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Course Code: MCA-101 Course Name: Discrete Structures

Assignment - 1

(Based on Unit - I & II)

Sr. No.	**Section A: Sets**	BTL	CO	Marks
1	Determine the power sets of following a) {a} b) { {a} } c) {ϕ, {ϕ} }	BTL5	CO1	3
2	Assume A= {φ,{φ}} and Justify True / false for following a) ϕ ∈ P(A) b) ϕ ⊆ P(A) c) { ϕ } ⊆ P(A) d) { ϕ } ⊆ A e) { ϕ } ∈ P(A) f) { ϕ } ∈ A g) {{ ϕ}} ⊆ P(A) h) {{ ϕ}} ⊆ A i) {{ ϕ}} ∈ P(A) j) {{ϕ }} ∈ A	BTL4	CO1	5
3	Assume A= {a,{a}} and state True/false a) ϕ ∈ P(A) b) ϕ ⊆ P(A) c) { a } ∈ P(A) d) { a } ⊆ P(A) e) { {a} } ∈ P(A) f) { {a} } ⊆ P(A) g) {a,{a}} ∈ P(A) h) {a,{a}} ⊆ P(A) i) {{ {a}}} ∈ P(A) j) {{{a} }} ⊆ P(A)	BTL4	CO1	5
4	Let A={φ} and B= P(P(A)) a) Tell ϕ ∈ B? Tell ϕ ⊆ B? b) Tell {ϕ} ∈ B? Tell {ϕ} ⊆ B? c) Tell {{ϕ}} ∈ B? Tell {{ϕ}} ⊆ B?	BTL1	CO1	3
5	Determine the cardinalities of the sets: a) P= { n:n is a positive integer} b) Q= {n: n is a positive integer} c) P ∪ Q d) P ∩ Q	BTL5	CO1	3

6	Let n as the set of all natural numbers, Let P denotes all finite subsets of N. What is cardinality of set P?	BTL1	CO1	1
7	Determine the Output a) {ϕ} U {ϕ} b) {ϕ} ∩ {ϕ} c) {ϕ} U { a, ϕ, {ϕ}} d) ϕ Φ {a, ϕ, {ϕ}} e) {ϕ} Φ {a, ϕ, {ϕ}}	BTL5	CO1	3
8	Determine True/false and Explain a) A U P(A) = P(A) b) A ∩ P(A) = A c) {A} U P(A) = P(A) d) {A} ∩ P(A) = A e) A - P(A) = A f) P(A) – {A} = P(A)	BTL5	CO1	5
9	Assume A= {φ, a} and Construct a) A – ϕ b) {ϕ} – A c) A U P(A) d) A ∩ P(A)	BTL4	CO1	3
10	Let A, B, C be sets . Under what conditions is each of the following true a) (A – B) U (A – C) = ϕ b) (A – B) ∩ (A – C) = ϕ	BTL1	CO1	3
11	What can you say about P and Q if a) P ∩ Q = P b) P U Q = P c) P Φ Q = P d) P ∩ Q = P U Q	BTL1	CO1	3
12	Assume A, B, C be sets Justify the following using laws a) (A – B) – C = A – (B U C) b) (A – B) – C = (A – C) -B c) (A – B) – C = (A – C) –(B –C)	BTL4	CO1	3
13	Given P U Q = P U R , Is it necessary that Q = R. Justify	BTL5	CO1	3
14	Prove (A – B) ∩ B = ϕ	BTL4	CO1	3
15	Given that (A ∩ C) $\underline{C}$ (B ∩ C) and (A ∩ C') $\underline{C}$ (B ∩ C'). Prove A $\underline{C}$ B	BTL4	CO1	5
	Section B: Principal Of Inclusion and Exclusion			
1	For any 3 sets A, B and C. Analyse and draw vienn diagram for following condition a) (A U B) $\underline{C}$ B and B $\underline{C}$ A b) A $\underline{C}$ B, A $\underline{C}$ C, (B ∩ C) $\underline{C}$ A and A $\underline{C}$ (B ∩ C) c) (A ∩ B ∩ C) = ϕ, A ∩ B = ϕ, A ∩ C = ϕ, C ∩ B = ϕ	BTL 4	CO3	5
2	Suppose A $\underline{C}$ B. Prove that n (A U B) = n (B) and n (A ∩B) = n (A)	BTL 4	CO1	3

3	Out of 300 students, 50 of them take course DM, 150 take ECO and 24 take both. Since both courses have scheduled examinations for the following day, only students who are not in either one of these courses will be able to go to the party the night before. Tell how many students will be at the party. Suppose 60 of 200 are under class students. Among underclass 20 of them take DM, 45 of them take ECO and 16 of them take both. Tell how many upper class students will be at the party?	BTL 1	CO1	5
4	30 cars were assembled with radio, A/C and tyres. 15 cars have radio, 8 cars have A/C and 6 have tyres. 3 had all. Tell at least how many cars do not have any option	BTL 1	CO1	5
5	Determine number of intergers between 1 and 250 that divisible by 2,3,5 and 7	BTL 5	CO1	5
	Section C: Relations			
1	Find one example of relation R1, R2, R3, R4 and R5 on A= {4,5,6,7,8} having property a) R1 is reflexive and transitive but not symmetric b) R2 is symmetric and anti-symmetric c) R3 is anti-symmetric but not reflexive d) R4 is neither symmetric nor anti-symmetric e) R5 is neither symmetric and asymmetric nor anti-symmetric	BTL 1	CO1	5
2	Find one example of relation R1, R2, R3 and R4 on A= {a, b, c, d} having property a) R1 is irreflexive and anti-symmetric b) R2 is asymmetric and anti-symmetric c) R3 is asymmetric but R2 U $R3^{-1}$ is symmetric d) R4 is transitive but R4 U $R4^{-1}$ is not transitive	BTL 1	CO1	5
3	Assume A as set of books a) Let R1 be a binary relation on A such that (a,b) is in R1 if book 'a' costs more and contains fewer pages than book 'b'. Tell its properties. b) R2= 'a' costs more or contains fewer pages than book 'b'. Tell its properties	BTL 4	CO3	5
4	Analyse the realtion and describe all the properties of relation R= {(a,b)$\in$R, a – b <=1| on the set I+)	BTL 4	CO1	5
5	Prove R= a – b is divisible by 5 $\forall$ a,b $\in$ I+ is equivalence realtion	BTL 4	CO1	5
6	Assume A = { a, b, c, d} R = { (a, b), (b, c), (d, c), (d, a), (a, d), (d, d)} Evaluate their a) Reflexive Closure b) Symmetric Closure c) Transitive Closure	BTL 4	CO1	5
7	Assume A ={ p, q,r,s} defined by partition p= {{p,s}, {q,r}} Determine equivalence relation	BTL 4	CO1	5
8	Assume R be equivalence relation on set A = {1,2,3,4,5} R={(1,1),(2,2),(3,3),(4,4),(5,5),(1,4),(4,1),(2,4),(4,2),(1,2),(2,1)} Determine Equivalence classes	BTL 4	CO1	3

9	Assume A = { 1,2,3,4} and R = {(2,1),(2,3),(3,2),(4,3)} Determine Transitive closure	BTL 4	CO1	3
	Section D: Preposition Calculus			
1	Prove argument is valid using deduction a) (p ∧ q) v (r → s), t → r, ~(p ∧ q) |-- t → s b) p → (q v r), (s ∧ t) →q, (q v r) →(s ∧ t) |-- p → q c) p v (q → p), ~ p ∧ r |-- ~q d) p → r, ~ p → r, q → s | -- ~r → s e) (p v q) → s, s → r, ~(r v q) |-- ~p f) p, q, (p ∧ q) → r |--~ r g) p, (p ∧ ~q) → ~ p |-- p → q h) p, p →q, q →r |-- r i) (p ∧ q) → r, p →q |-- p→ ((p ∧q) ∧r) j) (p v q) →~r, r V t, p|-- t k) (p ∧ q) → r, (r →q),(r →q) → (q ∧r)|-- (p∧q) → (q∧r)	BTL 4	CO3	10
2	Evaluate the validity of following statement a) If 6 is even then 2 does not divide 7, either 5 is prime or 2 divides 7. But 5 is prime, Therefore 6 is odd. b) If it rains then it will be cold, If it is cold then I shall stay at home. Since it rains, therefore I shall stay at home	BTL 5	CO3	5
3	Assume K(x): x is a 2 wheeler, L(x) : x is a scooter, M(x): x is manufactured by Bajaj. Express following with suitable notation a) Every 2 wheeler is a scooter b) There is a 2 wheeler that is not manufactured by Bajaj. c) There is a 2 wheeler manufactured by Bajaj that is not a scooter. d) Every 2 wheeler that is a scooter is manufactured by Bajaj	BTL 4	CO3	5
	Section E: Permutation And Combinations			
1	Evaluate total of 4 digit numbers that can be formed from 1,2,3,5,7 and 8 a) Assuming that repetition is not permitted. b) Evaluate how many of them are less than 4000 c) Evaluate how many of them are even d) Evaluate how many of them are odd e) Evaluate how many of them are multiple of 5 f) Evaluate how many of them are containing 3 and 5 both	BTL 5	CO1	5
2	Evaluate in how many ways a) can 6 boys and 4 girls sit in a row b) If boys are to sit together and girls sit together c) If girls are to sit together d) If just girls are to sit together	BTL 5	CO1	5
3	How many bit strings of length 10 contain a) Exactly 4 1's b) Almost 4 1's	BTL 1	CO1	5

	c) At least 4 1's d) An equal number of 0's and 1's			
4	How many permutations of letters A,B,C,D, E, F,G contain a) String BCD b) String CFGA c) Strings BA and GF d) Strings ABC and DE e) Strings CBA and BED	BTL 1	CO1	5
5	In how many ways can 20 students out of 30 be selected for an activity if a) Ram refuses to be selected b) Raja insist on being selected c) Gopal and Govind insist on being selected d) Either Gopal or Govind or Both get selected e) Just one of Gopal and Govind gets selected f) Rama and Raja refuse to be selected together	BTL 1	CO1	5
	Section F: Mathematical Induction			
1	Solve by mathematical induction $n^3 + 2n$ is divisible by 3, n>=1	BTL 3	CO1	5
2	Solve by mathematical induction $(3^n + 7^n - 2)$ is divisible by 8, n>=1	BTL 3	CO1	5
3	Solve by mathematical induction 1/root(1) + 1/root(2) + 1/root(3)+….1/root(n) > root(n)	BTL 3	CO1	5
4	Solve by mathematical induction $1+1/2 +1/3+\ldots1/2^n >= 1 +k/2$, n>=1	BTL 3	CO1	5