REVIEW STUDY GUIDE

① LOGIC

- WHAT'S A STATEMENT? WHAT ARE CONNECTIVES?
- SIMPLE VS. COMPOUND STATEMENTS.
- TRUTH TABLES - DON'T SKIP TOO MANY STEPS.
  (REMEMBER, $F \to T = T$ AND $F \to F = T$!)
- CONTINGENCIES, TAUTOLOGIES, FALLACIES. "QUICK" METHOD
- LOGICAL EQUIVALENCE, SUBSTITUTION
- EQUIVALENCE LAWS (COMMUTATIVE, DISTRIBUTIVE, DE MORGAN, ...)
- PREDICATES, QUANTIFIERS ($\forall, \exists$) AND THEIR NEGATIONS

METHODS OF PROOF

- ARGUMENT, ASSUMPTION, CONCLUSION, VALIDITY, SYLLOGISM
- PROOF OF VALIDITY BY TRUTH TABLE
- PROOF BY INDUCTION/GENERALIZED INDUCTION/STRONG INDUCTION
- PROOF BY CONTRADICTION
- DIRECT PROOF
- PROOF BY CASES

② NUMBERS

- WHAT'S AN OPERATION? WHAT'S A BINARY OPERATION?
- SETS, CLOSED OPERATIONS, IDENTITY & INVERSE ELEMENTS
- COMMUTATIVE/ASSOCIATIVE/DISTRIBUTIVE OPERATIONS
- WELL-ORDERED SETS

- SEQUENCES + SERIES
- RECURSION
- DIVISIBILITY
- QUOTIENT-REMAINDER THEOREM
- FUNDAMENTAL THEOREM OF ARITHMETIC
- gcd, lcm, EUCLIDEAN ALGORITHM, COPRIME NUMBERS
- PIGEONHOLE PRINCIPLE, GENERALIZED PIGEONHOLE PRINCIPLE

(3) MODULAR ARITHMETIC

- DEFINITION OF CONGRUENCE
- CONGRUENCE ARITHMETIC LAWS
- CANCELLATION LAW
- CONGRUENCE CLASSES $\mathbb{Z}_n$
- ADDITION & MULTIPLICATION OF CLASSES
- MULTIPLICATIVE INVERSE

(4) SET THEORY

- FINITE/INFINITE SETS
- EMPTY SET
- CARDINALITY
- SUBSETS, POWER SETS, PROPER SUBSETS
- PROVE EQUALITY OF SETS
- SET OPERATIONS $\cup, \cap, \overline{\ }, -, \subseteq, =$
- VENN DIAGRAMS, DISJOINT SETS
- SET ALGEBRA LAWS

(5) COMBINATORICS

- MULTIPLICATION RULE
- PERMUTATIONS / COMBINATIONS / FACTORIALS
- COUNTING STRATEGIES
- BINOMIAL COEFFICIENTS / BINOMIAL THEOREM

(6) FUNCTIONS & RELATIONS

- CARTESIAN PRODUCT
- DEFINITION OF RELATION
- REFLEXIVITY, SYMMETRY, TRANSITIVITY
- EQUIVALENCE RELATIONS / EQUIVALENCE CLASSES
- INVERSE RELATIONS
- DEFINITION OF FUNCTION
- DOMAIN & RANGE OF FUNCTIONS
- INJECTIVE / SURJECTIVE / BIJECTIVE FUNCTIONS
- INVERSE FUNCTIONS

(7) GRAPH THEORY

- DEFINITION OF GRAPH
- LOOPS, PARALLEL EDGES, ISOLATION, ADJACENCIES, SIMPLE GRAPHS
- COMPLETE GRAPHS
- BIPARTITE GRAPHS
- SUBGRAPHS
- DEGREES
- ISOMORPHISM
- WALKS, PATHS, CIRCUITS, TRAILS

- CONNECTED COMPONENTS
- EULERIAN CIRCUITS, EULER'S THEOREM
- TREES, SPANNING TREES
- WEIGHTED GRAPHS
- MINIMUM SPANNING TREES, KRUSKAL & PRIM

(8) PROBABILITY

- VENN DIAGRAMS, DISJOINTNESS
- CONDITIONAL PROBABILITY, INDEPENDENCE
- TWO-WAY TABLES, TREE DIAGRAMS
- BAYES' RULE
- BINOMIAL DISTRIBUTION
- DISCRETE PROBABILITIES
- CUMULATIVE FUNCTIONS
- EXPECTED VALUE & VARIANCE / STANDARD DEVIATION