CHRIST (DEEMED TO BE UNIVERSITY),BENGALURU - 560029

End Semester Examination March/April - 2019

Bachelor of Computer Applications II SEMESTER

Code: BCA231   Max.Marks: 100

Course: BASIC DISCRETE MATHEMATICS   Duration: 3Hrs

SECTION A

Answer any TEN questions   10X3=30

1   Define subset of a set. And show that an empty set is a subset of any set.

2   Through the examples , prove that the following statements are false.
(i) If $A \cap C = B \cap C$, then $A = B$.
(ii) If $A \cup C = B \cup C$, then $A = B$.
(iii) If $A - C = B - C$, then $A = B$.

3   Draw the graph of each of these functions over real numbers :
$i.\ f(x) = \lceil \frac{x}{2} \rceil \lfloor \frac{x}{2} \rfloor$
$ii.\ f(x) = \lceil 3x - 2 \rceil$.

4   Determine whether each of these functions is a bijection from R to R?
i. $f(x) = x^3$
ii. $f(x) = 1 + x^2$

5   What are the terms a_1, a_2, a_3 of the sequence $\{a_n\}$, where a_n equals
$i.\ 2^n + 1$
$ii.\ (n+1)^{n+1}$

6   What are the values of these sums?
$$(i)\ \sum_{k=1}^{2} \sum_{j=1}^{3} (k+j) \quad (ii)\ \sum_{i=1}^{4} (-2)^j$$

7   If $\begin{bmatrix} x & 4 & 1 \end{bmatrix} \begin{bmatrix} 2 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & 4 \end{bmatrix} = \begin{bmatrix} x & 4 & -1 \end{bmatrix}$ then find x.

8   If $A = \begin{bmatrix} 2 & 4 \\ -1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$ find $A^2 - B^2 - 2AB$.

9   Let $R_1 = \{(a,b)|a \equiv b(mod\ 3)\}$ and $R_2 = \{(a,b)|a \equiv b(mod4)\}$ on th set of integers. Find
i. $R_1 \cup R_2$
ii. $R_1 \cap R_2$

10 Let $R_1 = \{(a,b)|a \equiv b(mod3)\}$ and $R_2 = \{(a,b)|a \equiv b(mod4)\}$ on the set of integers. Find
i. $R_1 - R_2$
ii. $R_2 - R_1$

11 What is the reflexive closure of the relation $R = \{(a,b)|a > b\}$ on the set of integers?

12 Let R be the relation represented by the matrix $M_R = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$. Find the matrix representing R^2.

SECTION B

Answer any THREE questions   3X7=21

13 Suppose that, in a certain examination, 200 students appear for mathematics, 50 appear for physics, 100 appear for chemistry, 20 appear for mathematics and physics, 60 appear for mathematics and chemistry, 35 appear for physics and chemistry, while 245 appear for mathematics or physics or chemistry. Determine the number of

students appear
(a) For all the three of these subjects?
(b) Exactly for one of the subject?
Also construct the Venn diagram.

14 Use set builder notation and logical equivalencies to establish the De Morgan's law $\overline{A \cap B} = \overline{A} \cup \overline{B}$.

15 (a) Define the following terms with example:Injection, surjection.
(b)Give an example of a function from N to N that is

  1. **one-to-one but not onto**
  2. **both onto and one-to-one**
  3. **neither one-to-one nor onto**

16
(a) If $f : R \to R$ is defined by $f(a,b) = \begin{cases} 3x - 5 & x > 0, \\ -3x + 1 & x \le 0, \end{cases}$

Obtain $f^{-1}(5/3)$.
(b) Determine whether each of these functions is a bijection from R to R?
i. $f(x) = x^4$
ii. $f(x) = 1 + 2x^3$

SECTION C

Answer any four questions   **4X7=28**

17 Determine whether each of these sets is countable or uncountable.For those that are countable,exhibit a one-to-one correspondence between the set of natural numbers and that set.
(i)Integers not divisible by 3
(ii)The even integers

18 (a) Show that a subset of a countable set is also countable
(b) Show that the set of positive rational numbers is countable.

19 $C = \begin{bmatrix} 5 & -3 & 14 \\ 20 & 16 & -5 \end{bmatrix}, D = \begin{bmatrix} 30 & 7 & -11 \\ 4 & -8 & 9 \end{bmatrix}$ Find $20C - 30D, C^T D$ and $D^T C$.

20 If $C = \begin{bmatrix} 5 & -3 & 14 \\ 20 & 16 & -5 \end{bmatrix} D = \begin{bmatrix} 30 & 7 & 11 \\ 4 & -8 & 9 \end{bmatrix}$ Find $C^T + D^T$, $C^T D \& C D^T$.

21 $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}, B = \begin{bmatrix} 5 & 0 \\ -6 & 7 \end{bmatrix}$ Find A^2, AB and $A^2 B^2$.

SECTION D

Answer any three questions   **3X7=21**

22 Determine whether the relations represented by these zero-one matrices are equivalence relations:

$i. \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ $ii. \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$ $iii. \begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ $iv. \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

23 Which of these collections of subsets are partitions of the set of integers?
i. The set of even integers and set of odd integers
ii. The set of positive integers and set of negative integers

24 Construct the Hasse diagram for divisibility on the set representing positive divisors of 36.

25 Find the maximal elements for the poset
$(\{2, 4, 6, 9, 12, 18, 27, 36, 48, 60, 72\}, |)$.