

(7 Pages)

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Code No. : 10464 E      Sub. Code : CACS 11/  
CASE 11

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023.

First Semester

Computer Science/Software Engineering — Allied

DISCRETE MATHEMATICS

(For those who joined in July 2021 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. A relation means \_\_\_\_\_ on a set  $S$ .
- (a) dual relation      (b) binary relation  
(c) reflexive relation      (d) symmetric relation

2. If  $R_1$  and  $R_2$  are binary relations from set  $A$  to set  $B$ , then the equality \_\_\_\_\_ holds.
- (a)  $(R^c)^c = R^c$   
(b)  $(A \times B)^c = \Phi$   
(c)  $(R_1 \cup R_2)^c = R_1^c \cup R_2^c$   
(d)  $(R_1 \cup R_2)^c = R_1^c \cap R_2^c$
3. A function  $f(x)$  is defined from  $A$  to  $B$  then  $f^{-1}$  is defined \_\_\_\_\_
- (a) from  $A$  to  $B$   
(b) from  $B$  to  $A$   
(c) depends on the inverse of function  
(d) none of the mentioned
4. If  $f$  is a function defined from  $R$  to  $R$ , is given by  $f(x) = 3x - 5$  then  $f^{-1}(x)$  is given by \_\_\_\_\_
- (a)  $1/(3x - 5)$   
(b)  $(x + 5)/3$   
(c) does not exist since it is not a bijection  
(d) none of the mentioned

5. If a matrix  $A = [A_{11} A_{12} \dots A_{1n} A_{21} A_{2n} \dots A_{n1} A_{n2} \dots A_{nn}]$ , order  $(n \times n)$ ,  $A_{ii} = 1$ ,  $A_{ij} = 0$  for  $i \neq j$ . Then that matrix is known as \_\_\_\_\_
- (a) Identity matrix  
 (b) Null matrix  
 (c) Singular matrix  
 (d) None of the mentioned
6. The inverse of function  $f(x) = x^3 + 2$  is \_\_\_\_\_
- (a)  $f^{-1}(y) = (y - 2)^{1/2}$     (b)  $f^{-1}(y) = (y - 2)^{1/3}$   
 (c)  $f^{-1}(y) = (y)^{1/3}$         (d)  $f^{-1}(y) = (y - 2)$
7. A matrix having many rows and one column is known as \_\_\_\_\_
- (a) row matrix  
 (b) column matrix  
 (c) diagonal matrix  
 (d) none of the mentioned
8. Let  $A$  order  $(a \times b)$  and  $B$  order  $(c \times d)$  be two matrices, then for  $AB$  to exist, correct relation is given by \_\_\_\_\_
- (a)  $a = d$                       (b)  $b = c$   
 (c)  $a = b$                       (d)  $c = d$

Page 3 Code No. : 10464 E

9. In a graph if  $e = (u, v)$  means \_\_\_\_\_
- (a)  $u$  is adjacent to  $v$  but  $v$  is not adjacent to  $u$   
 (b)  $e$  begins at  $u$  and ends at  $v$   
 (c)  $u$  is processor and  $v$  is successor  
 (d) both (b) and (c)
10. An undirected graph possesses an Eulerian circuit if and only if it is connected and its vertices are \_\_\_\_\_
- (a) all of even degree    (b) all of odd degree  
 (c) of any degree        (d) even in number

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).  
 Each answer should not exceed 250 words.

11. (a) If a relation  $R$  is transitive, then prove that its inverse relation  $R^{-1}$  is also transitive.
- Or
- (b) Describe the classification of relations.
12. (a) Is the function  $f(x) = x + 1$  from the set of integers to the set of integers onto?
- Or
- (b) Summarize the advantages of inverse function.

Page 4 Code No. : 10464 E

[P.T.O.]

13. (a) Find the disjunction of the propositions  $p$  and  $q$  where  $p$  is the proposition 'Today is Saturday' and  $q$  is the proposition 'It is raining heavily today'.

Or

- (b) Write down the following sentence in symbolic form :

- (i) If Avinash is not in a good mood or he is not busy, then he will go to Kharagpur.  
(ii) If Sayantan knows object oriented programming and oracle, then he will get a job.

14. (a) If  $A$  and  $B$  are symmetric matrices, prove that  $(BAB)$  is also symmetric.

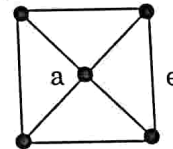
Or

- (b) What are the properties of adjoint of a matrix? Explain.

15. (a) Distinguish between the null graph and complete graph.

Or

- (b) For the graph  $G$ , as shown in figure, draw the sub graphs.



- (i)  $G - e$  (here,  $e$  is one edge)  
(ii)  $G - a$  (here,  $a$  is one vertex).

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).  
Each answer should not exceed 600 words.

16. (a) Let  $Z$  denote the set of integers and the relation  $R$  in  $Z$  be defined by  $aRb$  iff  $a - b$  is an even integer. Then, show that  $R$  is an equivalence relation.

Or

- (b) Let  $A = \{a, b, c\}$  and  $M_R = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ . Find the

relation  $R$  defined on  $A$ .

17. (a) Let  $f$  and  $g$  be the functions from the set of integers defined by  $f(x) = 2x + 3$  and  $g(x) = 3x + 2$ . Determine the compositions of  $f$  and  $g$  and of  $g$  and  $f$ .

Or

(b) Let  $f: R \rightarrow R$  be defined by  $f(x) = 3x - 4$ . Find a formula for  $f^{-1}$ .

18. (a) Show that  $(p \rightarrow q) \wedge (r \rightarrow q) \Leftrightarrow (p \vee r) \rightarrow q$ .

Or

(b) Show that  $p \Leftrightarrow q$  and  $(p \Rightarrow q)$  are equivalent.

19. (a) Show that the matrix  $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$  satisfies the equation  $A^2 - 4A + I = 0$  and hence find  $A^{-1}$ .

Or

(b) If  $A = \begin{bmatrix} 2 & 3 \\ 4 & 8 \end{bmatrix}$  verify that  $A(\text{adj } A) = (\text{adj } A)A = \det(A)I$ .

20. (a) Explain the operations of graph.

Or

(b) Compare the sub graph and isomorphic graph.