

# 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/2019WS/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](mailto:raecke@in.tum.de)
- ▶ Room: 03.09.044
- ▶ Office hours: (by appointment)

# Tutorials

**A01** Monday, 12:00–14:00, 00.08.038 (Stotz)

**A02** Monday, 12:00–14:00, 00.09.038 (Guan)

**A03** Monday, 14:00–16:00, 02.09.023 (Stotz)

**B04** Tuesday, 10:00–12:00, 00.08.053 (Czerner)

**B05** Tuesday, 14:00–16:00, 00.08.038 (Czerner)

**C06** Wednesday, 10:00–12:00, 03.11.018 (Guan)

**E07** Friday, 12:00–14:00, 00.13.009 (Stotz)

# 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 Monday on the module webpage.
- ▶ Solutions have to be handed in in the following week before the lecture on Monday.
- ▶ You can hand in your solutions by putting them in the mailbox "Efficient Algorithms" on the basement floor in the MI-building.
- ▶ 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.**

## 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

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