

Discrete Structures

Review for Test: List of Topics/Sections up to now

The following list of topics is a summary of content covered up to October 21, 2026, alongside sections of the textbook (Rosen, *Discrete Mathematics and its Applications*, 8th edition). This includes all topics that may be represented on the Test, Thursday, October 29, 2026. A sample test (which will describe the format of the test) will be available on the course website very soon, probably by Thursday, October 22.

The following lists of terms are incomplete, but more extensive glossaries are found at the end of each chapter. You are advised to continue solving exercises in the textbook as practice, including odd-numbered problems for which you can check answers in the back of the textbook.

1.1.1–5 Propositional Logic

Propositions. Truth tables. Logical operators. Conditional statements. Converse. Contrapositive. Equivalent propositions.

1.3.1–4 Propositional Equivalences

Tautology. Contradiction. De Morgan's Laws. Special cases of commutativity, associativity, distributivity, etc.

1.4.1–10 Quantifiers

Propositional functions $P(x)$. Universal and existential quantifiers. De Morgan's Laws for quantifiers. Translating between symbolic logic and English sentences.

1.5.1–7 Nested Quantifiers

Propositional functions $P(x)$. Universal and existential quantifiers. De Morgan's Laws for quantifiers. Translating between symbolic logic and English sentences.

1.7.1–9 Introduction to Proofs

Axioms. Theorems. Proofs. Direct proof. Proof by contraposition (using an equivalent contrapositive formulation). Vacuously true statements. Proof by contradiction. Counterexamples. Recognizing incorrect 'proofs'. Circular reasoning.

1.8.1–8 Proof Methods and Strategy

Proof by cases. Without loss of generality. Constructive and nonconstructive proofs. Uniqueness proofs. Forward and backward reasoning. Proofs in $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$ and $\mathbb{R}$. Rational and irrational numbers. Existence and nonexistence of tilings.

2.1.1–5 Sets

Set builder notation. Sets of numbers. Intervals. Subsets. Venn diagrams. Empty (null) set. Proper subset. Cardinality (size) of a set. Finite and infinite sets. Power set.

2.2.1–3 Set Operations

Union. Intersection. Disjoint sets. Difference of sets. Complements of sets. Universal set. Collections (families or sets) of sets. Unions and intersections of collections of sets. Russell's Paradox.

2.3.1–2 Functions

Domain and range. One-to-one and onto.

2.4.1–3 Sequences

Strings. Numerical sequences. Recurrence relations. Closed formulas. Fibonacci numbers.

2.5.1–3 Cardinality of Sets

Comparing cardinality with ' $=$ ', ' $\leq$ ', ' $<$ '. Hilbert's Hotel. Countable and uncountable sets. Schröder-Bernstein-(Cantor) Theorem. Cantor's Theorem.

5.1.1–7 Mathematical Induction

Initial case; inductive step; inductive hypothesis. Examples (proving algebraic identities, validity of an algorithm or strategy, tilability, etc.).

5.2.1–2 Strong Induction

Every positive integer is a product of primes (as we proved by strong induction). (We haven't covered well ordering yet.)

5.4.3 Recursion and Iteration

Recursive algorithm for generating the Fibonacci numbers.