

# 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 Racke
- ▶ 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.**

## 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