BACHELOR OF SCIENCE (COMPUTER SCIENCE) (CBCS - 2018 COURSE)
F.Y.B.Sc.(Computer Science) Sem-I : WINTER- 2022
SUBJECT : MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Day : Friday | Time : 10:00 AM-01:00 PM

Date : 9/12/2022 | **W-20068-2022** | Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.

Q.1 Attempt **ANY TWO** of the following: **(12)**

a) State and prove inclusion – exclusion principle for two sets. Deduce the principle for three sets.

b) P ={{1}, {2}, {4}, {1,2}, {1,4}, {2,4}, {3,4}, {1, 3, 4}, {2, 3, 4}} is the poset under set inclusion relation. Draw Hasse diagram and answer the following:

i) What are maximal elements?
ii) What are minimal elements?
iii) What are upper bounds for {{2}, {4}}?
iv) What is l.u.b. for {{2}, {4}}?

c) Find CNF of $f(x,y,z) = (x+y)\bar{z}$ and use it to find DNF.

Q.2 Attempt **ANY TWO** of the following: **(12)**

a) Explain the terms in recurrence relation:

i) Homogenous solution
ii) Particular solution
iii) Total solution

b) Solve the recurrence relation $b_n = 3b_{n-1} - 2b_{n-2}$ with initial conditions $b_1 = 5,\ b_2 = 3$.

c) Test the validity of following argument by using truth table:
$p \wedge (q \vee r),\ \sim r,\ q \rightarrow \sim p \ \vdash \sim p$

Q.3 Attempt **ANY TWO** of the following: **(12)**

a) How many ways are there to select 12 balls from 20 red, 22 blue and 24 green balls, so that atleast 8 blue balls are selected ?

b) How many integers between 999 and 9999 either begin or end with 3?

c) Prove the following logical equivalence :

i) $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$
ii) $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$

Q.4 Attempt **ANY THREE** of the following: **(12)**

a) Write converse, inverse and contrapositive of the given conditional statement:
'If the product of two integers x and y is odd, then both x and y are odd.'

b) Prove that 'x is even if and only if x^2 is even', where x is an integer by direct method proof.

c) Write the dual of the following statements in Boolean algebra:

i) $y + (x.(\overline{x} + (y.\overline{y}))) = y.$

ii) If $x \vee y = y$, then $x + (y.z) = y.(x + z).$

d) Solve the Fibonacci relation $a_n = a_{n-1} + a_{n-2}$ with the initial conditions $a_0 = 0,\ a_1 = 1.$

Q.5 Attempt **ANY FOUR** of the following: **(12)**

a) How many ways are there to arrange nine letters in the word COMMITTEE?

b) Show that a poset $(D_{30}, |)$ is lattice.

c) Let $\phi(\mathrm{x}, \mathrm{y}) : \mathrm{x} + \mathrm{y} = 0,\ x, y \in \mathbb{R}$. Write truth values of the following proposition with justification:

i) $\exists y\ \forall x\ \phi(x, y)$

ii) $\forall x\ \exists y\ \phi(\mathrm{x}, \mathrm{y})$

d) How many four letter words can be formed by using A, B, C , ..., Z when repetition is not allowed?

e) Find first six terms of the sequence; $a_n = 3a_{n-1} + 4a_{n-2}, a_0 = 2,\ a_1 = 4.$

f) Define Bounded Lattice L. When L becomes complemented?

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