

Final Exam Info

Details of the final exam

- 3-hour exam
- closed-book
- no aides
- one page formulae sheet of size 8.5 x 11
- both-sided acceptable
- Practice final exam:

www.cs.sfu.ca/~binay/2015/macm101/sampleExam

- Sample test questions (by the author of the text)

www.people.vcu.edu/~rhammack/math300/tests/index.html

Topics

1. Set Theory

- definitions; representations; universal set and the null set;
- relations among sets (subsets, proper subset, superset, equality);
- power set; ordered collection, cartesian product;
- operations on sets (union, intersection, difference, symmetric difference, complement);
- Venn diagram;
- indexed sets;
- the laws of set theory;
- proof technique using element argument (to show set equivalence); membership table;

2. Logic

- logical connectives;
- interpretation of logical expressions; translation between formal and natural language representations;
- logical equivalence; truth tables; the laws of logic; simplification of logical expressions;
- rules of inference; representation of open statements of predicates;
- interpretation of statements in predicate logic; logical equivalences and implications in predicate logic;
- universal and existential quantification; translation between formal and natural language representations;

3. Counting

- rule of sum and rule of product;
- permutations (counting lists) and combinations (counting subsets);
- Pascal's triangle; binomial theorem;
- the principle of inclusion-exclusion; combinations with repetitions
- permutations with repetitions; combinations with repetitions;
- distributing pennies to the kids; determining integral solutions of an equation;

4. Proofs

- trivial proof; vacuous proof;
- direct proof;
- indirect proof or proof by contradiction;
- proof by contrapositives;
- proof by cases;
- disproof;

5. Mathematical Induction

- weak and strong induction principle;
(be able to identify what is to be proved in the basis and inductive steps, as well as state the inductive hypothesis)
- well-ordered principle

6. Relations

- binary relations; subset of Cartesian product of sets;
- properties of relations (reflexive, symmetric, transitive, antisymmetric relations)
- representation of relations with digraphs and matrices;
- equivalence relations; equivalence classes;
- partial order relations; partial ordered sets (posets); Hasse diagram
- Diffie-Hellman key exchange; modular arithmetic;

7. Probability Theory (section 3.4 and 3.5 of Grimaldi's text)

- sample space; experiments; outcomes;
- axioms of probability
- Monty Hall game; birthday paradox;
- tossing with a biased coin;

8. Functions

- injective (one-to-one) and surjective (onto) functions
- composition of functions;
- inverse functions;
- special functions: permutations, identity functions, floor/ceiling functions.
- pigeonhole principle;

9. Cardinality

- sets with equal cardinalities;
- countable and uncountable sets;
- comparing cardinalities;
- $|\mathbb{N}| = |\mathbb{Z}|$;
- $|\mathbb{N}| = |\mathbb{Q}|$;
- \mathbb{R} is uncountable;