

TATA82: Discrete Mathematics, 6 credits Course Programme Spring 2023

Teaching and Self-Study

Teaching consists of lectures (Fö), 28 hours, and tutorials (Le), 26 hours.

This is a 6 credits course which corresponds to a total work of approximately 180 hours, divided into 54 contact hours and 126 hours of self-study .

Lectures

The purpose of the lectures is to show some of the course concepts. Fundamental concepts are defined and **discussed**.

Lectures are a complement to the literature and do not cover the whole material, which shall be read by the student on his/her own. All three books have many examples to help the student in reading them.

In the virtual classroom of the Course (LISAM) you will find [Lecture Notes](#) for all the lectures, and a collection of proposed exercises (with answers)

The exercises recommended are taken from **Diskret Matematik** (by Armen Asratian, Anders Björn och Bengt Ove Turesson below) for exercises in Swedish, and Grimaldi's book for Exercises in English (you find them under [Extra File](#) in the course's webpage. Google it!):

Discrete and Combinatorial Mathematics, R. P. Grimaldi, Addison-Wesley, 1999

Diskret Matematik, Armen Asratian, Anders Björn och Bengt Ove Turesson, Liber 2020 (ISBN 978-91-47-13358-1)

We also recommend to study *Discrete Mathematics and its Applications*, K. H. Rosen, Mc.Graw-Hill, 2013 or later. You can find it as e-book. To me, the best book.

The exercises in English proposed in this Program can be found on the webpage under "Extra Files "

Tutorials

To learn mathematics is to do mathematics. To work with exercises is the best way to learn mathematics, and using it. During lessons you can ask questions and discuss exercises. **Use it.**

Around 10 exercises will be proposed for each 2 hours tutorial. In general one cannot solve all them during tutorial time. But one should solve totally more than 150 exercises to grasp the material.

In the virtual classroom of the Course (LISAM) you will find as well a good collection of examples and solved exercises. We set more examples of exercises in the course room continuously. Sometimes, solutions from students.

Organization of Groups

Tutorials are held in three groups: A, B. and C **Exchange students and students in Industrial Economy, International are placed in group A** and tutorials will be held in English when talking to everyone, and in English or Swedish if so desired when talking individually (Spanish is also possible). In group B will be placed students in Industrial Economy whose surnames begin by A to Jonsson. The rest of the students, i.e. **industrial Economy, non-international with surnames beginning by Jozic to Ö, are placed in group C.**

Programme for Spring 2022. Proposed Exercises in Swedish, Swedish book

För 1	Principles of Counting (Recalling high school maths)	5.1-5.9. Online Lect. notes
Le 1	5.1, 5.3, 5.6, 5.8-9, 5.31, 5.33, 5.10, 5.11, 5.12, 5.39, 5.30, 5.36	
För 2	Sets, Principle for Inclusion and Exclusion	2.1-2.7 Online Lect. notes
Le 2	2.8, 2.9, 2.33, 2.32, 5.4, 5.25, 5.26, 7.5, 2.2, 2.16, 2.21, 2.12, 2.17, 2.30, 2.11	
För 3	Combinatorics: Multinomial Expansion, Pigeon Hole Principle, The Principle of Inclusion and Exclusion	5.7-5.15 Online Lect. notes
Le 3	5.15, 5.16, 5.18, 5.22, 5.25, 5.26, 5.29, 5.45, 5.50, 5.46, 5.47, 5.54, 5.57, 5.60, 5.58	
För 4	Principle of Induction. Recursive numbers and functions	Online notes for Lect. 4 & 5, 4.1-4.4, 6.1-6.2
Le 4	4.1, 4.9a), f), g), h), 4.2, 4.10, 4.14, 4.17, 4.18, 4.21, 4.19, 4.17, 4.23, 4.28b)	
För 01	Non-mandatory Digital Examination part 1	
För 5	Modelling with Recurrence: Derangement and Catalan Numbers.	Online notes for Lect. 4 & 5, 6.1-6.2
Le 5	Lists of Exercises on Recurrence https://courses.mai.liu.se/GU/TATA82/Dokument/ExamplesRecurrence1.pdf	
För 6	Recurrence: Linear Recurrence	Online notes for Lect. 6, 6.4-6.5
Le 6	Lists of Exercises on Recurrence, https://courses.mai.liu.se/GU/TATA82/Dokument/ExamplesRecurrence1.pdf	
För 7	Relations: Equivalence Relations and Partitions	Online Lect. notes, 8.1-8.4, 9.2
För 8	Relations: Posets	13.1-13.4, Online Lect. notes
Le 7	8.6, 8.7, 8.9, 8.10, 8.22, 8.12, 8.13, 13.2, 13.5, 13.3, 13.15, 13.8, 8.30	
För 9	Number Theory: Divisibility	Online Lect. notes, 7.1-7.7
Le 8	7.3, 7.6, 7.7, 7.11, 7.35, 7.39, 7.17, 7.45, 7.43, 7.38. Exercises in Lecture Notes for Lecture 9 in Didactical Materials	
För 02	Non-mandatory Digital Examination part 2	
För 10	Number Theory: Diophantine Equations and Congruences	Online Lect. notes 7.4, 7.8 & 9.1-9.3
Le 9	7.21, 7.24, 7.25, 7.26, 7.40, 7.46, 9.28, 9.2, 9.4, 9.19, 9.5, 9.17	
För 11	Number Theory: Applications and Chinese Remaining Theorem	Online Lect. notes, 9.4-9.7
Le 10	9.6, 9.8, 9.9, 9.10, 9.12, 9.30, 9.23, 9.24, 9.14. Exercises in Lecture Notes for Lecture 11 in Didactical Materials	
För 12	Graphs: Basic Concepts	Online Lect. notes 10.1-10.4
Le 11	10.3, 10.4-20b), 10.6, 10.8, 10.10, 10.11, 10.28, 10.16, 10.30, 10.31, 10.19	
För 13	Graph Theory: Trees with Applications	Online Lect. notes, 11.1-11.5
Le 12	11.2, 11.3, 11.4, 11.6, 11.1, 11.20, 11.21, 11.24, 11.16, 11.8, 11.11	
För 14	Graph Theory: Planar and Bipartite Graphs, Colorings	Online Lect. notes, 12.1-12.3, 10.5-10.6, 12.4
Le 13	12.1, 12.6, 12.15, 12.16, 12.2, 10.17, 11.19, 12.7, 12.11, 12.12, 12.14	
För 03	Non-mandatory Digital Examination part 3	

Programme for Spring 2023. Proposed Exercises in English. Extra Files in Course's Webpage

För 1	Principles of Counting (Recalling high school maths)	1.1-1.4. Online Lect. notes
Le 1	1.2.: 3, 5, 11, 13, 19; 1.3.: 7, 11, 13; 1.4.: 1, 3, 5a), 7a,b,c) 17	
För 2	Sets, Principle for Inclusion and Inclusion	3.1-3.3 Online Lect. notes
Le 2	3.1.: 3, 15, 13; 3.2.: 4, 17; 3.3.: 1, 3, 9, 4 suplem. exer.: 17; 5.1.: 11	
För 3	Combinatorics: Multinomial Expansion, Pigeon Hole Principle, The Principle of Inclusion and Exclusion	1.3, 5.5, 8.1-8.3
Le 3	1.3.: 25d), 27d; 1.4.: 7e,f; sup. ex. ch 1: 21; 5.5.: 3, 7a), 9a), 11; 8.1.: 1, 5, 9; 8.3.: 1, 11a), 7	
För 4	Principle of Induction. Recurrence	4.1-4.2, Online Lect. notes for Lect 4 & 5
Le 4	4.1.: 1, 11, 13a,b), 19a); 4.2.: 13; suplem. exer. ch 4: 1, 6, 7a), 27, 26	
För 01	Non-mandatory Digital Examination part 1	
För 5	Modelling with Recurrence: Derangement and Catalan Numbers.	Online Lect. notes for Lect 4 & 5, 1.6, 8.3
Le 5	Lists of Exercises on Recurrence https://courses.mai.liu.se/GU/TATA82/Dokument/ExamplesRecurrence1.pdf	
För 6	Recursion: Linear Recursion	Online Lect. notes & 10.1-10.3
Le 6	Lists of Exercises on Recurrence https://courses.mai.liu.se/GU/TATA82/Dokument/ExamplesRecurrence1.pdf	
För 7	Relations: Equivalence Relations and Partitions	Online Lect. notes & 5.1, 7.1, 7.4
För 8	Relations: Posets	Online Lect. notes, 7.3
Le 7	5.1.: 12; 7.1.: 1, 11, 5; 7.4.: 7, 13, 11a); 7.3.: 17, 19, 27a,c,e), 25	
För 9	Number Theory: Divisibility	Online Lect. notes, 4.3-4.5
Le 8	4.3.: 3, 9, 19, 29, 15, 16, 17; 4.4.: 1c), 13, 19; 4.5.: 11, 27; suplem. exer. ch 4.: 7b), 15, 17	
För 02	Non-mandatory Digital Examination part 2	
För 10	Number Theory: Diophantine Equations and Congruences	Online Lect. notes, 4.4 & 14.3
Le 9	4.4.: 15, 14; suplem. exer. ch 4: 16; 14.3.: 5, 9, 14-15, 13, 16	
För 11	Number Theory: Applications and Chinese Remaining Theorem	Online Lect. notes for Lect. 11
Le 10	Exercises in Lecture Notes for Lecture 11 in Didactical Materials in the Course's Webpage	
För 12	Graphs: Basic Concepts	Online Lect. notes, 11.1-11.3 & 11.5
Le 11	11.1.: 7a, b, c, d, e, f); 11.2.: 9; 11.3.: 1, 3, 21, 17, 19; 11.5.: 3; suplem exer ch 11: 15b), 5a)	
För 13	Graph Theory: Trees with Applications	Online Lect. notes, 12.1-12.4 & 13.2
Le 12	12.1.: 3, 7, 13; 12.4.: 1, 3 (only first digit); suplem. exer. ch 12: 12, 5, 11; 13.2.: 1, 4-5a)	
För 14	Graph Theory: Planar and Bipartite Graphs, Colorings	Online Lect. notes, 11.4 & 11.6
Le 13	11.4.: 3, 7, 5, 13, 19, 21; 11.6.: 1, 9, 15a, b, c), 5	
För 03	Non-mandatory Digital Examination part 3	