

Review for MAD2104 First Exam

- (1) First-Order Logic.
 - (a) Predicates, subjects, arity, (atomic) sentences, function symbols
 - (b) boolean connectives: conjunction, disjunction, negation,
 - (c) boolean connectives: and, or, not, conditional, biconditional
 - (d) conditional statements, converse, inverse, contrapositive
 - (e) $\wedge, \vee, \neg, \rightarrow, \leftrightarrow$
 - (f) contradiction, \perp
 - (g) Quantifiers: Universal \forall and Existential \exists
 - (h) Elimination, Introduction
 - (i) Examples of First-Order Languages: Blocks, Set Theory
- (2) Different Kinds of Proofs of Conditional Statements
 - (a) Direct
 - (b) Indirect, i.e. by contradiction
 - (c) Proof by Contrapositive
 - (d) Proof by Cases
 - (e) Introduce a universal.
 - (f) How to prove where the conclusion is a disjunction
 - (g) How to prove two sets are equal (double containment)
- (3) Know the Axioms:
 - (a) Set Existence.
 - (b) Extensionality.
 - (c) Comprehension Schema.
 - (d) Pairing.
 - (e) Union.
 - (f) Inductive Sets.
 - (g) Power Set.
- (4) Definitions:
 - (a) Cartesian Products
 - (b) Modular Arithmetic
 - (c) Divisibility
 - (d) Power Set
 - (e) Union
 - (f) Intersection
 - (g) Complement of one set in another
 - (h) Inductive Set
 - (i) Natural Numbers
 - (j) relations, e.g. functions, composition of relations
 - (k) partially ordered set, linearly-ordered set, well-ordered set
- (5) Know how to prove the Principle of Mathematical Induction, how to prove that \mathbb{N} is an inductive set, how to prove that \mathbb{N} is a well-ordered set
- (6) How to prove by Induction
- (7) Sets, Relations, Functions
 - (a) Different kinds of Relations: reflexive, symmetric, anti-symmetric, transitive
 - (b) Equivalence Relations, Partial Orders, Linear Order, Well-Ordered
 - (c) Different kinds of functions: injective, surjective, bijective
- (8) Division Algorithm

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- (9) Modular Arithmetic
- (10) Divisibility of Integers
- (11) How to change bases
- (12) Binomial Theorem (prove it)!!
- (13) Pigeon-Hole Principle