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கல்விப் பொதுத் தராட்சுப் பத்திர (உயர் தர)ப் பரிசீச, 2022(2023)

General Certificate of Education (Adv. Level) Examination, 2022(2023)

தொகை மற்றும் தொழில்நுட்ப தொழிற்சாலை
Information & Communication Technology

20 E I

படிய எடுக்கப்
இரண்டு மணித்திமாலம்
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 (x) 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 is/are correct?

A – Firmware is a computer program that is usually embedded in the volatile memory of a computer.

B - A *printer driver* is an example for an application software.

C - Linux is an example for a system software.

2. Which of the following require(s) *real-time* processing?

A = generating monthly electricity bills of customers

B – updating the bank account balance of a customer when she/he withdraws money from an ATM

C - updating the stock balance in a store upon successful completion of each transaction ✓

3. Which of the following lists a computer memory hierarchy in the **descending order** of access speed?

- (1) hard disk, registers, L2 cache, L1 cache, main memory
- (2) main memory, L1 cache, registers, L2 cache, hard disk
- (3) registers, main memory, hard disk, L1 cache, L2 cache
- (4) registers, L1 cache, L2 cache, main memory, hard disk
- (5) L1 cache, L2 cache, registers, main memory, hard disk

4. Which of the following gives the correct results of bit-wise AND and bit-wise OR operations between the two binary numbers 01010100, and 11101001, respectively?

- (1) 01000000_2 , 11111101_2
- (2) 00000010_2 , 10111001_2
- (3) 10111101_2 , 11001010_2
- (4) 11000000_2 , 00101100_2
- (5) 11111101_2 , 01010011_2

5. What is the correct binary equivalent of decimal 12.75_{10} ?

(1) 1011.01_2 , (2) 1011.11_2 , (3) 1100.00_2 , (4) 1100.11_2 , (5) 1100.01_2

6. What is the correct 2's complement binary representation of decimal -41_{10} using 8-bits?

(1) 00101001 (2) 01010110 (3) 10101001 (4) 11010110 (5) 11010111

0303000012011236



7. The address of an instruction was shown as **10f9** in hexadecimal. What is that address in decimal?
 (1) 25 (2) 1249 (3) 4345 (4) 10159 (5) 16249
8. A particular command can be used to output a text file in its binary format.

Assume a file contains the following text:

O Waste!

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

- (1) 00110000 00100000 01010111 01100001 01110011 01110100 01100101 00001010
 (2) 00110000 01010111 01100001 01110011 01110100 01100101 00100001 00001010
 (3) 00110000 00100000 01010111 01100001 01110011 01110100 01100101 00100001 00001010
 (4) 00110000 00100000 01110111 01100001 01110011 01110100 01100101 00100001 00001010
 (5) 00110000 00100000 01010111 01100001 01110011 01110100 01100101 00100000 00001010

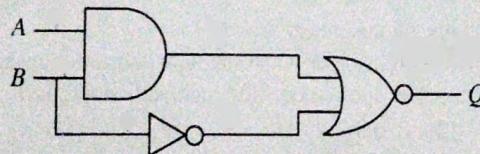
Important notes:

- (i) The file ends with a LINE FEED character.
 (ii) Some selected rows from the 7-bit ASCII table are given below:

Character	Binary
(LINE FEED)	0001010
(SPACE)	0100000
!	0100001
0	0110000
W	1010111

Character	Binary
a	1100001
e	1100101
s	1110011
t	1110100
w	1110111

9. Consider the following logic circuit:



When $B=1$, what would **definitely** be the output at Q ?

- (1) A (2) \bar{A} (3) B (4) \bar{B} (5) 0

10. Simplified Boolean expressions help to obtain simpler circuits.

Which of the following is a simplified form of $X + \bar{X}Y$?

- (1) X (2) Y (3) XY (4) $\bar{X}Y$ (5) $X + Y$

II. Consider the following truth table:

A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

What is the correct Karnaugh map for the above truth table?

A \ BC	00	01	10	11
	0	0	0	1
1	1	1	0	0

A \ BC	00	01	11	10
	0	0	0	1
1	1	1	0	0

A \ BC	00	10	01	11
	0	0	1	0
1	1	0	1	0

A \ BC	00	10	11	01
	0	0	1	1
1	1	0	0	1

A \ BC	00	11	10	01
	0	0	1	1
1	1	0	0	1

12. A program in execution in a computer is called a *process*. Such a process transits between several states during its lifetime. Which of the following correctly represents a possible state transition sequence of a process?

- (1) New → Ready → Running → Waiting → Ready → Running → Terminated
- (2) New → Ready → Waiting → Running → Waiting → Running → Terminated
- (3) New → Running → Ready → Waiting → Running → Ready → Terminated
- (4) New → Running → Waiting → Ready → Waiting → Running → Terminated
- (5) New → Waiting → Running → Ready → Running → Ready → Terminated

13. Which of the following is **not** a task of a computer operating system?

- (1) selecting a memory *frame* for a *page* of a process
- (2) maintaining a list of free memory *frames*
- (3) maintaining a *page table* for each process
- (4) monitoring the usage of binary files on a hard disk
- (5) swapping processes between main memory and hard disk

14. 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 indicates the blocks of the *average.py* file as well.

FAT

200	202
201	200
202	-1
203	201
204	205

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

II. 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 *average.py* file and the disk space allocated for the *average.py* file respectively?

- (1) 200, 12KB (2) 200, 16KB (3) 200, 20KB (4) 203, 16KB (5) 203, 20KB

15. Which of the following are *Transport Layer* protocols of the TCP/IP stack?

- A – Transmission Control Protocol (TCP)
 - B – User Datagram Protocol (UDP)
 - C – File Transfer Protocol (FTP)
 - D – Internet Protocol (IP)
- | | | |
|------------------|-----------------------|------------------|
| (1) A and B only | (2) A and C only | (3) B and C only |
| (4) B and D only | (5) All A, B, C and D | |

16. Which of the following statements is/are correct about MAC and IPv4 addresses?

- A – MAC addresses are 32 bits in length and are used in the network layer.
 - B – MAC addresses are 48 bits in length and are used in the datalink layer.
 - C – IPv4 addresses are 32 bits in length and are used in the network layer.
- | | | |
|------------------|------------------|------------|
| (1) A only | (2) B only | (3) C only |
| (4) A and C only | (5) B and C only | |

17. Which of the following is/are correct regarding a *firewall*?

- A – It can monitor and filter outgoing traffic from an internal network.
 - B – It protects a network from unauthorized accesses.
 - C – It can be a hardware, a software or a combination of both.
- | | | |
|------------------|--------------------|------------------|
| (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. An organization with the assigned IP address block 193.1.1.0/24 needs to define **eight** subnets. Each subnet should provide for more than 25 IP addresses. Which of the following correctly lists the number of bits needed to identify the given network, the total number of bits needed to identify the subnets, and the number of bits needed to assign unique IP addresses for this requirement, respectively?

- (1) 24, 3, 5 (2) 24, 5, 3 (3) 24, 27, 5 (4) 27, 3, 5 (5) 27, 30, 2

19. Which of the following statements is correct regarding network topologies?

- (1) In *bus topology*, a central network hub is used to connect all nodes.
- (2) In *star topology*, a linear cable is used to connect all nodes.
- (3) In *ring topology*, messages are sent only clockwise.
- (4) In *ring topology*, each node is directly connected only to two of its neighbors.
- (5) In *mesh topology*, each node is always connected to one other node only.

20. Consider the seven layer OSI reference model and match each of the given layers labeled from P to S to the corresponding responsibility of it labeled from 1 to 4.

Layer	Responsibility
P – Application layer	1 – binary transmission over the communication medium
Q – Physical layer	2 – route determination
R – Transport layer	3 – user services that include file transfer, remote access etc.
S – Network layer	4 – data delivery from process to process

- (1) P - 1, Q - 3, R - 2, S - 4 (2) P - 2, Q - 4, R - 3, S - 1
 (3) P - 3, Q - 1, R - 2, S - 4 (4) P - 3, Q - 1, R - 4, S - 2
 (5) P - 4, Q - 2, R - 1, S - 3

21. Which of the following statements is/are correct?

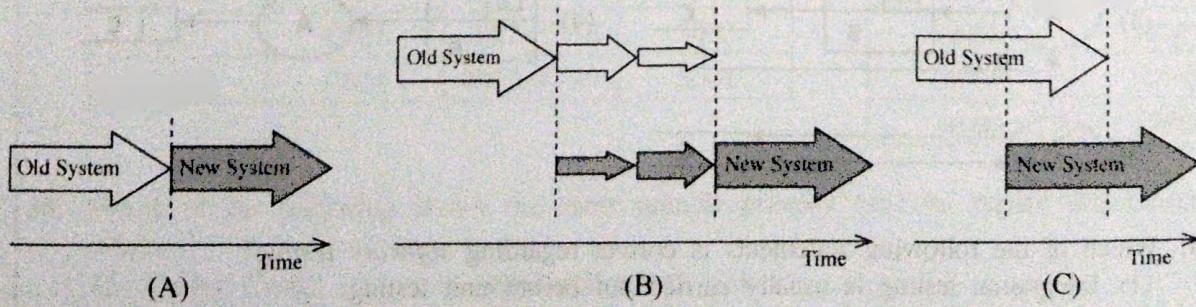
- A - A *digital signature* ensures the authenticity of a message.
 - B - In *asymmetric key encryption*, different keys are used for encryption and decryption.
 - C - The encryption process transforms plaintext to ciphertext.

22. Match each of the given data communication protocols labelled from P to T to the corresponding descriptions labelled from 1 to 5.

Protocol	Description
P – Hyper Text Transfer Protocol (HTTP)	1 – provides directory lookup service for given web addresses and URLs
Q – Transmission Control Protocol (TCP)	2 – provides a very reliable data transfer service
R – Domain Name System (DNS) Protocol	3 – used in the world wide web
S – Internet Protocol (IP)	4 – provides a connection-less transport service
T – User Datagram Protocol (UDP)	5 – handles unique addressing of hosts in the Internet

- (1) P - 2, Q - 4, R - 1, S - 5, T - 3
 - (2) P - 2, Q - 5, R - 4, S - 1, T - 3
 - (3) P - 3, Q - 2, R - 1, S - 5, T - 4
 - (4) P - 3, Q - 4, R - 5, S - 1, T - 2
 - (5) P - 4, Q - 2, R - 3, S - 1, T - 5

- 23.** The following diagrams labelled (A), (B) and (C) illustrate three software deployment types.



Which of the following correctly represents (A), (B) and (C) deployment types respectively?

- (1) Direct, Phased and Parallel (2) Direct, Pilot and Parallel
(3) Parallel, Phased and Direct (4) Parallel, Pilot and Phased
(5) Phased, Direct and Pilot

24. Consider the information system types in **List A** and the descriptive examples in **List B**. Identify the most suitable matching between the items in lists A and B.

List A	List B
A1 – Decision Support System (DSS)	B1 – a system that allows to update, create, and manage the details in a news website
A2 – Content Management System (CMS)	B2 – a system that handles electronic fund transfers
A3 – Transaction Processing System (TPS)	B3 – a system that combines data and analytical tools for sales forecasting based on historical data

- (1) A1 – B1, A2 – B2, A3 – B3
- (2) A1 – B2, A2 – B1, A3 – B3
- (3) A1 – B2, A2 – B3, A3 – B1
- (4) A1 – B3, A2 – B1, A3 – B2
- (5) A1 – B3, A2 – B2, A3 – B1

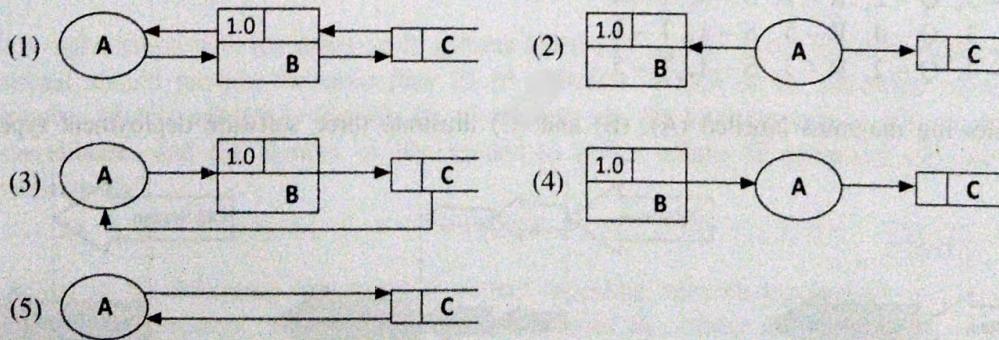
25. Which of the following statements is/are correct regarding System Development Life Cycle (SDLC) models?

- A – In the *agile* model, small portions of systematically developed working software are delivered to the client frequently.
 - B – Late changes in the requirements can be easily accommodated in the *waterfall* model.
 - C – *Prototyping* model can be practiced without client interactions.
- (1) A only
 - (2) B only
 - (3) C only
 - (4) A and B only
 - (5) A and C only

26. *Non-functional requirements* specify quality attributes of a system. Which of the following is an example for a *non-functional requirement*?

- (1) the email system should allow users to attach files
- (2) each page of the website must load within 4 seconds
- (3) administrator of the E-commerce website should be able to view a list of customers
- (4) a user of the online banking system should be able to view the last transactions
- (5) the ATM machine should allow users to print a receipt

27. Which of the following Data Flow Diagrams (DFDs) is correct with respect to the rules of data flow modelling? (Note: A – an external entity, B – a process, C – a data store)



28. Which of the following statements is correct regarding *software testing*?

- (1) Integration testing is usually carried out before unit testing.
- (2) Black-box testing techniques are usually used in acceptance testing.
- (3) White box testing examines the behaviour of a software based only on the inputs to a system.
- (4) Unit testing examines the entire system's functionality as a whole.
- (5) System testing is usually carried out after the user acceptance testing.

29. Consider the following relational schema:

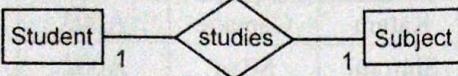
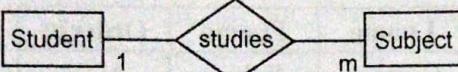
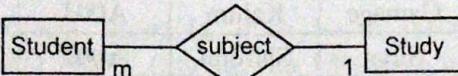
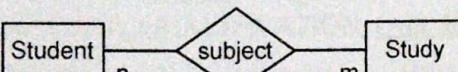
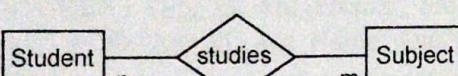
Student (StudentId, StudentName, Address, Gender, DateOfBirth)

↓
Study (StudentId, SubjectId, Grade)

Subject (SubjectId, SubjectName)

Which of the following is the most suitable *Entity Relationship (ER)* diagram to correctly represent the relationship between **Student** and **Subject** entities?

Note: In the ER diagrams, the entities are drawn without attributes.

- (1)  A diamond-shaped relationship symbol connects the two rectangular entity boxes. There is one line with the number '1' at each end, indicating a 1-to-1 relationship.
- (2)  A diamond-shaped relationship symbol connects the two rectangular entity boxes. One line has the number '1' and the other has the letter 'm', indicating a 1-to-many relationship.
- (3)  A diamond-shaped relationship symbol connects the two rectangular entity boxes. One line has the letter 'm' and the other has the number '1', indicating a many-to-1 relationship.
- (4)  A diamond-shaped relationship symbol connects the two rectangular entity boxes. Both lines have the letters 'n' and 'm' respectively, indicating a many-to-many relationship.
- (5)  A diamond-shaped relationship symbol connects the two rectangular entity boxes. One line has the letter 'n' and the other has the letter 'm', indicating a many-to-many relationship.

- The tables which are partially extracted from a database used in an information system developed for a shop are shown below. Answer the questions from **30** to **32** using those tables.

Customer

CusId	Fname	Lname	Location
C001	Saman	Perera	Dehiwala
C002	Kalum	Gamage	Galle
C003	Shiromi	Silva	Galle
C004	Kalum	Perera	Kandy

Product

ProdId	Name
PR001	Refrigerator
PB401	Blender
PM025	Mobile Phone
PP009	Inkjet Printer

Order

OrderId	CusId	OrderDate	SellerId
A001	C002	2022-07-14	S001
A002	C003	2022-07-14	S001
A003	C002	2022-07-18	S002
A004	C004	2022-07-20	S002

Order_Product

OrderId	ProdId
A003	PR001
A001	PR001
A002	PB401
A003	PM025
A004	PP009

30. Which of the following shows the most suitable *primary keys* for **Order** and **Order_Product** relations?

- | | |
|------------------------------|---------------------------------|
| (1) Order: CusId, | Order_Product: OrderId |
| (2) Order: OrderId, | Order_Product: OrderId |
| (3) Order: OrderId, | Order_Product: OrderId + ProdId |
| (4) Order: CusId + SellerId, | Order_Product: ProdId |
| (5) Order: OrderId + CusId, | Order_Product: OrderId |

31. What will be the output after executing the following SQL statement?

```
SELECT Customer.Fname, Customer.Lname, Order.OrderId
FROM Customer INNER JOIN Order ON Customer.CusId = Order.CusId
WHERE Customer.Location="Galle";
```

(1)	Fname	Lname	OrderId
Kalum	Gamage	A001	
Kalum	Gamage	A003	
Shiromi	Silva	A002	

(2)	Fname	Lname	OrderId
Kalum	Gamage	A004	
Kalum	Perera	A001	
Kalum	Gamage	A003	
Shiromi	Silva	A002	

(3)	Fname	Lname	OrderId
Kalum	Gamage	A001	
Kalum	Perera	A003	
Shiromi	Silva	A002	

(4)	Lname	Fname	OrderId
Gamage	Kalum	A001	
Gamage	Kalum	A003	
Silva	Shiromi	A002	

(5)	Fname	Lname	OrderId
Kalum	Gamage	A001	
Shiromi	Silva	A002	

32. Which of the following is correct regarding the **Order** relation?

- (1) CusId attribute uniquely identifies each tuple in the relation.
- (2) The relation is in First Normal Form (1NF).
- (3) The relation is in Second Normal Form (2NF).
- (4) Orders of each customer are handled by a unique salesperson.
- (5) The relation consists of a composite primary key.

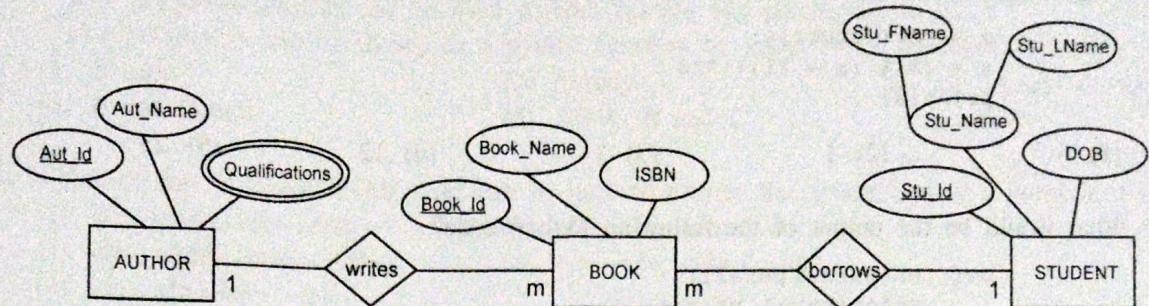
33. Which of the following statements is/are correct regarding the *normalization* concept?

- A – In first normal form, atomic attributes are **removed** from a relation.
 - B – In second normal form, partial dependency of attributes on the primary key are **removed**.
 - C – In third normal form, transitive dependency of attributes are **removed**.
- | | | |
|-------------------------|---------------------------|-------------------------|
| (1) B only | (2) A and B only | (3) A and C only |
| (4) B and C only | (5) All A, B and C | |

34. Which of the following statements is/are correct regarding *Entity Relationship (ER) modelling*?

- A – A weak entity is dependent on another entity.
 - B – A derived attribute is represented as an attribute in a relation.
 - C – An entity can contain a multi-value attribute and a composite attribute at the same time.
- | | | |
|-------------------------|---------------------------|-------------------------|
| (1) A only | (2) B only | (3) A and C only |
| (4) B and C only | (5) All A, B and C | |

35. The following ER diagram represents a scenario of students borrowing books from a library. Which of the following gives the most suitable relation list for the given ER diagram?

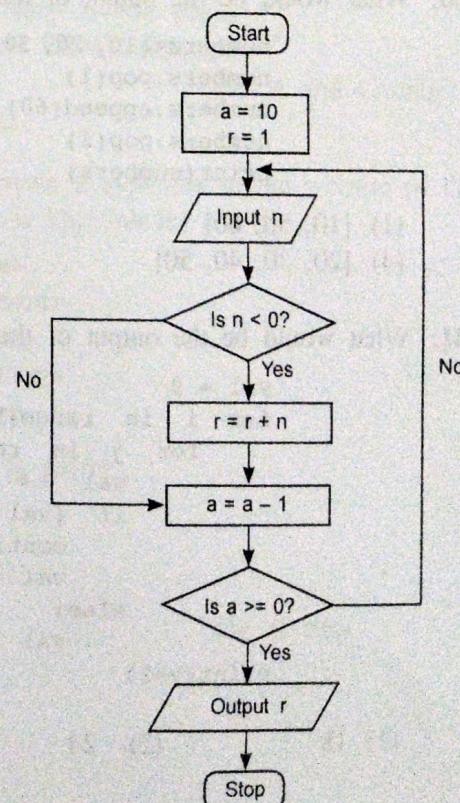


- (1) BOOK (Book_Id, Book_Name, ISBN, Stu_Id, Aut_Id)
 STUDENT (Stu_Id, Stu_FName, Stu_LName, DOB)
 AUTHOR (Aut_Id, Aut_Name)
 AUTHOR_QUALIFICATION (Aut_Id, Qualifications)
- (2) BOOK (Book_Id, Book_Name, ISBN)
 STUDENT (Stu_Id, Stu_FName, Stu_LName, DOB)
 AUTHOR (Aut_Id, Aut_Name)
 AUTHOR_QUALIFICATION (Aut_Id, Qualifications)
- (3) BOOK (Book_Id, Book_Name, ISBN, Stu_Id, Aut_Id)
 STUDENT (Stu_Id, Stu_FName, Stu_LName, DOB)
 AUTHOR (Aut_Id, Aut_Name, Qualifications)
- (4) BOOK (Book_Id, Book_Name, ISBN, Stu_Id, Aut_Id)
 STUDENT (Stu_Id, Stu_Name, DOB)
 AUTHOR (Aut_Id, Aut_Name)
 AUTHOR_QUALIFICATION (Aut_Id, Qualifications)
- (5) BOOK (Book_Id, Book_Name, ISBN, Stu_Id, Aut_Id)
 STUDENT (Stu_Id, Stu_Name, DOB)
 AUTHOR (Aut_Id, Aut_Name)
 AUTHOR_QUALIFICATION (Aut_Id, Qualifications)
 BORROW (Aut_Id, Book_Id)
 WRITE (Aut_Id, Book_Id)

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

- A – An input is taken from the user only once.
- B – The output of the algorithm is always 9.
- C – The algorithm outputs the summation of all the numbers entered.

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



37. What would be the output of the following Python code if the input was 25?

```
x = int(input())
x = (x % (x - 21)) **3
print(x)
```

- (1) 0 (2) 1 (3) 3 (4) 12 (5) 25

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

```
def fun(para1, para2):
    x=foo(para2, para1)
    return x

def foo(para3, para4):
    return para3 - para4

result=fun(2, 4)
print("Result is " + str(result))
```

- (1) Result is 0 (2) Result is 2 (3) Result is -2
 (4) Result is (2, 4) (5) Result is +2

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

```
def foo(name, age=18, address="Kandy"):
    print(name, address, age)

foo("Nimal", 25, "Colombo")
```

- (1) Nimal Colombo 25 (2) Nimal, Colombo, 25
 (3) Nimal, Kandy, 18 (4) Nimal Kandy 18
 (5) Nimal 18 Kandy

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

```
numbers=[10, 20, 30, 40, 50]
numbers.pop(1)
numbers.append(60)
numbers.pop(2)
print(numbers)
```

- (1) [10, 50, 60] (2) [10, 20, 40, 60] (3) [10, 30, 50, 60]
 (4) [20, 30, 40, 50] (5) [20, 30, 50, 60]

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

```
val = 9
for i in range(5):
    for j in range(2, 3, 1):
        val += 1
        if (val % 2) == 0:
            continue
        val += 2
    else:
        val += 2
print(val)
```

- (1) 18 (2) 24 (3) 29 (4) 38 (5) 39

48. Given below is a partially completed PHP script used to connect to a database named **Employees** using MySQLi (procedural method). Which option is most suitable to fill in the blank spaces **A**, **B** and **C** respectively?

```
<?php
    $servername = "127.0.0.1";
    $username = "username";
    $password = "password";
    $conn = mysqli_connect($servername, $username, $password);
    if (!$conn) {
        die("Connection failed: " . mysqli_connect_error());
    }
    $sql = "CREATE DATABASE __A__";
    if (mysqli_query(__B__, __C__)) {
        echo "Database created successfully";
    } else {
        echo "Error creating database: " . mysqli_error($conn);
    }
    mysqli_close($conn)
?>
```

- (1) \$sql, \$conn, \$Employees (2) \$conn, \$sql, Employees
 (3) \$Employees, \$conn, \$sql (4) Employees, \$conn, \$sql
 (5) Employees, \$sql, \$conn

49. Which of the following statements is/are correct?

- A – Quantum computing could be an alternative to overcome the limitations of the existing microprocessors.
- B – Natural phenomena such as the behaviour of ant colonies could be used to develop new computing models to solve complex problems.
- C – An inference engine of an expert system utilizes the facts in a knowledge base to support decision making.

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

50. Which of the following statements is/are correct?

- A – E-Commerce encourages to minimize physical interactions between buyers and sellers.
- B – The main purpose of sending a One Time Password (OTP) to a credit card holder's mobile phone during an online payment is to identify the current location of the card owner.
- C – Bitcoin is a leading virtual currency.

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

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