experimental information via the internet.

(b) The major issue behind the evolution of ICT is **Digital divide**. Write two causes for digital divide and two ways to establish **Digital bridge**.

……

……

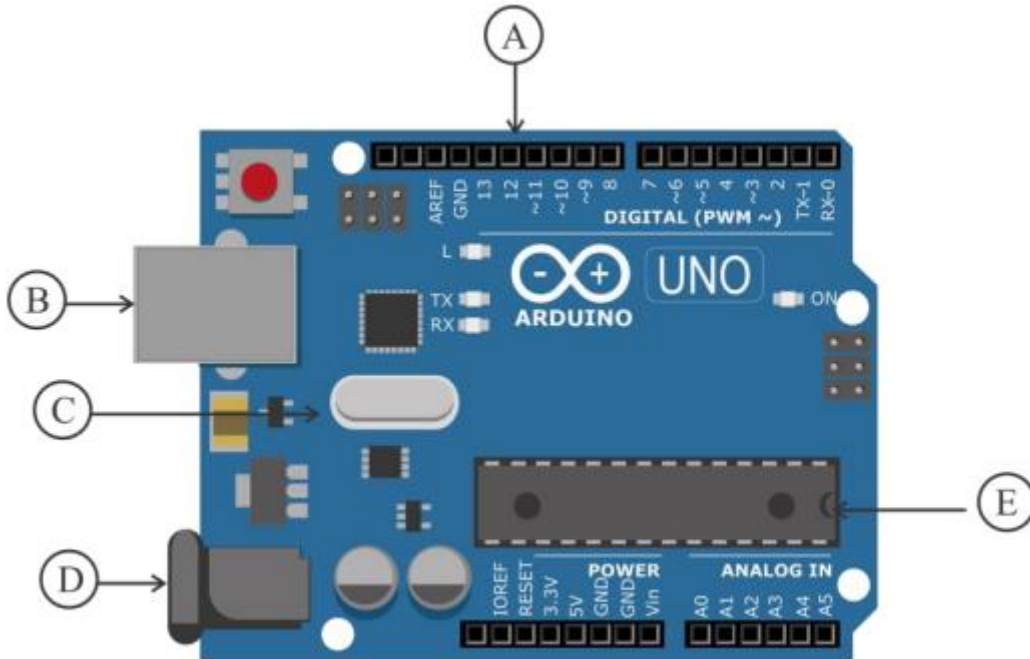……

……

(c) **Green Computing** concept was introduced to minimize and control e-waste. Specify how e-waste is properly managed via this concept.

……

……

……

Do not write in this column

(d) Identify the parts of the given Arduino board from the list provided.

[List: Micro controller, Digital pins, USB connect, Power Port, Crystal oscillator, Analog pins, Voltage regulator, Reset switch, USB interface chip**]**

A - …………………………………………....................................

B - …………………………………………....................................

C - …………………………………………....................................

D - …………………………………………....................................

E - …………………………………………....................................

(e) The distance between two computers connected via the internet is 1500km. The speed of data transmission is 3×10^5 km/s. To check the connectivity between the two devices, ping command is used. What would be the round trip time in milliseconds, obtained via the ping command?

Practice Test

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Information & Communication Technology   **II**

| 20 | E | II |

Part B

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

5.

(a) A circuit consists of 4 inputs namely P, Q, R and S which ranges from 0000 to 1111 in binary form. The circuit returns the value 1 if the decimal representation of the circuit ranges from 8 to 10 (inclusive of 8 and 10) or if the decimal value is divisible by 3 or divisible by 7. Zero is considered non-divisible by 3 or 7.

  (i) Construct a truth table for the above.

  (ii) Write a Boolean expression for output **F**, in terms of P, Q, R and S.

  (iii) Simplify the Boolean expression obtained in (ii) above.

  (iv) Design a logic circuit only using NAND gates.

(b)

  (i) A Full adder uses A and B as 2 inputs. If A and B represent values +11 and +5 respectively, complete the table given below.

A → (+11)	1	0	1	1
B → (+5)	0	1	0	1
Carry in				
SUM				
Carry out				

  (ii) **"NOR** gates can be used to represent **AND** gate.**"** Prove that this statement is true.

  (iii) Simplify the following expression using Karnaugh maps.

$$F = (A.B.C) = \overline{A}\overline{B}\overline{C} + \overline{A}B + AB\overline{C} + AC$$

  (iv) Convert the given expression to a product of sums (POS).

$$F = A\overline{B}C + AB\overline{C} + \overline{A}BC$$

6.

(a) In order to enhance the ICT knowledge of students in the sabaragamuwa province, a non-profit organization called ICT-KIO (ICT – Knowledge Improvement Organization) exchanges information across its branches via internet.

A branch uses an IP based method to communicate information via new technological communication modes. The branch is divided into multiple sectors namely Admin, Analysis, Development and Public. The public sector is to be designed as a wireless network. The district organizing committee has listed down the necessary requirements to establish the entire network.

Sector	Computers	Other networking devices
Admin	50	04 Printers
Analysis	42	02 Network printers
Development	25	03 Printers
Public	No	01 Wireless network printer 01 Smart phone 01 Tablet PC 23 Laptops

Each sector has the ability to communicate via the internal network. Each sector will be able access the internet via the Admin sector and the Admin sector will be monitoring all incoming and outgoing transmissions. The DNS and Proxy servers are installed in the Admin sector. The entore network is also protected by a firewall.

(i) What is the network topology suitable to design the above network? Give reasons.

(ii) The ISP has assigned the IP address block 205.225.28.0/24 to establish the above network. Subnetting has to be done minimizing IP address wastage. Explain how the network benefits from using the above address representation.

(iii) Complete the given table after subnetting.

Sector	Network address	Broadcast address	Subnet mask	Valid IP range
Admin				
Analysis				
Development				
Public				

(iv) Draw a labelled network diagram to depict the above network.

(b) To accomplish audio communication requirements of the clients, each sector is provided with a VoIP (Voice over IP) telephone.

   (i) How does VoIP work?

   (ii) VoIP uses packet switching technique. How does it use packet switching technique to communicate via the internet or and IP based network?

7. (a) Students who pass scholarship exams can apply to a different school from grade 6. In order to receive applications from these students, a web based information system is to be established.

   Based on the results obtained by the students, the parents of the students can enter the web based application and fill the form. The student's index number (IndexNo) and the parent's national identity card number (NIC) must be entered. If this information is correct, student's details, marks obtained (Marks) and parent's information is displayed.

   The IndexNo, Name and DOB of the student along with the SchoolName is specified. It would also display the parent's name (ParentName), Address, NIC and mobile phone number (Mobile). The directory of schools that can be applied for is activated on the web page and the page allows the user to select the names of schools from that directory to fill the application form. The school directory consists of SchoolName and SchoolAddress. The user can select up to 10 schools from the directory. The order of the schools selected (SchoolOrder) is also specified on the page.

   Each application form has a unique ApplicationNo. ApplyDate is also recorded in the system. Apart from that, examYear and examName is also recorded.

   Construct an Entity Relationship Diagram (ERD) for the above scenario specifying suitable primary keys and assumptions if any.

   (b) A movie production company has created a database to store details of all artists responsible for contributing to the movies under the production company. The database table **FilmArtist** is displayed below. An actor contributes to one or more films.

ArtistID	Name	Address	MobileNo	Year	FilmID	Film	Role

   (i) What anomalies will be present in the above table? Briefly explain.

   (ii) What normal form is the above table in? Give reasons.

   (iii) Show the relational schema for the above relation.

(c) In order to record the marks obtained by students following Information Technology diploma for particular assignments **Assignment** and **Student** tables are created.

Assignment (SubjectNo, AssignmentNo, IndexNo, Marks)
Student (IndexNo, Name, Email)

   (i) Write an SQL statement to record the marks (83) obtained for first assignment on Python subject (P1011) of student having index number 23080.

   (ii) Write an SQL statement to retrieve IndexNo and Name of students who obtained marks greater than 75 for the second assignment on Python subject P1011.

8. (a) The algorithm given below outputs cube value if the entered integer is odd and displays the square value if the entered integer is an even number. Identify A, B and C.
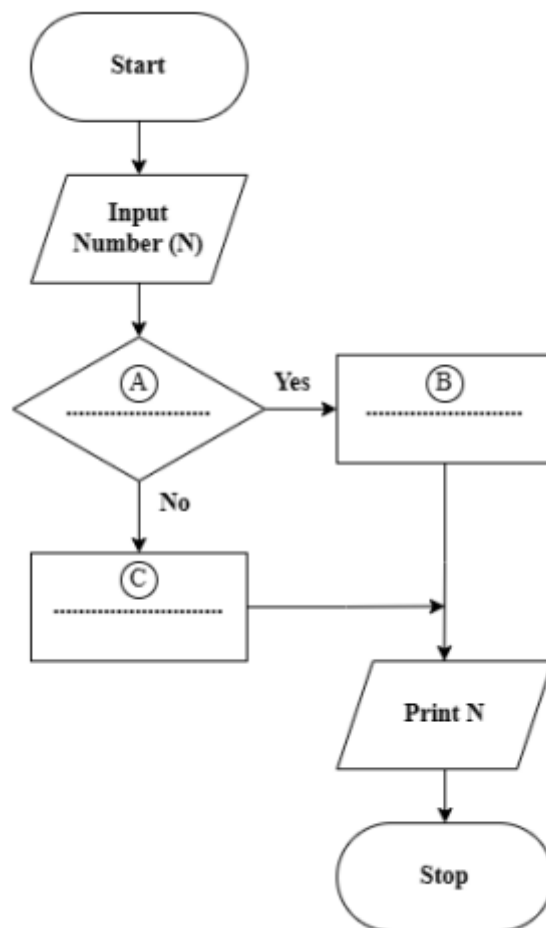
(b)

(i) What is the output of the following python code?

```python
for i in range(10):
    num=i
    result=0
    n=len(str(i))
    while(i!=0):
        digit=i%10
        result=result+digit
        i=i//10
    if num==result:
        print(num)
```

(ii) Find the output of the given python code and write the purpose of the program code.

```python
def fun_1(str):
    rev=""
    for i in str:
        rev=i+rev
    return rev
str="ARUNA"
print(fun_1(str))
```

(c) A particular school in Polonnaruwa has decided to create a system to separate students in to houses for the inter-house sportsmeet. The Principal has provided a text file named stu_de.txt, which includes Name and admission number of students.

```
Neel,1001
Jude,1004
Isuru,1005
Dammika,1003
Thanuja,1002
```

• Students are divided in to houses as follows:

| Remainder when the Admission number is divided by 4	House
0	Meththa
1	Karuna
2	Maditha
3	Upeksha

- After executing the program, a text file named house.txt must be created as follows:

```
Neel        karuna
Jude        meththa
Isuru       karuna
Dammika     upeksha
Thanuja     muditha
```

Write a python code to read the stu_de.txt file and record data on to the house.txt file.

9. (a) A water tank in a house is located in the third floor of the house and an IoT system is used to check the volume of the tank when necessary.

In order to check the water level of the tank, an ultrasonic sensor is used. The sensor captures the level up to the empty space above the water level. It measures the height of the water level in the tank and calculates the volume of water in the tank. This value is displayed on the LCD monitor in the first floor of the house. The home owner has the ability to check the water level or volume of the tank via his mobile phone at any given time.
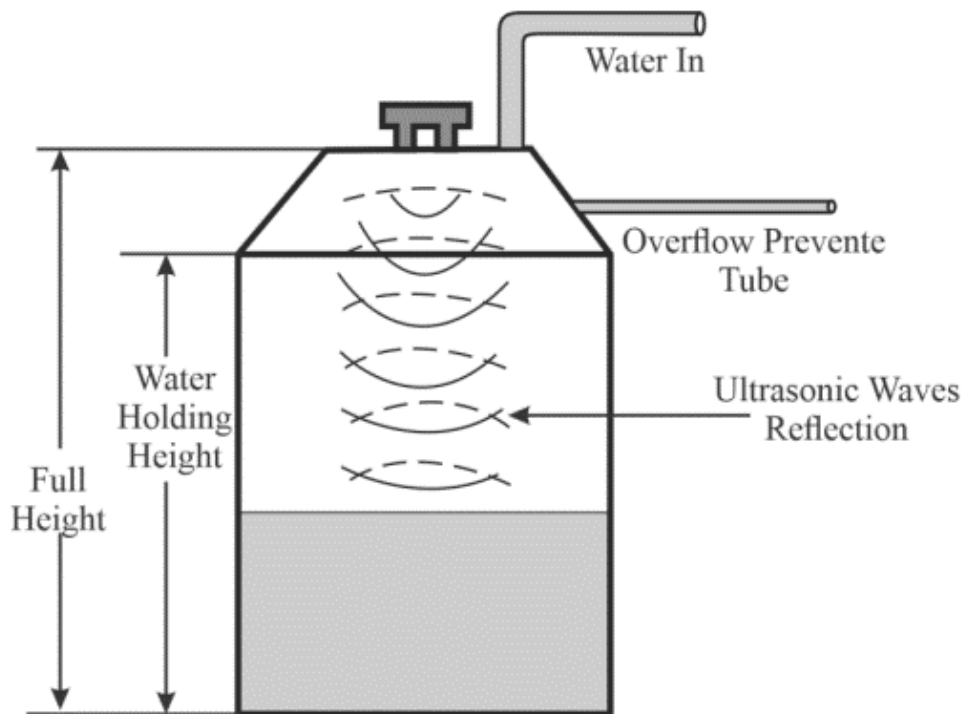
(i) Design a sketch of the circuit used for the above system using ultrasonic sensor, atmega328p microchip and other necessary devices.

(ii) Describe how the volume of the water tank is measured using the value captured by the ultrasonic sensor. *(not necessary to write program codes.)*

(b)   Consider the following scenario.

RoSmart company is responsible for servicing customers' smartphones using a mobile agent system. When the customer hands over the phone, the first thing checked is whether the phone gets turned on. If the phone does not get activated, the technical officer fixes that issue. A phone that can be turned on or activated is then checked by a technician agent to check for anomalies.

Once the technician agent identifies the anomalies of a phone, it goes through a process to fix or resolve all the anomalies. Once resolved, a feedback report is sent to the manage agent.

If the file storage capacity of the phone has exceeded its limit then the mobile agent sends an alert to the manage agent. A notification is also sent to the mobile user as well. Once the user accepts the notification the excess files are to the cloud system automatically.

(i) Draw an agent diagram for the above scenario. Specify the entities and connections between them clearly.

(ii) Write 02 characteristics of the mobile agent and state 04 functions of the mobile agent.

(iii) Is the mobile agent suitable to execute the functions elaborated above? Give reasons.

(c)   In order to connect the Course database, the following PHP code is designed. Write the PHP code segment to update the course name of the courseID IS22 to *Object Oriented Design*.

```php
<?php
    $server = "192.168.110.2";
    $user = "techro";
    $pass = "pass$$2023";
    $db = "myDB";

    // Create connection
    $conn = new mysqli($server, $user, $pass, $db);
    if ($conn->connect_error) {
        die("Connection failed: " . $conn->connect_error);
    }
?>
```

10. (a)   The page size of a byte addressable memory is 8KB. There are 64 frames in the physical memory that has 128 pages.

(i) Calculate the no. of bits allocated for the page number and page offset of the virtual address. Derive the total no. of bits allocated for the logical address.

(ii) Calculate the no. of bits allocated for the frame number and the total number of bits allocated for the physical address.

(iii) Write the first and last addresses of the 45th page in the virtual address space.

The page table of the system is given below.

Page #	Frame #	Present/Absent
25	8	1
26	3	1
27	20	1
28	42	0
29	11	1
30	34	1
31	40	0
32	29	0
33	36	1
34	52	1
35	60	1

(b)

(i) Consider the virtual address given below. Find the relevant physical address. *(Show your steps.)*

  01000101100111010101

(ii) The following virtual address is requested by the CPU for admission. Is this requested address available in physical memory? If not, give reasons.

  01000101100111010101

(iii) The OS decides to copy the above address to the frame allocated for page number 26. What will happen during this process? What changes would happen in the page table?

(iv) What is a page fault? What function is performed by the CPU when a page fault occurs?

(c) The block size of a storage device is 8KB. This device uses FAT system (File Allocation Table). The

  following shows a part of the storage device, which starts from block 300 and -1 indicated the end of the file block.

300	306
301	-1
302	304
303	
304	301
305	
306	302

(i) What is the entry block? What is the capacity of the file?

(ii) If an additional 6KB is added to the file and block 305 is occupied to store that additional portion of the file, show the change that would occur in the table above.

(d) The information relevant to a device that uses indexed allocation method to store the file named abc.py is given below.

(i) The block size of this storage device is 512 bytes. What is the size of the file abc.py?

(ii) Assume that this file size got extended by 1KB. If 100 and 122 blocks are used to store this additional capacity, what changes would occur in the index block?

* * *

52
43
84
39
71
80
95
-1