Obtaining credit for the course

To obtain credit for the course, you must pass an exam. University regulations guarantee three opportunities to students for passing a course, and you must repeat the course if you fail to pass any of the provided exams. So we follow the following general structure.

- There will be three written exams whose dates will be announced in advance. You may register for any number of them.
- If you register for an exam, a grade is entered in the SIS (1/2/3/fail/absent) and it counts as one of those three attempts.
- There will be no other option to take an exam (except in exceptional cases due to serious unavoidable problems).

The format for the written exams will be identical for the three exams and is described in the following.

1 Format of the Written Exam

The exam will consist of three parts A, B, and C.

1.1 Part A

This part (40 points) will require students to provide definitions and statements of theorems/facts. No proofs/computations will be required. The purpose of this part is to test knowledge of the material covered in the course. You need at least 30 points in this part for a "clear pass".

1.2 Part B

This part (35 points) will consist of problems where you are expected to solve a problem (perform computations/provide proofs/etc). The problems for this part will be selected from the exercise sheets for the tutorial (with possibly only minor changes), as well as a list provided to students (See Subsection 3.2) The purpose of this part is to test the student's understanding of the material covered in the course. You need at least 17.5 points in this part for a "clear pass".

1.3 Part C

This part (25 points) will be similar to part B and will consist of problems that you are expected to solve (perform computations/provide proofs/etc). The purpose of this part is to test the student's ability to apply the knowledge from the course to new problems. You need at least 6.5 points in this part for a "clear pass".

2 Grading

A weighted score of $\frac{30}{40}a + \frac{30}{35} + \frac{40}{25}c$ will be calculated for each student, where a, b, c are the points obtained in parts A, B, and C respectively.

In case of a "clear pass" in each part, the final grade will be

Weighted Score	Grade
85-100	1
55-84	2
45-54	3
0-44	4

In other cases, the final grade will be

Weighted Score	Grade
45-100	3
0-44	4

3 Syllabus

3.1 Part A

- functions and relations including various types
- number of functions/injective/surjective/bijective; number of relations: reflexive, symmetric, anti-symmetric
- Binomial theorem
- Equivalence relation, partitition into equivalence classes
- Orderings; linear/total vs. partial; Poset; minimal, maximal, minimum, maximum elements; chains and anti-chains; Tall-or-wide theorem; Erdös-Szekeres theorem;
- Inclusion-Exclusion principle; Number of derangements;
- Discrete/Finite Probability space, uniform probability; Conditional probability; Independent events; Finite version of Boole's inequality; Baye's theorem; Random variable, expectation; Indicator function; Linearity of expectation;
- Graphs; Graph isomorphism; Examples of graphs: $K_n, K_{m,n}$, cycle, path; Handshake lemma; Subgraphs/Induced subgraphs; connectedness; walk; (closed) tour; Eulerian graphs: definition, and characterization using vertex degrees;
- Trees; End-vertex lemma; Tree-growing lemma; five different tree characterizations;
- planar graph; Euler formula for planar graphs; number of edges in planar graphs; number of edges in triangle-free planar graphs; Graph minors; Graph subdivision; Kuratowski's theorem; Wagner's theorem;
- Chromatic number; Chromatic number of planar graphs

3.2 Part B

- All problems in the exercise sheets including homework problems.
- number of functions/injective/surjective/bijective; number of relations: reflexive, symmetric, anti-symmetric
- Binomial coefficients; Pascal's identity; number of subsets; number of subsets of size k;
- number of nonnegative integer solutions of $x_1 + x_2 + \cdots + x_r = n$ s.t. $l_i \leqslant x_i \leqslant u_i$;
- Binomial theorem; number of even and odd cardinality subsets;
- Every finite poset has at least one minimal element; Drawing posets: Hasse diagram; chains and anti-chains; Tall-or-wide theorem; Erdös-Szekeres theorem;
- Inclusion-Exclusion principle; Number of derangements;
- Boole's inequality; Linearity of expectation;

- Eulerian graphs: definition, and characterization using vertex degrees;
- Trees; End-vertex lemma; Tree-growing lemma; five different tree characterizations;
- Euler formula for planar graphs; number of edges in planar graphs; number of edges in triangle-free planar graphs; Non-planarity of $K_5, K_{3,3}$;
- Chromatic number of planar graphs

3.3 Part C

There is no specific list for this part and anything can be asked. The tasks that need to be completed for this part will only require the notions/facts listed in the syllabus for parts A and B, but in a way that demonstrates the ability to apply knowledge/understanding for new problems (or familiar problems stated in a new way).