QP CODE	2143510202

Reg.No

DMI-ST. EUGENE UNIVERSITY

ZAMBIA

DEGREE EXAMINATION – DECEMBER 2023

Semester: IV **351GC02 DISCRETE MATHEMATICS**

Time: 3:00 Hours **Max. Marks: 100**

Answer any FIVE Questions (5 x 20 = 100 Marks)

1. a) Describe the properties of complement sets. **(5 Marks)**

   b) If A = {3,6,9, 12, 15, 18, 21} B = {4, 8, 12, 16,20} , C = {2, 4, 6, 8, 10, 12, 14, 16}, D = {5, 10, 15, 20). Find. (i) A-B (ii) B-C (iii) C-D (iv) D-A (v) C-A **(5 Marks)**

   c) List all the subsets of the set {-1,0,1}. **(5 Marks)**

   d) If X and Y are two sets such that n(x) = 17, n(y) = 23 n(x∪y)= 38. and find n(x∩y). **(5 Marks)**

2. a) Explain the Equivalence relation. **(5 Marks)**

   b) Let R = {(1,1), (1,3), (3,2), (3,4), (4,2)} and S = {(2,1), (3,3), (3,4), (4,1)}Find (i) R.S and (ii) S.R **(5 Marks)**

   c) Considerv f:N→N, g: N→ N and h:N→R defined as f (x) = 2x, g(y) = 3y +4 and h(z) = sin z, for all x,y and z in N. show that h$\circ(g\circ f)$ = (ho g)o f. **(5 Marks)**

   d) Let f:N→Y be a function defined as f(x) = 4x+3, where Y = {y∈N, y = 4x+3 for some x∈N}. Show that f is invertible. Find the inverse. **(5 Marks)**

3. a) Using truth table prove the logical equivalence pv(qΛr)≡(pvq)Λ(pvr). **(10 Marks)**

   b) Determine the following compound propositions tautology, using truth table [(pvq)vr] ↔ [pv(qvr)] **(10 Marks)**

4. a) Prove that the necessary and sufficient Condition for a non-empty Subset H of a group {G,∗} to be a subgroup is a,b ∈H => a∗ b^{-1} ∈ H . **(10 Marks)**

   b) State and prove Lagrange's theorem. **(10 Marks)**

5. a) Explain. (i) Prim's Algorithm and (ii) Kruskal's Algorithm. **(10 Marks)**

   b) Prove that the number n of vertices of a full binary tree is odd and the number of pendant vertices of the tree is equal to $\frac{n+1}{2}$. **(10 Marks)**

6. a) Show that the relation R in the Set {1,2,3} given by R = {(1,1), (2,2), (3,3), (1,2),(2,3)} is reflexive but neither symmetric nor transitive. **(5 Marks)**

b) Explain the following the definitions. **(5 Marks)**

(i) Composition function

(ii) Invertible function

c) Prove that $3\sin\frac{\pi}{6}\ \sec\frac{\pi}{3}\ - 4\sin\frac{5\pi}{6}\ \cot\frac{\pi}{4}\ = 1$. **(5 Marks)**

d) Let f : {2,3,4,5} →{3,4,5,9} and g: {3,4,5,9} →{7,11,15} be functions defined as f(2) = 3, f(3) = 4, f(4) = f(5)=5 and g(3) = g(4) = 7 and g(5) = g(9) = 11, Find gof.

(5 Marks)

7. a) Construct a truth table for the Compound proposition.(pΛq)→(~p). **(5 Marks)**

b) Construct the following a truth table for the compound proposition.(p→q) ↔ (~p∨q)

(5 Marks)

c) Using truth tables prove logical equivalences.p↔q ≡ (pΛq)∨ (~p Λ ~q). **(5 Marks)**

d) Determine the following compound Proposition Contradiction, using truth table (~pΛq)Λ(q→p. **(5 Marks)**