REV-00
BCA/ 08 /18 2013/02

# BACHELOR OF COMPUTER APPLICATION
## Second Semester
## Discrete mathematics
## (BCA - 09)

**Duration: 3Hrs.** **Full Marks: 70**

**(PART-B: Descriptive)**

**Duration: 2 hrs. 40 mins.** **Marks: 50**

**1. Answer the following (Any five)** **2x5=10**

a. The sum of the degrees of all vertices of a graph is an even integer.

b. Does there exist a simple graph with five vertices having degree 2, 2,4,4,4? Justify.

c. Make the truth table of the following

$$(p\rightarrow q) \rightarrow (\sim q \rightarrow \sim p)$$

*d.* Show that f(x) =7x +5 is one-one, where f is a function from R to R.

e. If f: R→ $R_+$ is a function, define by f(x) $=e^x$, then show that f is homomorphism. (Where R is the additive group of real numbers & $R_+$is the multiplicative group of real numbers)

f. If A ={ 2,3,4,5}, B ={4,5,6} then fine A\B.

*g. If R is a ring prove that*

*i. a(-b)=-ab*

*ii. a (b-c)=ab-ac*

*PTO....*

**2. Answer the following (Any five)** **3x5=15**

a. If I be the set of integers and R = {(x, y): x – y is divisible by 5; x, y ∈ I}. Then show that R is and equivalence relation on I.

b. Prove that a non –empty subset H of a group G is a subgroup of G if $ab^{-1} \in H$, $\forall$ a, b ∈ H

c. Define the homomorphism of a group. If $f$: G→ G' is a homomorphism, Then prove That $f(a^{-1}) = f(a)^{-1}$ $\forall$ a∈ G

d. How many vertices are there in a graph with 15 edges if each vertices is of degree 3?

e. Prove that every connected graph has at least one spanning tree.

f. Determine whether the following statements are tautology, contradiction or Contingents.

$$p \rightarrow (q \rightarrow (p \wedge q))$$

g. Draw a circuit diagram of the Boolean expression

xyz'+ xy'z + x'y'z'

**3. Answer the following (Any five)** **5x5=25**

a. Prove that if f is a homomorphism from G into G' with kernel K, then K is normal.

b. Construct a logical circuit of the following Boolean expressions

i. x'yz + xyz' + x'yz' + x'y'z +x'y'z'

ii. xy' + y(x' + y)

c. Prove that a tree with n vertices contains exactly n – 1 edges.

d. Prove that if a connected graph G is Eulerian, then every vertex of G has even degree.

e. Show that the set of all positive rational numbers forms and abelian group under the composition defined by $a*b = (ab)/2$

f. Prove that a ring R is without zero divisors if and only if the cancellation laws hold in R.

g. If R is a relation in NxN defined by

$$(a, b) R (c, d) \text{ if } ad = bc$$

Prove that R is an equivalence relation in NxN (where N is the set of natural numbers).

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*(The figures in the margin indicate full marks for the questions)*

**ration: 20 minutes** **Marks – 20**

### PART A- Objective Type

**I. Answer each of the following:** **1×20=20**

1. If A= {2n: n ∈ N, n < 6}, then A∪N is

a. A b. R c. N d. None of these

2. Which of the following is false?

a. $A^c \cap B^c = A \setminus B$ b. $A \cap B^c = A \setminus B$

c. $A^c \cap A = U$ d. None of these

3. Every cyclic group is abelian. **True/False**

4. Intersection of two subgroups is a subgroup. **True/False**

5. In a graph there are even number of vertices of odd degree. **True/False**

6. A walk with no repeated edges is called a trail. **True/False**

7. For a Boolean algebra which of the following is false

a. a.1=a b. a + 1=1

c. a + a=a d. a.a=1

8. a + b'=1 if and only if

a. a + b = a b. a + b=b

c. a + b=0 d. a + b =1

9. The simplest Boolean expression of {(x + y) (x + y') y + x} x +yy' is

a. x b. x + y c. y d. x'

10. If f: R → R defined by f(x) =2x + 3, then

a. f is one –one    b. f is onto

c. f is both one-one & onto    d. None of these

11. A subset H of a group G is a subgroup of G if

a. $ab^{-1} \in H, \forall a, b \in H$    b. $ab \in H, \forall a, b \in H$

c. . $ab^{-1} \in H, \forall a, b \in G$    d. . $ab \in H, \forall a, b \in G$

12. If f is a homomorphism, then it will be an isomorphism if

a. f is one –one    b. f is onto

c. f is both one-one& onto    d. None of these

13. A ring R is without zero divisors if for a, b ∈ R

a. ab=0 => a=0 or b=0    b. ab=0 => a≠0 or b≠0

c. ab=0 => a≠0 or b=0    d.None of these

14. If n ∈ N, then 1+2+3+.....+n is

a. $\frac{n(n-1)}{2}$    b. $\frac{n(n+1)}{2}$

c. $\frac{n}{2}$    d. $\frac{n^2}{2}$

15. If f(x) =3x + 4, then $f^{-1}$ is

a. $\frac{x-4}{3}$    b. x – 4

d. 4x – 3    d. None of these

16. The identity element of a group is

a. unique    b. May not be unique

c. More then one    d. None of these

17. The set of natural number is a group w.r.t. addition. **True/False**

18. Every one-one function is onto. **True/False**

19. $\pi$ is a rational number. **True/False**

20. A graph is simple if it contains a loop. **True/False**

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