(f) Give the partition of a set based on an equivalence relation.

(g) Decide if a given relation is a function. Determine its domain and range.

(h) Determine and prove whether a function is injective, surjective and/or bijective.

(i) Use functions to establish the cardinality of a set.

(j) Form new functions by using composition of functions. Determine the domain and range of the composition.

Additional Criteria:

(a) Prove that a relation is a partial order.

(b) Construct a Hasse diagram for partial order.

(c) Identify maximal and minimal elements of a partially ordered set.

3. Apply number theory to perform computations and construct proofs about integers.

Core Criteria:

(a) Compute the greatest common divisor (gcd) and least common multiple (lcm) for a pair of integers.

(b) Use the Euclidean algorithm to compute the gcd of a pair of numbers.

(c) Apply the division algorithm. Be able to write a number in the form of $a = qb + r$ for given a and b.

(d) Prove statements involving divisibility of integers.

(e) Perform modular arithmetic.

(f) Solve linear congruences.

Additional Criteria:

(a) Prove that $\sqrt{n}$ is irrational for n not a perfect square.

(b) Apply number theory to RSA encryption.

(c) Solve a problem using Chinese Remainder Theorem.

4. Perform computations with sequences and series.

Core Criteria:

(a) Construct a sequence recursively.

(b) Determine an explicit closed form expression for a given sequence.

(c) Identify arithmetic and geometric sequences.

(d) Find closed form expressions for nite series.

(e) Use induction to prove statements about sequences and series.

(f) Solve rst and second order linear di erence equations.

Additional Criteria:

(a) Find the sum of a convergent geometric series.

5. Apply concepts from graph theory to solve problems.

Core Criteria:

(a) De ne a graph and a directed graph formally (vertices, edges).