Roll No. …………………..

BCA/BSIT–204(GE1)

B. C. A. /B. S. I. T. (Second Semester) EXAMINATION, 2023-24

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Time : $2\frac{1}{2}$ Hours

Maximum Marks : 60

Note : All questions have to attempted.

Section—A

1. Multiple Choice Questions : 1 each

(a) The condition for a binary relation to be symmetric is : (CO1, BL-1)

(i) $s(R) = R$

(ii) $R \cup R = R$

(iii) $R = R^{-1}$

(iv) $f(R) = R$

(b) If $x \in N$ and x is prime, then x is .... set. (CO2, BL-1)

(i) Infinite set

(ii) Finite set

(iii) Empty set

(iv) Setis both Non-empty and Finite

(c) The function (gof) is ...., if the function *f* and *g* are onto function ? (CO2, BL-2)

(i) Into function

(ii) One to one function

(iii) Onto function

(iv) One-to-many function

(d) The number of reflexive closure of the relation {(0,1), (1,1), (1,3), (2,1), (2,2), (3,0)} on the set {0, 1, 2, 3} is .... (CO2, BL-1)

(i) 36

(ii) 8

(iii) 6

(iv) 2^6

(e) Which of the following Law is X.X = X ?

(CO5, BL-1)

(i) Identity Law

(ii) Double Complement Law

(iii) Complement Law

(iv) Idempotent Law

(f) Minimum subgroup of a group is called ....

(CO2, BL-2)

(i) A commutative subgroup

(ii) A lattice

(iii) A trivial group

(iv) A monoid

(g) Which one of the following is NOT logically equivalent to $\neg\exists x(\forall y(\alpha) \wedge \forall z(\beta))$?

(CO3, BL-2)

(i) $\forall x(\exists z(\neg\beta) -> \forall y(\alpha))$

(ii) $\forall x(\forall z(\beta) -> \exists y(\neg\alpha))$

(iii) $\forall x(\forall y(\alpha) -> \exists z(\neg\beta))$

(iv) $\forall x(\forall y(\alpha) -> \exists z(-\beta))$

(h) Let P : i am in Bangalore. ; Q : I love cricket. ; then $q \rightarrow p$ (*q* implies *p*) is ? (CO3, BL-2)

(i) If I love cricket then I am in Bangalore

(ii) If I am in Bangalore then I love cricket

(iii) I am not in Bangalore

(iv) I love cricket

(i) For m = 1, 2, ..., $4m + 2$ is a multiple of ....

(CO3, BL-2)

(i) 3

(ii) 5

(iii) 6

(iv) 2

(j) If every two elements of a poset are comparable then the poset is called ? (CO4, BL-1)

(i) Sub ordered poset

(ii) Totally ordered poset

(iii) Sub lattice

(iv) Semigroup

(k) The relation is a partial order if it is ....

(CO3, BL-1)

(i) Reflexive, antisymmetric and transitive

(ii) Reflexive, symmetric

(iii) Asymmetric, transitive

(iv) Irreflexive and transitive

(l) A .... has a greatest element and a least element which satisfy $0 <= a <= 1$ for every ‘a’ in the lattice (say, L). (CO2, BL-2)

(i) Semilattice

(ii) Join semilattice

(iii) Meet semilattice

(iv) Bounded lattice

2. Attempt any *four* of the following : 3 each

(a) Prove by mathematical induction 1.2 + 2.3 + 3.4 + ... + n. (n + 1) = n (n + 1) (n + 2)/3.

(CO3, BL-5)

(b) Explain and write the dual (a * 1) * (0 + *a'*) = 0. (CO2, BL-2)

(c) Examine the following statement formulae is tautology or not : (CO3, BL-4)

$$\sim (p \vee q) \vee (\sim p \vee q) \vee p$$

(d) Given A = {1, 2, 3} and B = {a, b}. Find

(i) B × A (CO3, BL-1)

(ii) B × B.

(e) Prove that $\mathrm{P} \vee \mathrm{Q} \Leftrightarrow \neg(\neg \mathrm{P} \vee \neg \mathrm{Q})$ using truth table. (CO3, BL-5)

Section—B

3. Attempt any *two* of the following : 6 each

(a) Prove that if R is an equivalence relation on set A, then R^{-1} is also an equivalence relation on set A. (CO4, BL-5)

(b) Show that $\varphi : \mathrm{R} \to \mathrm{R}^{+}$; defined by $\varphi(x) = e^{x}$, for $x \in \mathrm{R}$ is one-one homomorphism.

(CO4, BL-1)

(c) Given A = {1, 2, 3, 4}, draw directed graph of relation in A : R {(1, 1), (2, 2), (2, 3), (3, 2), (4, 2), (4, 4)}. (CO5, BL-2)

Also find $R^2 = R \, o \, R$.

4. Attempt any *two* of the following : 6 each

(a) What is a Well Formed Formula ? What are rules of the Well Formed Formulas ? (CO3, BL-1)

(b) Obtain the PCNF of the following formula $\left(\sim P \rightarrow R\right) \wedge \left(Q \rightarrow P\right)$: (CO4, BL-3)

(i) Using Truth Table

(ii) Without using Truth Table

(c) Prove or disprove the validity of the following arguments using the rules of inference :

(CO3, BL-5)

All men are fallible

All kings are men

Therefore, all kings are fallible

5. Attempt any *two* of the following : 6 each

(a) Prove that (S,) is a Lattice, where S = {1, 2, 3, 6} and is for divisibility. Prove that it is also a Distributive Lattice. (CO4, BL-5)

(b) Construct the Hasse diagram for the divisibility on the set {1, 2, 3, 6, 12, 24, 36, 48, 96}.

(CO5, BL-3)

(c) Explain the following terms with suitable examples : (CO4, BL-1)

(i) Lattice

(ii) Bounded Lattice

(iii) Partially Ordered Set