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**SEC45CSC101(T)25**

**1st Semester Exam., 2025 (Nov) (FYUP)**

**SEC-1 (COMPUTER SCIENCE)**

**[ Introduction to Mathematical Foundation ]**

*Full Marks : 70*

*Pass Marks : 28*

*Time : 3 hours*

*The figures in the margin indicate full marks  
for the questions.*

**PART—A**

Choose the correct answer and rewrite them :

1×10=10

1. If  $A$ ,  $B$  and  $C$  are sets, then  $A - (B \cup C)$  is equal to

(a)  $(A - B) \cap (A - C)$

(b)  $(A - B) \cup (A - C)$

(c)  $(B - A) \cap (A - C)$

(d)  $(B - A) \cup (A - C)$

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( Turn Over )



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2. A relation  $R$  on a set  $A$  is said to be symmetric, if
- (a)  $aRb$  for all  $a$  in  $A$
  - (b)  $aRb$  implies  $bRa$
  - (c)  $aRb$  and  $bRc$  imply  $aRc$
  - (d)  $aRa$  implies  $bRb$
3. A square matrix is said to be unit matrix, if
- (a) elements of diagonal are 1
  - (b) elements of upper triangular matrix is 1
  - (c) elements of lower triangular matrix is 1
  - (d) all the elements of square matrix is 1
4. What is the result of the binary addition  $1010+1100$ ?
- (a) 10110
  - (b) 11110
  - (c) 10010
  - (d) 11010

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5. In a map, if city  $A$  has a one-way road to city  $B$ , what type of graph would best represent this situation?
- (a) Undirected graph
  - (b) Directed graph
  - (c) Tree
  - (d) Binary tree
6. Match the following and select the correct answer using the codes given below :
- |               |  |
|---------------|--|
| A. $A \cup B$ | 1. $\{x x \in A \text{ and } x \notin B\}$ |
| B. $A \cap B$ | 2. $\{x x \in A \text{ or } x \in B\}$     |
| C. $A - B$    | 3. $\{x x \in A \text{ and } x \in B\}$    |
| D. $A'$       | 4. $\{x x \notin A\}$                      |
|               | 5. $\{x x \in U \text{ and } x \in A\}$    |

Codes :

- |     |   |   |   |   |
|-----|---|---|---|---|
| (a) | A | B | C | D |
|     | 2 | 3 | 1 | 5 |
| (b) | A | B | C | D |
|     | 1 | 2 | 3 | 4 |
| (c) | A | B | C | D |
|     | 3 | 1 | 2 | 5 |
| (d) | A | B | C | D |
|     | 2 | 3 | 1 | 4 |

( Turn Over )



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7. In propositional logic, which statements are true?

1.  $p \wedge q$  is true, if both  $p$  and  $q$  are true.
2.  $p \vee q$  is true, if both  $p$  and  $q$  are true.
3.  $\sim p$  is true, if  $p$  is true.
4.  $p \wedge \sim p$  is tautology.
5.  $\sim(\sim p)$  is  $\sim p$

- (a) 1 and 2 only  
(b) 2 and 3 only  
(c) 3 and 4 only  
(d) 1, 2, 3 and 4 only

8. Arrange the following steps in correct order to find the inverse of a matrix :

1. Adjoint of the matrix
2. Determinant of the matrix
3. Transpose of the cofactor matrix
4. Divide the adjoint by the determinant

- (a)  $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$   
(b)  $2 \rightarrow 3 \rightarrow 1 \rightarrow 4$   
(c)  $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$   
(d)  $3 \rightarrow 2 \rightarrow 1 \rightarrow 4$

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9. Assertion (A) :

The binary number 1111 is greater than the binary number 1010.

Reason (R) :

The binary number 1111 is equal to 15 in decimal and 1010 is equal to 10 in decimal.

Codes :

- (a) Both A and R are true, and R is the correct explanation of A  
(b) Both A and R are true, but R is not the correct explanation of A  
(c) A is true, but R is false  
(d) A is false, but R is true

10. Assertion (A) :

A directed graph can have cycles.

Reason (R) :

A directed graph is a graph where edges have direction.

Codes :

- (a) Both A and R are true, and R is the correct explanation of A  
(b) Both A and R are true, but R is not the correct explanation of A  
(c) A is true, but R is false  
(d) A is false, but R is true

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PART—B

Answer **all** the questions in approximately 30–40 words : 2×5=10

11. What is the difference between a subset and a proper subset?
12. Define transitivity of a relation  $R$  on a set  $A$ .
13. How are matrices used in computer graphics?
14. Why is the binary number system used in computer?

*Or*

How do you convert a decimal fraction to binary?

15. How does preorder traversal differ from postorder traversal?

*Or*

How are graphs used in mapping and navigation system?

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PART—C

Answer **all** the questions in around 80–100 words : 5×6=30

16. Describe the properties of set operations.

*Or*

Explain the concept of a tautology and contradiction in propositional logic.

17. How are functions used in data transformation in computer applications? Explain.

*Or*

Explain one-one (bijective) and onto (surjective) function with example.

18. Describe the process of converting a decimal number to binary, octal and hexadecimal.

*Or*

Perform binary addition  $1010+1100$  and explain the process.

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19. Find the determinant of the following matrix :

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Or

Solve the system of equations

$$2x + 3y - z = 5$$

$$x - 2y + 4z = 11$$

$$3x + y + 2z = 8$$

using matrices.

20. Read the text carefully and write the answer to the questions from the text that follow :

“In computing, functions are used to model real-world relationship. For example, a function can be used to map a student’s ID to their name.”

Questions :

- (a) Provide a real-world example of a function in computing. What are the domain and range of this function? 2

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(b) What is the concept of inverse functions? Give an example. 2

(c) What is mapping? 1

21. Read the text carefully and write the answer to the questions from the text that follow :

A matrix is a rectangular array of numbers, symbols or expressions arranged in rows and columns. The matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

is a  $2 \times 3$  matrix, where 2 represents the number of rows and 3 represents the number of columns.

Questions :

(a) Explain the concept of matrix transpose. Find the transpose of the matrix A. 3

(b) What is the order of the matrix A? What is the element of the position (1, 2) in the matrix A? 2

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PART—D

Answer **all** the questions within 180–200 words :  
10×2=20

22. Prove that every square matrix can be uniquely expressed as the sum of a symmetric matrix and a skew-symmetric matrix.

Or

Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 3 \\ 1 & 2 & 4 \end{bmatrix}$$

23. A company's organizational structure is represented as a tree structure. Explain how you would—
- (a) traverse the tree to find all employees under a given manager;
  - (b) identify the level of an employee in the organizational hierarchy;
  - (c) calculate the total number of employees in the company. 3+3+4=10

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Or

A social network is represented as a graph where users are vertices and friendships are edges. Explain how you would—

- (a) find the shortest path between two users;
- (b) identify clusters of users with similar interest;
- (c) recommend friends to a user based on their interest and friendships. 3+3+4=10

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