# CHRIST (DEEMED TO BE UNIVERSITY), BENGALURU - 560029

# End Semester Examination March - 2018

## **Bachelor of Computer Applications II SEMESTER**

Code: BCA231 Max.Marks: 100
Subject: BASIC DISCRETE MATHEMATICS Duration: 3Hrs

### **SECTION A**

#### **Answer any TEN questions**

- 1 Prove that  $\hat{\mathbf{A}}|A \cup B\hat{\mathbf{A}}| = \hat{\mathbf{A}}|A\hat{\mathbf{A}}| + \hat{\mathbf{A}}|B\hat{\mathbf{A}}| \hat{\mathbf{A}}|A \cap B\hat{\mathbf{A}}\hat{\mathbf{A}}|.$
- 2 How many elements does the following sets have
  - (i)  $P(\phi)$ .
  - (ii)  $P(P(P(P(P(P(\phi)))))$ .
  - (iii) $P(\{\phi, \{\phi\}, c, \{c\}, \{\{c\}\}\})$  where c is a distinct element.
- **3** Let  $S = \{-1, 0, 2, 4, 7\}$  .Find f(S) if
  - **i.** f(x) = 1
  - **ii.** f(x) = 2x + 1
- 4 Define the following terms Function, Range of a function and Range of a function with examples.
- **5** What are the values of following sums where  $M=\{1,3,5,7\}$ 
  - i)  $\sum_{j \in M} j$  .
  - ii)  $\sum_{j \in M} \frac{4}{j}$
- 6 What are the values of these sums?

i) 
$$\sum_{k=1}^{5} (2k^3 + k + 1)$$
 (ii)  $\sum_{i=1}^{150} 2$ .

- If  $A=\left[egin{smallmatrix}2&5&1\\0&-1&3\end{smallmatrix}
  ight], B=\left[egin{smallmatrix}4&-2\\6&3\\1&0\end{smallmatrix}
  ight], C=\left[egin{smallmatrix}1\\3\end{smallmatrix}
  ight]$  then find A(BC).
- If  $A-B=egin{bmatrix} 5&3&1\ 2&4&6\ 1&0&2 \end{bmatrix}$  and  $A+B=egin{bmatrix} 1&7&5\ 0&2&4\ 5&4&2 \end{bmatrix}$  find A and B.
- **9** 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.  $R_2 R_1$
- **10** Let R be the relation  $\{(1,2),(1,3),(2,3),(2,4)(3,1)\}$  and let S be the relation  $\{(2,1),(3,1),(3,2),(4,2)\}.$

Find  $R^2$  and  $S^2$ .

- 11Which of these relations on  $\{0,1,2,3\}$  are Reflexive, Symmetric, anti-symmetric and transitive relations?
  - i.  $\{(0,0),(1,1),(2,2),(3,3)\}$
  - $ii.\{(0,0),(0,2),(2,0),(2,2),(2,3),(3,2),(3,3)\}$
  - iii. {}.
  - iv.  $\{(2,3)\}$ .
- 12 Write the relation matrix for the relation R defined below on the set

$$A = \{1,2,3,4\} \& R = \{(1,1),(1,2),(1,3),(2,1),(2,2),(2,3),(3,2),(3,3),(4,1),(4,4)\}$$
 Also draw the diagraph of R.

#### **SECTION B**

## Answer any THREE questions

3X7=21

10X3

13 In a survey of 60 people it was found that, 25 read weekly magazines, 26 read fortnightly magazines, 26 read monthly magazines, 9 read both weekly and monthly magazines, 11 read both weekly and fortnightly magazines, 8 read both monthly and fortnightly

magazines and 3 read all 3 magazines. Determine

(a) the number of people who read at least one of the three magazines

(b)the number of people who read exactly one magazine.

Also develop the Venn diagram.

For any three sets *A*,*B*,*C*,prove the associative laws using set builder notation and **14** membership table.

(a) Given  $f:A\to B$  defined  $f(x)=\dfrac{x-3}{2x-1}$ , verify that 'f' is bijective. **15** 

(b) Let f(n)=n+2, g(n)=n-2 & h(n)=4n for  $n\in R$  find  $f\circ g,$   $g\circ g,$   $f\circ h$  and  $f\circ (h\circ g)$ .

(a) If f:A o B & g:B o C are two bijective mappings show that  $(g\circ f)$  is a bijective mapping.

(b) Let f:R o R & g:R o R are mapping defined by  $f(x)=x^2,g(x)=2x-1$  verify that  $(g\circ f)^{-1}=f^{-1}\circ g^{-1}$  .

### **SECTION C**

### Answer any four questions

4X7 = 28

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

Find the value of 18

i)
$$\sum_{i=50}^{100} i^3$$

ii) 
$$\sum_{i=25}^{75} i^2$$
  
iii)  $\sum_{i=95}^{225} i$ 

iii) 
$$\sum_{i=95}^{225} i$$

**19** Find the inverse of  $A = \begin{bmatrix} 4 & 1 & 2 \\ 6 & 2 & 5 \\ 8 & 3 & 8 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & -1 & 4 \\ 0 & 0 & -1 \\ 1 & 5 & -2 \end{bmatrix}$ . Also find  $A^{-1}B^{-1}$ .

 $\left[egin{smallmatrix} 1 & -3 & 4 \ 2 & 6 & -5 \end{smallmatrix}
ight], D = \left[egin{smallmatrix} 3 & 7 & -1 \ 4 & -8 & 9 \end{smallmatrix}
ight]$  Find  $C^TD, C^TD^T,\ D^TC^T$  and  $D^TC$ . 20

21 Find the inverse of  $A=\begin{bmatrix}1&1&2\\1&2&5\\1&3&7\end{bmatrix}$  and  $B=\begin{bmatrix}1&-1&1\\0&1&-1\\1&3&-2\end{bmatrix}$  . Also find  $A^{-1}B^{-1}$  .

#### **SECTION D**

## Answer any three questions

3X7 = 21

(a) Which of these are posets? **22** 

i. 
$$(R,=)$$

ii. 
$$(R, \neq)$$

iii. 
$$(R,<)$$

(b) Which of these relations on  $\{0,1,2,3\}$  are partial orderings?

i. 
$$\{(0,0),(1,1),(2,2),(3,3)\}$$

$$ii.\{(0,0),(1,1),(2,0),(2,2),(2,3),(3,3)\}$$

(a)Let R be the relation on the set of real numbers such that xRy if x and y**23** are real numbers that differ by less than 1, ie,|x-y| < 1 . Show that R is not an equivalence relation.

(b) What are the sets in the partition of the integers arising from congruence modulo 4?

24 Construct the Hasse diagram for divisibility relation on the set  $\{1, 2, 3, 6, 12, 24, 36, 48\}$ 

Find the maximal and minimal elements for the poset

 $(\{2,4,6,9,12,18,27,36,48\},|)$ .