

Part I

Organizational Matters

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- ▶ Modul: IN2003
- ▶ Name: “Efficient Algorithms and Data Structures”
“Effiziente Algorithmen und Datenstrukturen”
- ▶ ECTS: 8 Credit points
- ▶ Lectures:
 - ▶ 4 SWS
Mon 10:00–12:00 (Room Interim2)
Fri 10:00–12:00 (Room Interim2)
- ▶ Webpage: <http://www14.in.tum.de/lehre/2021WS/ea/>

▶ Required knowledge:

- ▶ IN0001, IN0003
“Introduction to Informatics 1/2”
“Einführung in die Informatik 1/2”
- ▶ IN0007
“Fundamentals of Algorithms and Data Structures”
“Grundlagen: Algorithmen und Datenstrukturen” (GAD)
- ▶ IN0011
“Basic Theoretic Informatics”
“Einführung in die Theoretische Informatik” (THEO)
- ▶ IN0015
“Discrete Structures”
“Diskrete Strukturen” (DS)
- ▶ IN0018
“Discrete Probability Theory”
“Diskrete Wahrscheinlichkeitstheorie” (DWT)

The Lecturer

- ▶ Harald Räcke
- ▶ Email: raecke@in.tum.de
- ▶ Room: 03.09.044
- ▶ Office hours: (by appointment)

Tutorials

- | | | | | |
|---|------------|--------------|------------|------------------------|
| 1 | Monday, | 12:00-14:00, | 00.08.038 | (Michael Laraia) |
| 3 | Monday, | 14:00-16:00, | 02.09.023 | (Ruslan Zabrodin) |
| 4 | Tuesday, | 10:00-12:00, | 00.08.053 | (Letian Shi) |
| 5 | Tuesday, | 14:00-16:00, | 00.08.038 | (Arnor Kristmundsson) |
| 6 | Wednesday, | 10:00-12:00, | 03.11.018 | (Abdelrahman Metwally) |
| 2 | Wednesday, | 12:00-14:00, | online | (Arnor Kristmundsson) |
| 8 | Wednesday, | 14:00-16:00, | online | (Abdelrahman Metwally) |
| 9 | Thursday, | 16:00-18:00, | online | (Michael Laraia) |
| 7 | Friday, | 12:00-14:00, | 00.13.009A | (Ruslan Zabrodin) |

Registration for Tutorials

Registration Period for Tutorial Sessions:

Saturday, 23 Oct– Tuesday, 26 Oct

via TUMonline; you have to choose at least 3 options...

Registration for Attending the Lecture

- ▶ For the following lectures we will do random checks of ca. 10% of the vaccination certificates.
- ▶ Then you have to sit one seat apart according to current Corona regulations.
- ▶ The number of seats reduces to roughly 140.
- ▶ Therefore, you must register if you want to attend the lecture inside the lecture hall.
- ▶ This is done via Moodle.

Assignment sheets

In order to pass the module you need to pass an exam.

Assessment

Assignment Sheets:

- ▶ An assignment sheet is usually made available on Friday on the module webpage.
- ▶ Solutions have to be handed in in the following week before the lecture on Monday.
- ▶ Solutions are submitted electronically via Moodle.
- ▶ Solutions have to be given in English.
- ▶ Solutions will be discussed in the tutorial of the week when the sheet has been handed in, i.e., **sheet may not be corrected by this time.**
- ▶ **You should submit solutions in groups of up to 2 people.**

Assessment

Assignment Sheets:

- ▶ Submissions must be handwritten by a member of the group. Please indicate who wrote the submission.
- ▶ Don't forget name and student id number for each group member.

Assessment

Assignment can be used to improve you grade

- ▶ If you obtain a bonus your grade will improve according to the following function

$$f(x) = \begin{cases} \frac{1}{10} \text{round} \left(10 \left(\frac{\text{round}(3x)-1}{3} \right) \right) & 1 < x \leq 4 \\ x & \text{otw.} \end{cases}$$

- ▶ It will improve by 0.3 or 0.4, respectively.

Examples:

- ▶ 3.3 → 3.0
- ▶ 2.0 → 1.7
- ▶ 3.7 → 3.3
- ▶ 1.0 → 1.0
- ▶ > 4.0 no improvement

Assessment

Assignment can be used to improve you grade




Requirements for Bonus

- ▶ 50% of the points are achieved on submissions 2-8,
- ▶ 50% of the points are achieved on submissions 9-14,
- ▶ each group member has written at least 4 solutions.





1 Contents

- ▶ Foundations
 - ▶ Machine models
 - ▶ Efficiency measures
 - ▶ Asymptotic notation
 - ▶ Recursion
- ▶ Higher Data Structures
 - ▶ Search trees
 - ▶ Hashing
 - ▶ Priority queues
 - ▶ Union/Find data structures
- ▶ Cuts/Flows
- ▶ Matchings





2 Literatur

-  Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman:
The design and analysis of computer algorithms,
Addison-Wesley Publishing Company: Reading (MA), 1974
-  Thomas H. Cormen, Charles E. Leiserson, Ron L. Rivest,
Clifford Stein:
Introduction to algorithms,
McGraw-Hill, 1990
-  Michael T. Goodrich, Roberto Tamassia:
*Algorithm design: Foundations, analysis, and internet
examples*,
John Wiley & Sons, 2002

2 Literatur

-  Ronald L. Graham, Donald E. Knuth, Oren Patashnik:
Concrete Mathematics,
2. Auflage, Addison-Wesley, 1994
-  Volker Heun:
*Grundlegende Algorithmen: Einführung in den Entwurf und
die Analyse effizienter Algorithmen*,
2. Auflage, Vieweg, 2003
-  Jon Kleinberg, Eva Tardos:
Algorithm Design,
Addison-Wesley, 2005
-  Donald E. Knuth:
*The art of computer programming. Vol. 1: Fundamental
Algorithms*,
3. Auflage, Addison-Wesley, 1997

2 Literatur

-  Donald E. Knuth:
*The art of computer programming. Vol. 3: Sorting and
Searching*,
3. Auflage, Addison-Wesley, 1997
-  Christos H. Papadimitriou, Kenneth Steiglitz:
Combinatorial Optimization: Algorithms and Complexity,
Prentice Hall, 1982
-  Uwe Schöning:
Algorithmik,
Spektrum Akademischer Verlag, 2001
-  Steven S. Skiena:
The Algorithm Design Manual,
Springer, 1998