

## The Department of Mathematics

2017–18–B term

**Course Name** Fundamentals of Logic and Set Theory for Information Systems

**Course Number** 201.1.9651

**Course web page**

<https://math.bgu.ac.il/en/teaching/spring2018/courses/fundamentals-of-logic-and>

**Lecturer** Prof. Gregory Mashevitsky, <gmash@bgu.ac.il>, Office 304

**Office Hours** <https://math.bgu.ac.il/en/teaching/hours>

### Abstract

### Requirements and grading<sup>1</sup>

### Course topics

The course provides a basic introduction to “naive” set theory, propositional logic and predicate logic. The course studies many important concepts which serve as the building blocks for any mathematical theory. An emphasis is given to clear proof writing and correct usage of the mathematical language.

**A. Basics of Set Theory**

1. The notion of a set. Set operations: union, intersection, difference, complementation, and the power set.
2. Cartesian products and binary relations. Operations on relations.
3. Functions: domain and range, one to one and onto. Composition.
4. Equivalence relations and set partitions.
5. Order relations: partial, linear and well-founded.
6. Induction theorems: mathematical, complete and well-founded.

**B. Set Cardinality**

1. The notion of cardinality. Finite, infinite and countable sets.
2. Cantor’s theorem.
3. The cardinality of the set of real numbers and other sets.

**C. Propositional Calculus**

1. The language of propositional calculus. Logical connectives.
2. Logical implication and logical equivalence of propositional formulas.
3. Disjunctive normal form.
4. Complete sets of logical connectives.

**D. Predicate Calculus (First Order Logic)**

1. The language of predicate calculus: terms, formulas, sentences.
2. Structures, assignments for a given structure.
3. Logical implication and logical equivalence of first order formulas.
4. Elementary equivalence of structures, definable sets in a given structure.

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<sup>1</sup>Information may change during the first two weeks of the term. Please consult the webpage for updates