TATA82 Discrete mathematics, 6 credits, spring 2024

Course webpage: `http://courses.mai.liu.se/GU/TATA82/`

Examiner

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Literature

Choose one of the following textbooks:

- På svenska:
  A. Asratian, A. Björn, B. O. Turesson, *Diskret matematik*, Liber, 2020.
- In English:
  K. H. Rosen, *Discrete Mathematics and its Applications*, 8th ed., McGraw-Hill, 2019.

All recommended exercises are taken from *Exercises in Discrete Mathematics* which is freely available from the course webpage.

Examination

The course is examined by one written exam (TEN1) comprised of eight problems. Problems 1–3 are worth one point each. Problems 4–8 are worth three points each. In order to receive grade 3/4/5, it is required to obtain 9/12/15 points.

During the course, three non-mandatory digital exams (KTR1–3) are given. Passing all three gives one bonus point to add to the total exam score (on all future exams, until further notice). Passing less than three gives no bonus. The digital exams are taken at home on your own electronic device. Consult the course webpage for detailed instructions.

Language

The course is given in English unless everyone who is present understands Swedish. The written exam (TEN1) will be available both in Swedish and in English. Questions from students are welcome in either language at all times.

Teaching

Fourteen lectures are offered. The last one is devoted to review before the exam. The other thirteen are followed by one exercise session each. The lectures cover a selection of the material; be prepared to read the rest on your own. Similarly, the time available during the exercise sessions is most likely not going to be enough for you to be able to solve all recommended exercises. Work at home, if possible before class, in order to collect questions so that you can make the most out of the time spent in the classroom.

Groups

The exercise sessions are split into two groups that are run by Karl Eriksson and Axel Hultman, respectively. The rule of thumb is that if your last name begins with A–J, you belong to Karl's group and otherwise to Axel's. However, just switch groups if you wish.

Planning

On the next page, you find a detailed plan for the lectures as well as recommended exercises for the exercise sessions and your individual studies.

Program 2024

Part I, lectures 1–5. Material for KTR1.		
Lec 1	Introduction, sets, induction **Exercises: P.1.1–5, P.2.1–8**	ABT: 2.1–5, 4.1–3 Rosen: 2.1–2, 2.5, 5.1–2
Lec 2	Recursive definitions, recurrence relations **Exercises: P.2.9–20**	ABT: 4.4, 6.1–5 Rosen: 5.3, 8.1–2
Lec 3	Combinatorics: sum and product rules, permutations, selections **Exercises: P.3.1–13**	ABT: 5.1–5, 5.7–8 Rosen: 6.1, 6.3–4
Lec 4	Combinatorics: multinomial coefficients, multiset selections **Exercises: P.3.14–23**	ABT: 5.6, 5.9 Rosen: 6.5
Lec 5	Combinatorics: pigeonhole principle, inclusion-exclusion **Exercises: P.3.24–33**	ABT: 5.10–13 Rosen: 6.2, 8.5–6

Part II, lectures 6–10. Material for KTR2.		
Lec 6	Number theory: Euclid's algorithm, diophantine equations **Exercises: P.4.1–15**	ABT: 7.1–8 Rosen: 4.1, 4.3–4
Lec 7	Relations: equivalence relations, partial orders **Exercises: P.5.1–11**	ABT: 8.1–4 Rosen: 9.1, 9.3–6
Lec 8	Posets, Hasse diagrams, lattices **Exercises: P.5.12–21**	ABT: 13.1–4 Rosen: 9.6
Lec 9	Number theory: modular arithmetic, Chinese remainder theorem **Exercises: P.6.1–11**	ABT: 9.1–4 Rosen: 4.1, 4.3–4
Lec 10	Number theory: Fermat's little theorem, cryptography, RSA **Exercises: P6.12–19**	ABT: 9.5–6 Rosen: 4.4, 4.6

Part III, lectures 11–13. Material for KTR3.		
Lec 11	Graphs: basics, Hamilton, Euler, isomorphisms **Exercises: P.7.1–16**	ABT: 10.1–4 Rosen: 10.1–5
Lec 12	Graphs: trees and forests, bipartiteness, planarity **Exercises: P.7.17–26**	ABT: 10.5, 11.1–3, 12.1 Rosen: 10.2, 10.7, 11.1–5
Lec 13	Graphs: planar graphs, chromatic numbers and polynomials **Exercises: P.7.27–39**	ABT: 12.1–4 Rosen: 10.7–8 + handout

Lec 14	Course review	all of the above