2   Paper I

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கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2021(2022)
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தகவல், தொடர்பாடல் தொழினுட்பவியல்	I	20 E I		இரண்டு மணித்தியாலம்
Information & Communication Technology	**I**			***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 pairs contains types of software that are **different** with respect to *ownership / licensing*?
   (1) Application software and open-source software
   (2) Application software and utility software
   (3) Proprietary software and open-source software
   (4) Proprietary software and systems software
   (5) Systems software and utility software

2. Which of the following is a good example for *batch processing*?
   (1) an air traffic control system
   (2) driving system in a driver-less (autonomous) car
   (3) Intensive Care Unit (ICU) patient monitoring and care system
   (4) payroll system
   (5) nuclear plant control system

3. There are different storage components which vary in capacity and access speed.
   Consider that the shown diagram portrays capacity and access speed variation of the storage components *L1 cache*, *L2 cache*, *main memory*, *registers* and the *hard disk*. The capacity increases and access speed decreases from top to bottom, as shown.

   Capacity   Access speed
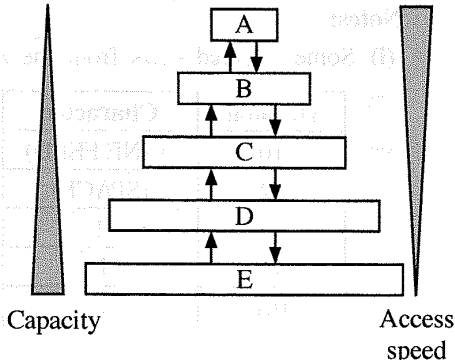
   Which is correct with respect to the A, B, C, D and E above?
   (1) A – hard disk, B – registers, C – L2 cache, D – L1 cache, E – main memory
   (2) A – L1 cache, B – L2 cache, C – registers, D – hard disk, E – main memory
   (3) A – main memory, B – registers, C – hard disk, D – L1 cache, E – L2 cache
   (4) A – registers, B – L1 cache, C – L2 cache, D – main memory, E – hard disk
   (5) A – registers, B – main memory, C – L2 cache, D – L1 cache, E – hard disk

4. Consider the following paragraph:

   To run a program, the program code is copied from ......A...... into ......B...... The Central Processing Unit's (CPU's) *program counter* register is set to the memory location where the first instruction of the program has been saved and execution of the program starts. The ......C...... implements the fetch – decode – execute cycle.

   Which of the following is the correct combination for A, B and C?

   (1) A – CPU, B – primary memory, C – secondary storage
   (2) A – CPU, B – secondary storage, C – primary memory
   (3) A – primary memory, B – secondary storage, C – CPU
   (4) A – secondary storage, B – CPU, C – primary memory
   (5) A – secondary storage, B – primary memory, C – CPU

5. What is the correct result of bit-wise XOR operation between the two binary numbers 01011100_2 and 11111001_2?

   (1) 00000010   (2) 01011000   (3) 01011010   (4) 10100101   (5) 11111101

6. What is the correct 2's complement binary representation of decimal -32_{10} using 8-bits?

   (1) 00100000   (2) 10100000   (3) 11011111   (4) 11100000   (5) 11100001

7. What is the correct decimal equivalent of hexadecimal 88.8_{16}?

   (1) 88.5_{10} (2) 88.8_{10} (3) 129.5_{10} (4) 136.5_{10} (5) 136.8_{10}

8. A particular command can be used to output the values of every byte in a file in decimal format. Assume a file contains the following text:

   Love trees!

   Referring the two **Notes (i)** and **(ii)** given below, select the correct output that will result when the said command is run on that file.

   (1) 76   111   118   101   32   116   114   101   101   115   10
   (2) 76   111   118   101   116   114   101   101   115   33   10
   (3) 76   111   118   101   32   116   114   101   101   115   33   10
   (4) 108   111   118   101   116   114   101   101   115   33   10
   (5) 108   111   118   101   32   116   114   101   101   115   33   10

   Notes:

   (i) Some selected rows from the ASCII table are given below:

Decimal	Character		Decimal	Character
10	(LINE FEED)		108	l
32	(SPACE)		111	o
33	!		114	r
76	L		115	s
101	e		116	t
			118	v

   (ii) The file ends with a LINEFEED character.

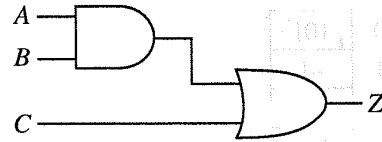0002621

9. Consider the following Karnaugh map and the logic circuit implemented based on it where A, B and C are the inputs and Z is the output:

AB

C \ AB	00	01	11	10
0	0	e	f	0
1	1	g	h	1

(*a*) Karnaugh map   (*b*) Logic circuit based on Karnaugh map

For the logic circuit to correctly implement the logic function represented in the Karnaugh map, what should be the values of **e, f, g, h**?

(1) e=0, f=0, g=1, h=1   (2) e=0, f=1, g=1, h=1
(3) e=1, f=0, g=1, h=1   (4) e=1, f=1, g=0, h=0
(5) e=1, f=1, g=0, h=1

10. Amara logs into a single-processor computer and starts a program to work on his presentation. He opens up a web browser too to get some information as well.
Consider the following process state transition diagram with respect to the process corresponding to Amara's **presentation program.**
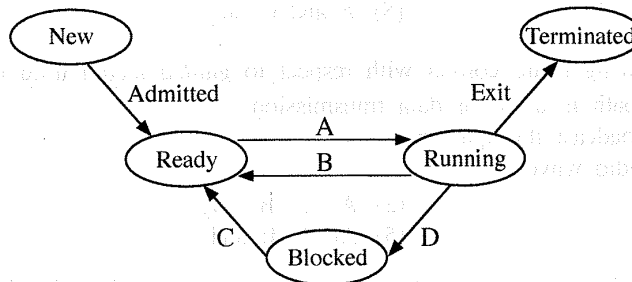
Consider some reasons for above state transitions:

Reason	Description
1	Amara saving his presentation on the hard disk
2	Operating system scheduling the presentation process to run on the processor
3	Operating system suspending the presentation process to let the web browser process to run on the processor
4	The finishing of saving the presentation on the hard disk

Which of the following gives a correct combination of reasons for transitions A to D?

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

11. A *page table* is
(1) a computer hardware unit through which all memory references pass.
(2) a data structure that keeps information about the pages that are in processor caches.
(3) a hardware component in memory that facilitates page movement.
(4) an operating system data structure that keeps virtual to physical address mapping of a process' pages.
(5) a piece of processor hardware that keeps a count of the number of pages of a process that are in virtual memory.

[*See page four*

12. The *block size* of a disk is 4KB. A portion of its **File Allocation Table** (**FAT**) at a particular time is shown below. The portion shown gives the blocks of the *myprog.py* file as well.

    FAT

100	101
101	−1
102	
103	100
104	

    Notes: 1. The last block of a file is indicated by −1.

    2. The *directory entry* of a file contains the block number of the first block of the file.

    Which of the following gives the *directory entry* for the *myprog.py* file **and** the disk space allocated for the *myprog.py* file respectively?

    (1) 100, 12KB   (2) 101, 12KB   (3) 101, 16KB   (4) 103, 12KB   (5) 103, 16KB

13. Which of the following is/are correct with respect to a *digital signal*?
    A – denoted by a square wave
    B – contains a continuous range of values
    C – uses discrete values to represent information
    (1) A only   (2) B only   (3) C only
    (4) A and B only   (5) A and C only

14. Which of the following is/are correct with respect to *guided media* used for data transmission?
    A – a physical path is used for data transmission
    B – signal is broadcast through air
    C – Example: radio waves
    (1) A only   (2) A and B only   (3) A and C only
    (4) B and C only   (5) All A, B and C

15. Which of the following could be used to digitally represent analog signals?
    (1) attenuation   (2) decoding   (3) distortion
    (4) pulse code modulation   (5) synchronization

16. Read the following sentence:
    When devices send and receive data over a network, a protocol is used uniquely identify the sender interface and the correct delivery of the data to the receiver's interface.
    What is the protocol that the writer in above sentence is referring to?
    (1) FTP   (2) HTTP   (3) MAC   (4) TCP   (5) UDP

17. Given below are some characteristics of *Transmission Control Protocol (TCP)* and *User Datagram Protocol (UDP)*:
    A – best suited for applications that need high reliability and where the transmission time is less critical
    B – faster and requires fewer resources
    C – guarantees that no packets are missing
    D – packets may not arrive in order
    E – used for voice communications over internet
    Which of the above are the characteristics of **UDP**?
    (1) A, B and C only   (2) A, C and E only   (3) A, D and E only
    (4) B, C and D only   (5) B, D and E only

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18. Which of the following is/are examples for the use of the *Client-Server* model?
   A – A user printing a document using a printer connected to her computer
   B – A bank customer accessing online banking services with a web browser
   C – A cashier of a shop that accepts payments by credit cards
   (1) A only   (2) B only   (3) C only
   (4) A and C only   (5) B and C only

19. Sender A wants to send the message HELLO to receiver B. Before sending the message, it is converted to IFMMP. Which of the following is correct with respect to this scenario?
   A –   HELLO is the *plaintext* while IFMMP is the *ciphertext*.
   B –   IFMMP is the result of applying the ASCII code to HELLO.
   C –   +1 is the *encryption key* while −1 is the *decryption key*.
   (1) A only   (2) A and B only   (3) A and C only
   (4) B and C only   (5) All A, B and C

20. Consider the following paragraph with three blanks labelled A, B and C:
   When there are multiple computers in an office, each computer can be given a private IP address. The router in the office gets a ......A...... IP address, and each of the computers connected to that router through guided/unguided media gets a private IP address from the ......B...... via the ......C...... protocol.
   Which of the following is the correct combination for the blanks A, B and C?
   (1) A – private, B – file server, C – HTTP
   (2) A – private, B – Internet, C – DHCP
   (3) A – private, B – router, C – FTP
   (4) A – public, B – file server, C – FTP
   (5) A – public, B – router, C – DHCP

21. Consider the information system types in **List A** and some examples in **List B**:

List A	List B
A1 – Enterprise Resource Planning System	**B1** – A customer account system in a bank
A2 – Expert system	**B2** – A system that facilitates manufacturing, marketing and sales of a garment business
A3 – Transaction processing system	**B3** – A system that prescribes ayurvedic medicines using a knowledge base

   A good matching between lists **A** and **B** is:
   (1) A1-B1, A2-B2, A3-B3   (2) A1-B2, A2-B3, A3-B1
   (3) A1-B3, A2-B1, A3-B2   (4) A1-B2, A2-B1, A3-B3
   (5) A1-B3, A2-B2, A3-B1

22. Which of the following is **incorrect** about the *Agile Method*?
   (1) It cannot be used when the project has a fixed set of requirements.
   (2) It recommends a time sliced schedule for task completion.
   (3) It delivers gradual builds of the working product in an iterative manner.
   (4) It facilitates stakeholders (e.g., buyer, user) to review progress and provide feedback at every phase.
   (5) The product of each build is tested independently.

[See page six

23. Which of the following statements is/are correct with respect to *Object Oriented Programming*?

    A – System output is determined by the object behaviour and their interactions.

    B – System is modelled as a collection of objects.

    C – Writing a program in this method is different from writing one according to the *structured programming* method.

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

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

24. Which of the following lists the activities of Structured System Analysis and Design Methodology (SSADM) in the correct order?

    (1) Feasibility study, Physical design, Requirement analysis, Requirement specification, System development

    (2) Feasibility study, Requirements analysis, Requirement specification, Logical system specification, Physical design

    (3) Feasibility study, Requirement specification, Requirements analysis, Logical system specification, Physical design

    (4) Requirements analysis, Logical system specification, Feasibility study, Requirement specification, Physical Design

    (5) Requirements analysis, Requirement specification, Feasibility study, Physical design, System development

● A system that gives the list of closest taxi drivers to a passenger is to be developed. Answer questions **25** and **26** with respect to it.

25. Assume that the following is the *Level 1 DFD* for this system:
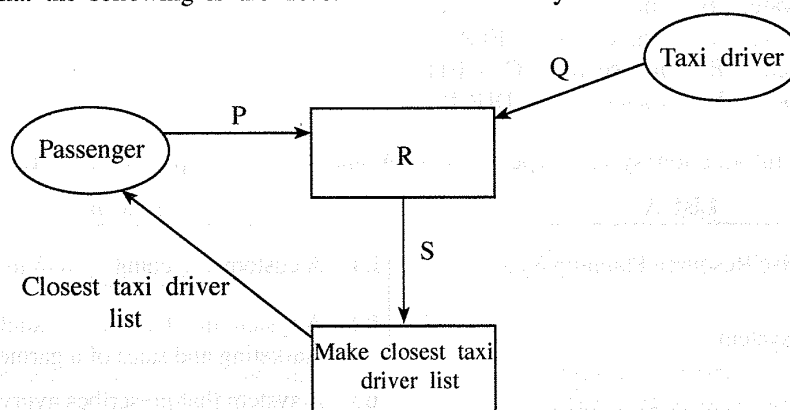
Which of the following contains the suitable replacements for P, Q, R and S in the above diagram?

    (1) P – Location, Q – Driver code, R – Get passenger and driver locations, S – Passenger and driver locations

    (2) P – Location, Q – Driver code and location, R – Get passenger and driver details, S – Passenger and driver details

    (3) P – NIC number, Q – NIC number, R – Get passenger and driver NIC numbers, S – Passenger and driver NIC numbers

    (4) P – Passenger code, Q – Driver code, R – Get passenger and driver codes, S – Passenger and driver codes

    (5) P – Passenger code, Q – Location, R – Get passenger and driver locations, S – Passenger and driver locations

26. Above Level-1 DFD was later improved so that a data store (D1) was connected to the process labelled R. What could be this data store?

    (1) NIC data   (2) Passenger details   (3) Taxi driver details

    (4) Travel cost details   (5) Weather records

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27. Which of the following gives a suitable order of activities to follow when developing a system that involves a database?
    (1) Design the database, Draw the DFD, Draw the ER diagrams, Do the coding, Write the pseudo-code
    (2) Design the database, Write the pseudo-code, Draw the ER diagrams, Draw the DFD, Do the coding
    (3) Do the coding, Write the pseudo-code, Design the database, Draw the ER diagrams, Draw the DFD
    (4) Draw the DFD, Draw the ER diagrams, Design the database, Write the pseudo-code, Do the coding
    (5) Draw the ER diagrams, Do the coding, Write the pseudo-code, Design the database, Draw the DFD

28. Which of the following statements is/are correct about *acceptance testing*?
    A – Acceptance testing is done when the user requirements of the software are analysed.
    B – An essential activity in acceptance testing is checking through the conditional statements and loops in the code.
    C – Users may refuse to accept the software after the Acceptance Test.
    (1) A only   (2) B only
    (3) C only   (4) A and C only
    (5) All A, B and C

29. Which of the following statements is correct about software deployment?
    (1) *Direct deployment* has the highest risk of complete failure but may be the only suitable method for some cases.
    (2) *Direct deployment* is the most expensive and offers slowest learning to the users.
    (3) *Parallel deployment* is the least expensive deployment option.
    (4) *Phased deployment* does not provide the freedom for the relevant organization to make any needed adjustments to the system.
    (5) *Pilot deployment* always rolls out the new system to a test user group larger than 50% of the users.

30. Which of the following statements is/are correct?
    A – *Business Process Re-engineering* helps to modify the existing business practices to fit with Commercial-Off-The-Shelf (COTS) software.
    B – Users may have to pay for certain features of COTS even if those are not needed.
    C – A well developed *custom software* can bring a competitive advantage to an organization.
    (1) A only   (2) B only
    (3) A and B only   (4) B and C only
    (5) All A, B and C

31. Which of the following is a (are) good practice(s) to follow in database development?
    A – the use of meaningful names for tables and fields
    B – letting different tables repeat the same information (other than the primary keys)
    C – avoiding a field and and its table having the same name (in order to avoid confusion while writing queries)
    (1) A only   (2) B only
    (3) C only   (4) A and B only
    (5) A and C only

- Consider the following **Results** and **Subjects** tables to answer questions from **32** to **35**:

Results

StudentNo	NIC	FirstName	SubjectID	Grade
S1234	986888457V	Nilam	ENG	B
S1447	992562321V	Praveena	PHY	C
S1234	986888457V	Nilam	ACC	A
S1323	900251452V	Thilan	ENG	S
S1323	900251452V	Thilan	ACC	B

Subjects

SubjectID	SubjectName
ENG	English
PHY	Physics
ECO	Economics
ACC	Accountancy

32. Which of the following is most suited to be selected as the *primary key* of the **Results** table with respect to the given details?
    (1) NIC
    (2) SubjectID
    (3) StudentNo
    (4) StudentNo and NIC
    (5) StudentNo and SubjectID

33. What is the correct SQL statement to retrieve the values of attributes **StudentNo**, **SubjectName** and **Grade**?
    (1) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN ON Results.SubjectID = Subjects.SubjectID;
    (2) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN Results.SubjectID = Subjects.SubjectID;
    (3) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN Subjects IN Results.SubjectID = Subjects.SubjectID;
    (4) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade FROM Results INNER JOIN Subjects ON Results.SubjectID = Subjects.SubjectID;
    (5) SELECT Results.StudentNo, Subjects.SubjectName, Results.Grade INNER JOIN Results AND Subjects Results.SubjectID = Subjects.SubjectID;

34. Which of the following is the correct statement about the **Results** table?
    (1) All the non-key attributes are fully functionally dependent on the primary key.
    (2) It has one candidate key.
    (3) It is in the *First Normal Form* (1NF).
    (4) It is in the *Second Normal form* (2NF).
    (5) The cardinality of the table is four.

35. Which dependency is removed when converting the **Results** table to next normal form?
    (1) foreign key dependency
    (2) fully functional dependency of non-key attributes on the primary key
    (3) multivalued dependency
    (4) partial dependencies of non-key attributes on the primary key
    (5) transitive dependency of non-key attributes

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36. Following are the steps involved in creating an *Entity Relationship* (ER) *Diagram*:

      I. Determine the   .....**A**..... in your diagram.

      II. Add ....**B**.... to each ....**C**....

      III. Include the ...**D**.... between the ....**A**....

      IV. Add ....**E**.... to every relationship

Which of the following gives suitable choices for the **A, B, C, D** and **E** blanks in the above steps?

(1) A – attributes, B – entities, C – attribute, D – cardinality, E - entities

(2) A – attributes, B – cardinality, C – attribute, D – entities, E- entity

(3) A- entities, B – attributes, C – entity, D – relationships, E – cardinality

(4) A- entities, B – relationship, C – entity, D – attributes, E – cardinality

(5) A – relationships, B – cardinality, C – relationship, D – attributes, E – entities

37. Which of the following can be modelled with an *Extended Entity Relationship* diagram?

      A – subclasses of an entity

      B – inheritance of attributes

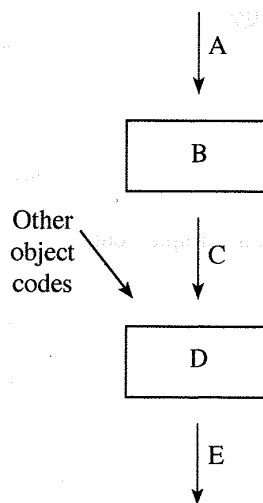   C – specialization of entities

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

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

38. A teacher of a programming class draws the following diagram and asks the students to identify the components indicated by A, B, C, D and E:

Which of the following gives the correct choices for A, B, C, D and E?

(1) A – compiler, B – executable code, C – source code, D – linker, E – object code

(2) A – compiler, B – source code, C – executable code, D – object code, E – linker

(3) A – linker, B – source code, C – object code, D – executable code, E – compiler

(4) A – source code, B – object code, C – linker, D – compiler, E – executable code

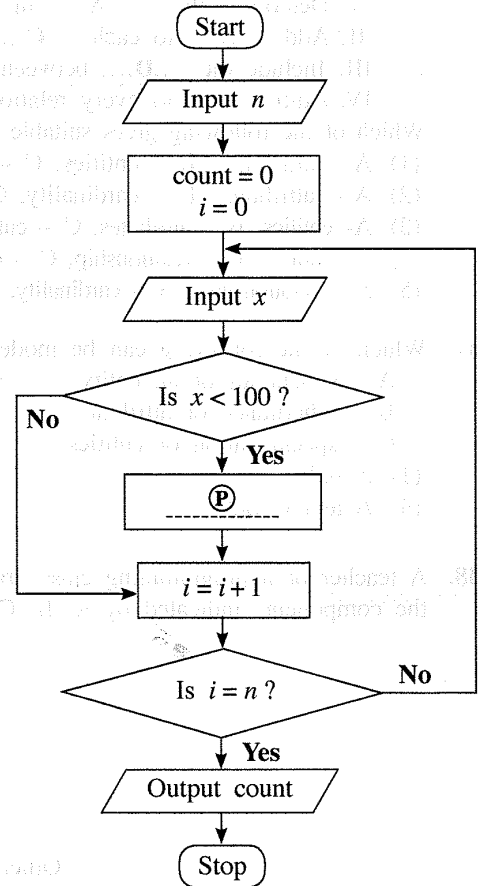(5) A – source code, B – compiler, C – object code, D – linker, E – executable code

- Consider the algorithm expressed by the flowchart and answer questions **39** and **40**.

  This algorithm takes as input first an integer n (≥ 1) followed by a sequence of n integers one by one. The algorithm is expected to output the count of integers that are less than 100 among the sequence of n inputs.

39. For the algorithm to function correctly as expected, what should be inserted at the blank $\textcircled{P}$?

(1) count = count + 1
(2) count = count + i
(3) count = count + x
(4) n = n – 1
(5) n = n + 1

40. Which of the following Python programs implement the algorithm in the flowchart?

```
I   n = int(input())
    count = 0
    for i in range(n):
            x = int(input())
            if (x < 100):
                    count = count + i
    print(count)
II  n = int(input())
    count = 0
    for i in range(n):
            x = int(input())
            if (x < 100):
                    count += 1
    print(count)
III n = int(input())
    count = i = 0
    while (i < n):
            x = int(input())
            if (x < 100):
                    count = count + 1
    print(count)
```

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

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41. What would be the output after executing the following Python code?

```
n = 117
m = (n & 127) // (2 ** 3)
print(m)
```

(1) 1   (2) 14   (3) 14.625   (4) 15   (5) 19

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

```
x = 10
def myfun(a):
        global x
        a = x + a
        x = 30
        return a
print(myfun(x))
```

(1) 10   (2) 20   (3) 30   (4) 40   (5) an error

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

```
S = ["covid", "pandemic", "vaccine", "booster", "virus"]
V = "aeiou"
count = 0
for i in range(len(S)):
        for j in range(len(S[i])):
                if (S[i][j] in V):
                        count = count + 1
print(count)
```

(1) 0   (2) 5   (3) 12   (4) 13   (5) 32

44. What will be the output when the following Python code is executed?

```
s = 1
for  i  in  range(1,10):

        if (i < 5):
                s = s * i
        elif (i < 8):
                s = s - i
        else:
                s = s + i
                break
print(s)
```

(1) 6   (2) 14   (3) 23   (4) 33   (5) 121

45. Read the following sentence about *website development*:

To make an effective website, it is important to identify its objectives and the target .....A..... and then design the most useful information layout for the website accordingly.

Which of the following is the correct choice for the blank **A** above?

(1) audio   (2) images   (3) text   (4) users   (5) video

46. Which of the following is the correct example for CSS group selector?

(1) h1{text-align:left ; color:blue;}
(2) h1,h2{text-align:left , color:blue;}
(3) h1.h2{text-align:left; color:blue;}
(4) h1:h2{text-align:left; color:blue;}
(5) h1,h2{text-align:left; color:blue;}

47. Consider the following HTML code:

```
<!DOCTYPE html>
<html>
<head>
<style>
body {
    background-image: url('srilanka.jpg');
}
</style>
</head>

<body>
<h2>Sri Lanka</h2>
<p>Sri Lanka, the island of serendipity, is really a <i>pearl in the
orient</i>.</p>
</body>
</html>
```

Which of the following statements is/are correct about the observations when the above code is viewed through a web browser?

    A – The srilanka.jpg image (if existing) will be displayed as the background to the web page.
    B – The **Sri Lanka** word which is enclosed within <h2> and </h2> tags will appear in italics.
    C – The **pearl in the orient** phrase enclosed within <i> and </i> tags will appear in italics.

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

48. Which of the following statements is correct about the following code line when it is rendered through a web browser?

```
<input type="radio" name="vaccinate" value="Yes">
```

  (1) It shows a radio button with a label named vaccinate at left side.
  (2) It shows a radio button with a label named vaccinate at right side.
  (3) It shows a radio button with a label named Yes at left side.
  (4) It shows a radio button with a label named Yes at right side.
  (5) The word Yes is not shown to user.

49. Consider the following PHP code line which is used to create a MySQL database connectivity:

```
$conn = new mysqli($var1, $var2, $var3, $var4);
```

Which of the following is the correct representation for the above variables?

  (1) $var1 = database, $var2 = server name, $var3 = user name, $var4 = password
  (2) $var1 = database, $var2 = user name, $var3 = password, $var4 = server name
  (3) $var1 = server name, $var2 = database, $var3 = user name, $var4 = password
  (4) $var1 = server name, $var2 = user name, $var3 = password, $var4 = database
  (5) $var1 = user name, $var2 = password, $var3 = server name, $var4 = database

50. What would be the output when the following PHP code is executed?

```
<html>
<body>
<?php
    $class = array ("12-A", "12-B", "13-A");
    echo "IT classes are " . $class[1] . " and " . $class[2] ;
?>
</body>
</html>
```

  (1) IT classes are 12-A and 12-B   (2) IT classes are "12-A" and "12-B"
  (3) IT classes are 12-B and 13-A   (4) IT classes are .12-A. and .12-B
  (5) IT classes are .12-B. and .13-B

* * *

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