Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: MCA
Sub_Code: MCBS1001

1st Semester Regular/Back Examination: 2025-26
SUBJECT: DISCRETE MATHEMATICS
BRANCH(S): MCA (2 Yrs)
Time: 3 Hours
Max Marks: 100
Q.Code: U501

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) State the converse and contrapositive of the implication "If it rains, then I will stay home."
b) Show that $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent.
c) Let $A = \{a, b, c\}$. List all elements of the Power Set $P(A)$.
d) Give an example of a one-one function which is not onto.
e) What is the Time Complexity $(Big - O)$ of the Binary Search algorithm?
f) Find the number of permutations of the letters in the word "APPLE".
g) State Pigeonhole principle and partial ordering relation.
h) Is K_5 planar? Justify your answer.
i) What is graph isomorphism?
j) Differentiate between a Tree and a forest.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Construct a truth table to determine if $(p \wedge (p \rightarrow q)) \rightarrow q$ is a tautology.
b) Let $A = \{1,2,3\}$ and $B = \{2,3,4\}$. Find $(A \cup B) - (A \cap B)$ and draw the Venn Diagram.
c) Use rules of inference to show that the hypotheses "If it does not rain or if it is not foggy, then the sailing race will be held" and "The sailing race is not held" imply the conclusion "It rained".
d) Let $f, g: R \rightarrow R$ be defined by $f(x) = 2x - 3$ and $g(x) = x^2 + 1$. Then compute $(f \circ g)(x)$ and $(g \circ f)(x)$. Are the compositions equal?
e) Write the pseudo code for Bubble Sort and analyze its worst-case complexity.
f) Show that if a function has an inverse, then the inverse is unique.
g) Find a recurrence relation for the number permutations of a set with n elements.
h) Students are awarded 4 grades $A, B, C,$ and D. How many students must be there in a group so that at least 6 students get the same grade.
i) In how many ways can a committee of 5 people be chosen from 10 men and 8 women if the committee must contain at least 3 women?

j) Explain Dijkstra's Algorithm for finding the shortest path in a weighted graph.

k) Define chromatic number. Find the chromatic number of a complete graph K_5 and a bipartite graph $K_{3,3}$.

l) Prove or disprove that there is no connected Eulerian simple graph that has even number of vertices and odd number of edges.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 a) Using Mathematical Induction prove that $n! > 2^n$ for $n \geq 4$. **(8)**

b) Explain universal and existential quantifiers with suitable counterexamples. **(8)**

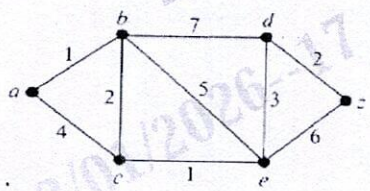
Q4 a) Arrange the following functions in increasing order of asymptotic growth: $n!, 2^n, n \log n, n^2 \log n, n$. Justify your answer using Big-O definitions. **(8)**

b) Describe the Binary Search algorithm. Show the steps to search for the element '15' in the sorted list: $\{2, 5, 8, 12, 15, 18, 22, 25, 30\}$. **(8)**

Q5 a) Let R be a relation on $A = \{1,2,3,4\}$ defined by $R = \{(1,1), (1,2), (2,1), (2,2), (3,4), (4,3), (3,3)\}$. Is R an equivalence relation? Justify your answer. **(8)**

b) Find the coefficients of x^5y^7 and x^7y^5 in the expansion of $(x + y)^{12}$. **(8)**

Q6 Define Hamiltonian paths and circuits with example. Define Eulerian path and Eulerian circuit with example. Find shortest path from a to z in the following graph **(16)**



Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: MCA
Sub_Code: MCPC1001

1st Semester Regular/Back Examination: 2025-26
SUBJECT: Digital Logic Design
BRANCH(S): MCA (2 Yrs)
Time: 3 Hours
Max Marks: 100
Q.Code: U577

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) The Boolean fun $F(A,B,C) = \sum m(1,2,5,7)$ is implemented using only NAND gates. What is the minimum number of NAND gates required?

b) A Boolean function of 5 variables is to be implemented using 4:1 multiplexer only. What is the minimum number of multiplexers required?

c) A T flip-flop toggles on every positive clock edge. If the initial output is 0, what will be the output after 11 clock pulses?

d) A MOD-10 synchronous counter is implemented using JK flip-flops. What is the minimum number of flip-flops required?

e) A 4-bit shift register is initially loaded with 1101. After three right shifts, what is the content of the register (serial input = 0)?

f) A combinational circuit has a maximum propagation delay of 12 ns. What is the maximum clock frequency at which it can be safely operated?

g) Which memory type requires periodic refreshing?

h) What are the main components used in FPGA?

i) A PLA has 6 inputs and 10 product terms. How many fuses are required in the AND plane?

j) A ROM has 256 words, each of 8 bits. How many address lines are required?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) Explain the architecture and working of SRAM and DRAM cells.
Compare SRAM and DRAM in terms of:
- Speed
- Power consumption
- Area
- Applications

b) Design a MOD-10 synchronous counter using JK flip-flops.
I. Draw the state transition diagram
II. Obtain flip-flop input equations
III. Explain how unused states are handled

c) Minimize the following Boolean function using Karnaugh map and implement it using only NAND gates: $F(A, B, C, D) = \Sigma\, m\,(0, 2, 5, 7, 8, 10, 13, 15)$ Show all simplification steps and the final logic diagram.

d) Implement the Boolean function $F = A\bar{B}C + AB\bar{C} + \bar{A}BC$ using:
(I) Decoder and OR gates
(II) Multiplexers
Compare the two implementations.

e) Design a 4:1 multiplexer using only 2:1 multiplexer. Draw the logic diagram and explain the selection process.

f) Design a combinational circuit that compares two 4-bit binary numbers and generates outputs indicating A > B, A = B, and A < B. Explain the working of the comparator.

g) Explain the working of JK flip-flop with characteristic equation and timing diagram. What is race-around condition and how can it be eliminated?

h) Design a serial-in serial-out (SISO) shift register using D flip-flops. Explain its operation with timing diagrams and mention its applications.

i) Design a synchronous up-down counter using JK flip-flops. Explain the operation for both up-counting and down-counting modes.

j) Explain the working of a ring counter and Johnson counter. Compare them in terms of number of states, hardware complexity, and applications.

k) Explain the working of Flash memory. Compare Flash memory and EEPROM in terms of erase operation, speed, and applications.

l) Explain the architecture of a Field Programmable Gate Array (FPGA) with a neat block diagram. Discuss the role of CLBs, interconnection network, and I/O blocks.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3	a)	Explain the working of JK flip-flop with characteristic and excitation tables.	(4)
	b)	Design a MOD-12 asynchronous counter using T flip-flops.	(6)
	c)	Draw the state diagram and derive the flip-flop input equations.	(6)
Q4	a)	Explain the architecture of a Programmable Logic Array (PLA).	(4)
	b)	Design a PLA to implement the functions: $F_1(A,B,C) = \sum m(1,3,5,7), F_2(A,B,C) = \sum m(0,2,4,6)$	(8)
	c)	Discuss advantages of PLAs over fixed logic circuits.	(4)
Q5		Demonstrate how only 4-to-1 Multiplexers can be used to implement the 1-bit Full adder.	(16)
Q6	a)	Explain hardware description languages (HDLs) and their levels of abstraction.	(4)
	b)	Write a Verilog HDL code for a Full adder.	(8)
	c)	Explain simulation vs synthesis in digital design.	(4)

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: MCA
Sub_Code: MCPC1002

1st Semester Regular/Back Examination: 2025-26
SUBJECT: Computer Networks
BRANCH(S): MCA (2 Yrs)
Time: 3 Hours
Max Marks: 100
Q.Code: U632

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Define data communication and list its basic components.
b) What is TELNET?
c) What is meant by a protocol in computer networks?
d) What is the function of ICMP?
e) State any two differences between analog and digital signals.
f) Define multiplexing.
g) What is transmission impairment? Name any one type.
h) What is a repeater?
i) Define guided transmission media with one example.
j) Define ARP.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Describe data rate limits and explain the concept of bandwidth.
b) Explain CRC codes and their role in error detection.
c) Discuss sliding window protocols for flow control.
d) Explain HDLC protocol and its frame structure.
e) Discuss packet switching and circuit switching with examples.
f) Explain Distance Vector Routing with an example.
g) Describe IPv4 addressing and its classes.
h) Discuss the working of FTP protocol.
i) A stop-and-wait protocol is used on a link with 20 ms propagation delay and 1 ms transmission time. Calculate channel utilization.
j) Discuss congestion control and Quality of Service (QoS) in computer networks.
k) Explain the HTTP protocol in detail. Describe request and response messages.
l) Describe the Domain Name System (DNS).

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3	Explain the channel allocation problem and discuss multiple access protocols. Compare ALOHA, Slotted ALOHA, and CSMA/CD.	(16)
Q4	Explain the working of Electronic Mail System. Describe SMTP, POP, and IMAP protocols.	(16)
Q5	Design a subnetting scheme for the IP block 172.16.0.0/20 to create at least 12 subnets. Calculate subnet mask, number of hosts, and address range for one subnet.	(16)
Q6	Explain the layered architecture of computer networks. Discuss the advantages of layering with suitable examples from the OSI and TCP/IP models.	(16)

274-20/01/2026--17

Registration No.: | | | | | | | | | | |

Total Number of Pages: 03

Course: MCA
Sub_Code: MCPC1003

1st Semester Regular/Back Examination: 2025-26
SUBJECT: Programming for Problem Solving
BRANCH(S): MCA (2 Yrs)
Time: 3 Hours
Max Marks: 100
Q.Code: U686

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Classify the following as valid/invalid Identifiers with proper justifications.
I) num2 II) $num1 III) 199_space IV) _apple V) #12

b) Briefly write about conditional operator with a suitable example.

c) Write a program segment to swap (interchange) two variables without using a third variable.

d) Distinguish between logical operators and bitwise operators. Find the value of the following:
25 & 35
25 && 35

e) What is the output of following program?

```
#include <stdio.h>
int main()
{
   int a = 1;
   int b = 1;
   int c = a || --b;
   int d = a-- && --b;
   printf("a = %d, b = %d, c = %d, d = %d", a, b, c,d);
   return 0;
}
```

f) Write a C program to check whether a character is VOWEL or CONSONANT using switch case.

g) Write the C code to allocate space dynamically to a two-dimensional array of size 20 X 30.

h) Distinguish between syntax errors, runtime errors, and logical errors.

i) What is a debugger? Discuss breakpoints, watch variables, and step-wise execution.

j) What are the types of linked lists? Give an example of circular linked list with 3 nodes.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain different types of operators used in C programming with suitable examples.

b) Distinguish between an entry-controlled loop and an exit-controlled loop with suitable examples. Write a program to find the sum of the digits of a given integer.

c) An electricity board charges the following rates for the use of electricity: for the first 100 units, 50 paise per unit; for the next 100 units, 70 paise per unit; and beyond 200 units, Rs 1 per unit. All users are charged a minimum of Rs. 50 as meter charge. If the total amount is more than Rs 300, then an additional surcharge of 10 % of the total amount is charged. Write a C program to read the number of units consumed and print out the charges.

d) A recursive function and a for loop can often achieve the same logical result. But what is the difference between them in terms of the concept, memory usage, and processing efficiency?

e) Write a C program that takes a given number of bytes as input and computes the equivalent number of gigabytes (GB), megabytes (MB), kilobytes (KB), and the remaining bytes, using the conversions:
1 KB = 1024 B, 1 MB = 1024 KB, and 1 GB = 1024 MB.
Example: 5003062580 bytes = 4 GB, 675 MB, 299 KB, and 308 bytes

f) A Fibonacci number is a member of a sequence in which each number is the sum of the previous two numbers. The sequence will look like 〈0, 1, 1, 2, 3, 5, 8, 13, 21, · · ·〉 . Write a program to print first 50 Fibonacci numbers.

g) Distinguish between call by value and call by reference with a suitable example. Write a C program to swap the contents of two variables using Call by reference.

h) Write a program that fills a ten-by-ten matrix as follows:
- Except for diagonal elements, each element takes the value = row number + column number
- Diagonal elements take the value zero

Display the contents of the matrix using not more than two printf statements.

i) Write a function (using a pointer parameter) that receives a string and returns the reverse string. Do not use any library functions.

j) Provide the prototype declarations of malloc() and realloc(). Also, state the differences between these two functions. Predict the output of the program given below and state whether the program exhibits undefined behavior. If yes, identify the exact statement responsible and explain why.

```
#include <stdio.h>
#include <stdlib.h>
int main() {
    int *p = (int *)malloc(3 * sizeof(int));
    int i;
    for (i = 0; i < 3; i++)
        p[i] = i + 1;
    free(p);
    printf("%d %d\n", p[0], p[2]);
    return 0;
}
```

k) What is meant by an abstract data type (ADT)? Differentiate between linear and nonlinear data structures with suitable examples.

l) Explain the steps involved in inserting and deleting elements in a singly linked list.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Define an array. Demonstrate the static (compile-time) initialization for one-dimensional and two-dimensional arrays, with suitable examples. **(16)**

Write a program to check the repeating elements in an array.

Example: input = 1, 3, 4, 1, 2, 3, 5, 5, output = 1, 3, 5

Q4 Define a pointer. Demonstrate how pointers are declared and initialized using examples. Write a C program that demonstrates the use of a pointer to a pointer. The program should dynamically allocate memory for an m × n matrix, accept elements from the user, and display the matrix using pointers only (without array indexing). **(16)**

Q5 What is a structure data type in C? How is the size of an instance of a structure data type calculated? How does a union type differ from a structure type? A complex number consists of two parts: a real part and an imaginary part. Define a user-defined data type in C using a structure to represent a complex number. Write a complete C program where two complex numbers are created by accepting user input, multiplied, and the result of the multiplication is displayed. **(16)**

Q6 State the differences between a text file and a binary file. What are the different modes of opening text files and binary files? **(16)**

Write a C program that performs the following tasks:

a) Accepts a text file name as a command-line argument.
b) Checks whether the correct number of command-line arguments is provided.
c) Opens the specified file in read ("r") mode.
d) Reads the contents of the existing text file character by character. Displays the contents on the standard output (screen).
e) If the file cannot be opened or the command-line argument is missing, display an appropriate error message and terminate the program.

274-22/01/2026--17

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: MCA
Sub_Code: MCPC1004

1st Semester Regular/Back Examination: 2025-26
SUBJECT: Database Management Systems
BRANCH(S): MCA (2 Yrs)
Time: 3 Hours
Max Marks: 100
Q.Code: U724

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) In Relational model what do you mean by cardinality?
b) Find the number of candidate keys from the following FDs.
I) R (A, B, C, D) FD = {A→B, B→C, A→C}
II) R (X, Y, Z, W, P) FD = {Y→Z, Z→Y, Z→W, Y→P}
c) How can you map a conceptual model to a relational model?
d) Let F be the following set of functional dependencies:
{AB→CD, B→DE, C→F, E→G, A→B}.
Show if the FD: {A→FG} is logically implied by F.
e) A primary key if combined with a foreign key creates what?
f) What is the use of DML in DBMS?
g) What is ACID property?
h) Define Meta data with examples
i) What is nested query? How is it different from a correlated query?
j) List two reasons why we may choose to define a view.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) What do you understand by a data model? Explain the difference between conceptual data model and the internal model.
b) What are the basic operations for a relational language? How are basic operations represented in relational algebra and SQL?
c) Explain the entity integrity and referential integrity constraints. How they are useful in database Design?
d) Define and explain the integrity constraints in DBMS.
e) Does a relation in a 3rd Normal form satisfy the properties of Lossless decomposition and dependency preservation? Explain with an example.

f) Given R(ABCDEFGH) with FDs F = {A→C, B→D, E→F, G→H, C→G}. How many numbers of candidate keys are there? Which normal form R is in?

g) What is the goal of query optimization? Why is optimization important?

h) Why do query optimizers consider only left-deep join trees? Give an example of a query and a plan that would not be considered because of this restriction.

i) Explain why 4NF is a normal form more desirable than BCNF.

j) During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur.

k) What is an unsafe query? Give an example and explain why it is important to disallow such queries.

l) What is update anomalies? Explain with example.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 a) What is normalization? Explain the first and second normal forms using appropriate example. **(8 x 2)**

b) Define (i) primary key and (ii) foreign key. Suppose relation R (A, B, C, D, E) has functional dependencies:
AB → C
D → A
AE → B
CD → E
BE → D
Find all the candidate keys of R.

Q4 a) Explain various locking technique for concurrency control. **(8 x 2)**

b) When a transaction is rolled back under timestamp ordering, it is assigned a new timestamp. Why can it not simply keep its old timestamp?

Q5 What is serializability? Explain conflict serializability and view serializability. **(16)**
Test if the given schedule is conflict serializable or not R1 (A), R2 (D), W1 (B), R2 (B), W3 (B), R4 (B), W2 (C), R5 (C), W4 (E), R5 (E), W5 (B).

Q6 What is lossy decomposition? Check whether the following decompositions are lossy or lossless. **(16)**

i. Let R = ABCD, R1 = AD, R2 = AB, R3 = BE, R4 = CDE, R5 = AE, F = {A→C, B→C, C→D, DE→C, CE→A}

ii. R (XYZWQ), FD = {X→Z, Y→Z, Z→W, WQ→Z, ZQ→X, R1 (XW), R2 (XY), R3 (YQ), R4 (ZWQ), R5 (XQ)}

Eliminate redundant FDs from.

i. F = {X→Y, Y→X, Y→Z, Z→Y, X→Z, Z→X}

ii. F = {X→YZ, ZW→P, P→Z, W→XPQ, XYQ, YW, WQ →YZ}

Registration No.: | | | | | | | | | | |

Total Number of Pages: 03

Course: MCA
Sub_Code: MCHS1001

1st Semester Regular/Back Examination: 2025-26
SUBJECT: Communicative English
BRANCH(S): MCA (2 Yrs)
Time: 3 Hours
Max Marks: 100
Q.Code: U531

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is verbal communication? Give an example.

b) State any two barriers to effective communication.

c) What is plagiarism?

d) The developer _____ the application to fix the bug.
I) knows
II) understands
III) is debugging
IV) believes

e) When the power failed, the system _____ automatically.
I) shuts down
II) has shut down
III) shut down
IV) was shutting down

f) By this time next semester, we _____ the project documentation.
I) complete
II) will complete
III) will have completed
IV) have completed

g) Neither the faculty nor the students _____ aware of the schedule change.
I) was
II) were
III) is
IV) has

h) Effective interpersonal communication helps in:
I) Conflict creation
II) Relationship building
III) Misunderstanding
IV) Isolation

i) Body language is a part of:
I) Verbal communication
II) Written communication
III) Non-verbal communication
IV) Visual communication

j) Which element ensures response from the receiver?
I) Encoding
II) Channel
III) Feedback
IV) Noise

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Identify 04 major barriers to effective communication and suggest practical ways to overcome them.

b) Explain active listening techniques and discuss their role in improving communication.

c) State the steps involved in preparing and delivering an effective presentation.

d) How should a candidate prepare for a job interview? Explain briefly.

e) Explain techniques for effective reading comprehension.

f) Distinguish between verbal and non-verbal communication. Explain how both complement each other.

g) Explain the role of feedback in the communication process with an example.

h) Write the key components of a professional memo and state its purpose.

i) Discuss the importance of visual aids in professional presentations.

j) Explain state verbs and event verbs with examples.

k) Write a short blog (120-150 words) on: Online Learning vs Classroom Learning: A Student's Perspective.

l) Write a web article (120-150 words) on Advantages and Limitations of Social Media Communication.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Your organization recently received a consignment of office chairs. On inspection, several chairs were found to be damaged and not in accordance with the specifications mentioned in the order. **(16)**
Write a complaint letter to the supplier highlighting the issue and requesting replacement or refund.

Q4 You are a final-year student applying for the post of Graduate Trainee in a reputed IT company. **(16)**
Write a formal job application letter addressed to the HR Manager highlighting:

1. Your educational qualifications,
2. Relevant technical skills,
3. Internship or project experience, and

Willingness to learn and grow with the organization.

Q5 Read the passage and answer the questions that follow. **(16)**

Dr. A. P. J. Abdul Kalam, widely known as the "Missile Man of India," often credited his success not to individual brilliance but to discipline, teamwork, and humility. One such incident from his early career at the Indian Space Research Organisation (ISRO) reflects this belief. As the Project Director of the SLV-III launch vehicle, Kalam faced intense pressure when the first launch attempt failed in 1979. The failure was public, and expectations were high.

At the press conference that followed, Kalam was prepared to explain the technical reasons for the setback. However, his senior, Dr. Satish Dhawan, then Chairman of ISRO, stepped forward and took full responsibility for the failure, shielding the young team from criticism. He emphasized that failure was part of scientific progress and encouraged the team to learn from it.

The following year, when the mission succeeded, Dr. Dhawan insisted that Kalam address the press and take the credit. This gesture deeply influenced Kalam, teaching him a lasting lesson in leadership. He realized that true leaders accept responsibility during failure and generously share credit during success. Throughout his life, Kalam practiced this principle, inspiring generations of students and professionals to pursue excellence with integrity and humility.

Questions

1. Why was the failure of the SLV-III launch particularly challenging for Dr. Kalam and his team?
2. How did Dr. Satish Dhawan respond to the failure of the mission?
3. What lesson in leadership did Dr. Kalam learn from this incident?
4. Why did Dr. Dhawan ask Dr. Kalam to address the press after the successful launch?
5. How does the passage highlight the qualities of an effective leader?
6. Find a word from the passage that means *"protecting someone from blame or criticism."*
7. Find a word from the passage that means *"honesty and strong moral principles."*
8. What message does the passage convey to students and young professionals?

Q6 A technical workshop on Artificial Intelligence / Cyber Security / Cloud Computing was conducted in your institution. **(16)**

Draft a structured technical report covering:

- objectives of the workshop,
- key topics discussed,
- resource persons and activities,
- benefits to students, and
- conclusion.