On the difficulties to deliver a 1st-semester course "Foundations of Programming" at HU: prerequisites, contents, success rate

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Humboldt University Berlin

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Jahorina, BiH, 22th – 26th August 2016

The problem

Difficulties at a 1st-semester course "Foundations of Programming“ at HU

- Completely different prerequisites from school:
  One lecture for so different students?
- Don‘t know the number of really interested students
- Contents and methodology of the lecture

Contents

Bachelor at HU: Schedule Overview

1. Semester	Fundamentals of Programmierung (OO, Java)		Basics of theoretical informatics				Mathematics 1: Linear Algebra		Second subject
2. Semester	Algorithms and data structures		Compiler construction		Digital systems: basics and architectures		Informatics and Society		Second subject
3. Semester	Software Engineering		Logic in informatics		Seminar		Mathematics 2: Analysis		Second subject
4. Semester	Operating systems		Database systems		Communication systems: basics and network architectures		Mathematics 3: Numerics & Stochastics		Second subject
5. Semester	Semester Project		Elective modules						Second subject
6. Semester	Bachelor thesis		Elective modules						Second subject

Bachelor at HU: Schedule Overview

1. Semester	Fundamentals of Programmierung (OO, Java)		Basics of theoretical informatics						
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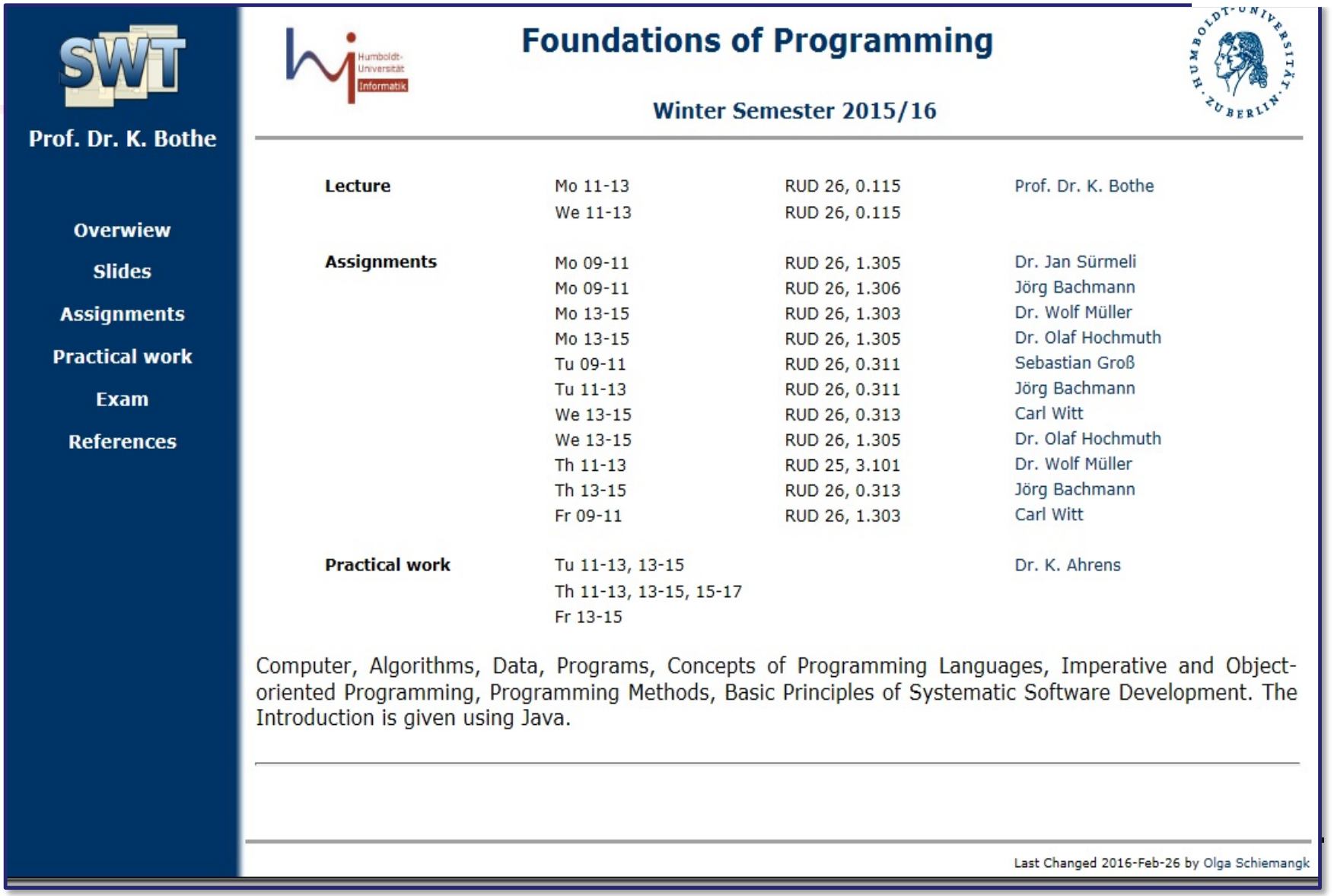
5. Semester	Project				ive modules				Second subject
6. Semester	Bachelor thesis		Elective modules						Second subject

Organisation:
- Lecture: 4 lecture hours / week
- 16 weeks
- assignments
- practical work

Substantial effort:
12 ECTS

Contents and goals:
- Imperative programming
- Object-oriented programming
- Java

GdP Website: Organisation



SWT

Prof. Dr. K. Bothe

Overwiew
Slides
Assignments
Practical work
Exam
References

Humboldt-Universität Informatik

Foundations of Programming

Winter Semester 2015/16

HUMBOLDT-UNIVERSITÄT ZU BERLIN

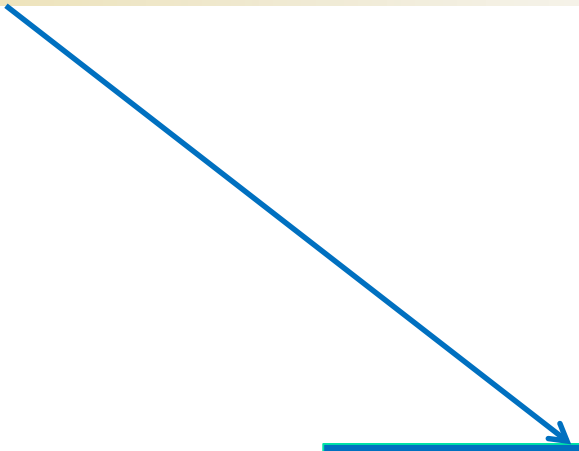
Lecture	Mo 11-13	RUD 26, 0.115	Prof. Dr. K. Bothe
	We 11-13	RUD 26, 0.115	
Assignments	Mo 09-11	RUD 26, 1.305	Dr. Jan Sürmeli
	Mo 09-11	RUD 26, 1.306	Jörg Bachmann
	Mo 13-15	RUD 26, 1.303	Dr. Wolf Müller
	Mo 13-15	RUD 26, 1.305	Dr. Olaf Hochmuth
	Tu 09-11	RUD 26, 0.311	Sebastian Groß
	Tu 11-13	RUD 26, 0.311	Jörg Bachmann
	We 13-15	RUD 26, 0.313	Carl Witt
	We 13-15	RUD 26, 1.305	Dr. Olaf Hochmuth
	Th 11-13	RUD 25, 3.101	Dr. Wolf Müller
	Th 13-15	RUD 26, 0.313	Jörg Bachmann
	Fr 09-11	RUD 26, 1.303	Carl Witt
Practical work	Tu 11-13, 13-15		Dr. K. Ahrens
	Th 11-13, 13-15, 15-17		
	Fr 13-15		

Computer, Algorithms, Data, Programs, Concepts of Programming Languages, Imperative and Object-oriented Programming, Programming Methods, Basic Principles of Systematic Software Development. The Introduction is given using Java.

Last Changed 2016-Feb-26 by Olga Schiemangk

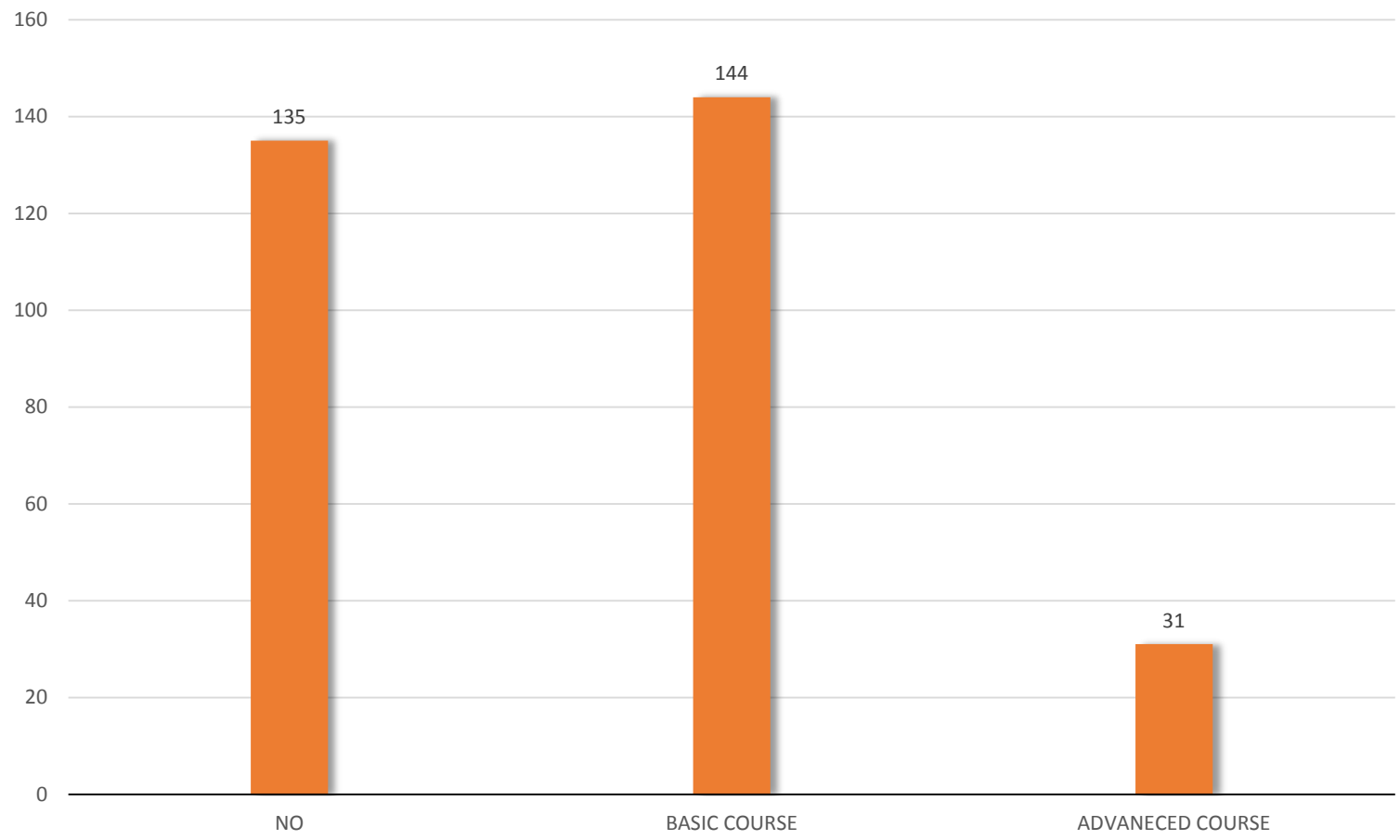
Contents

- Bachelor Curriculum at HU
- Prerequisites of new students
- How many students?
- Course contents
- Results
- Summary

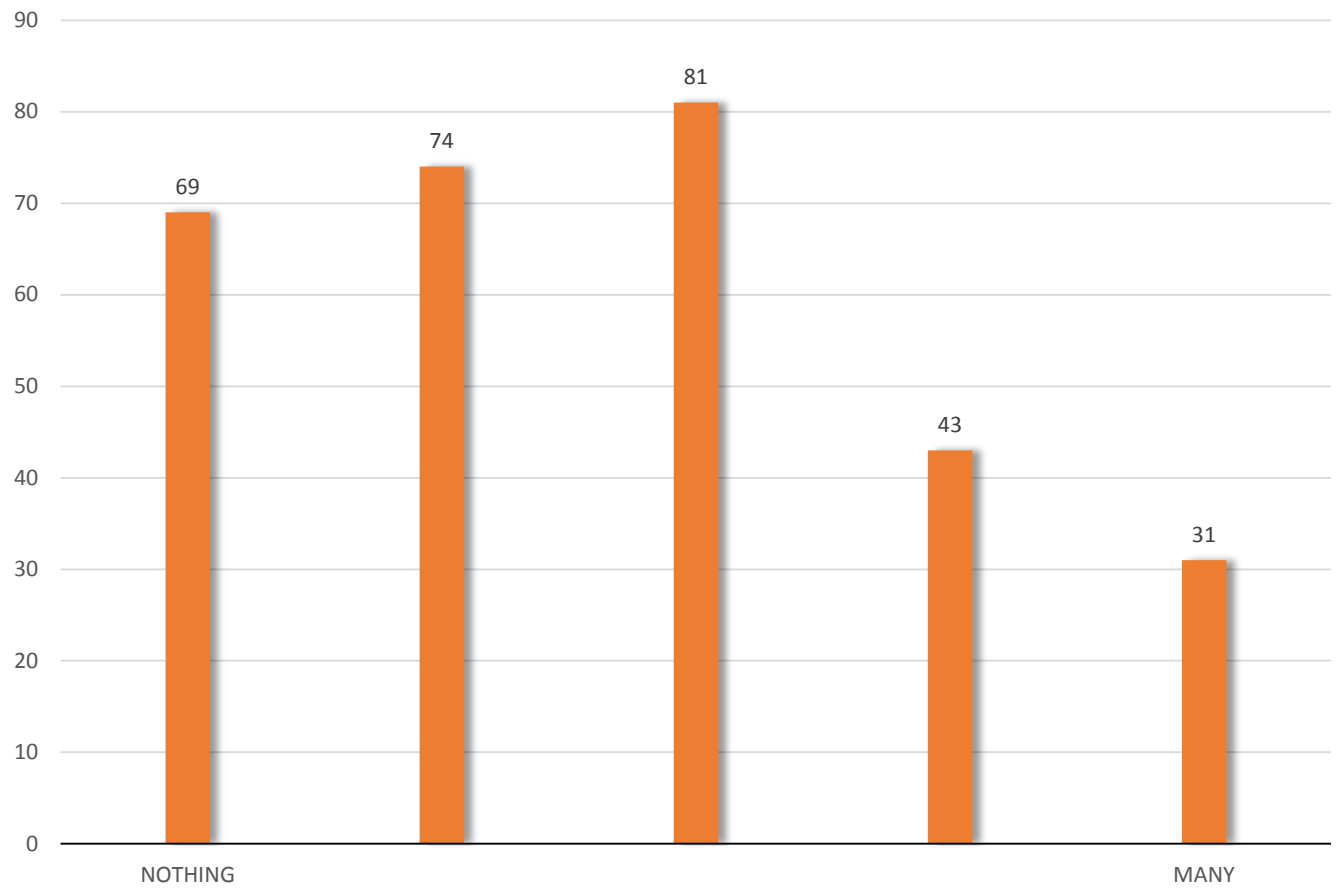


Questionnaire
(at the beginning)

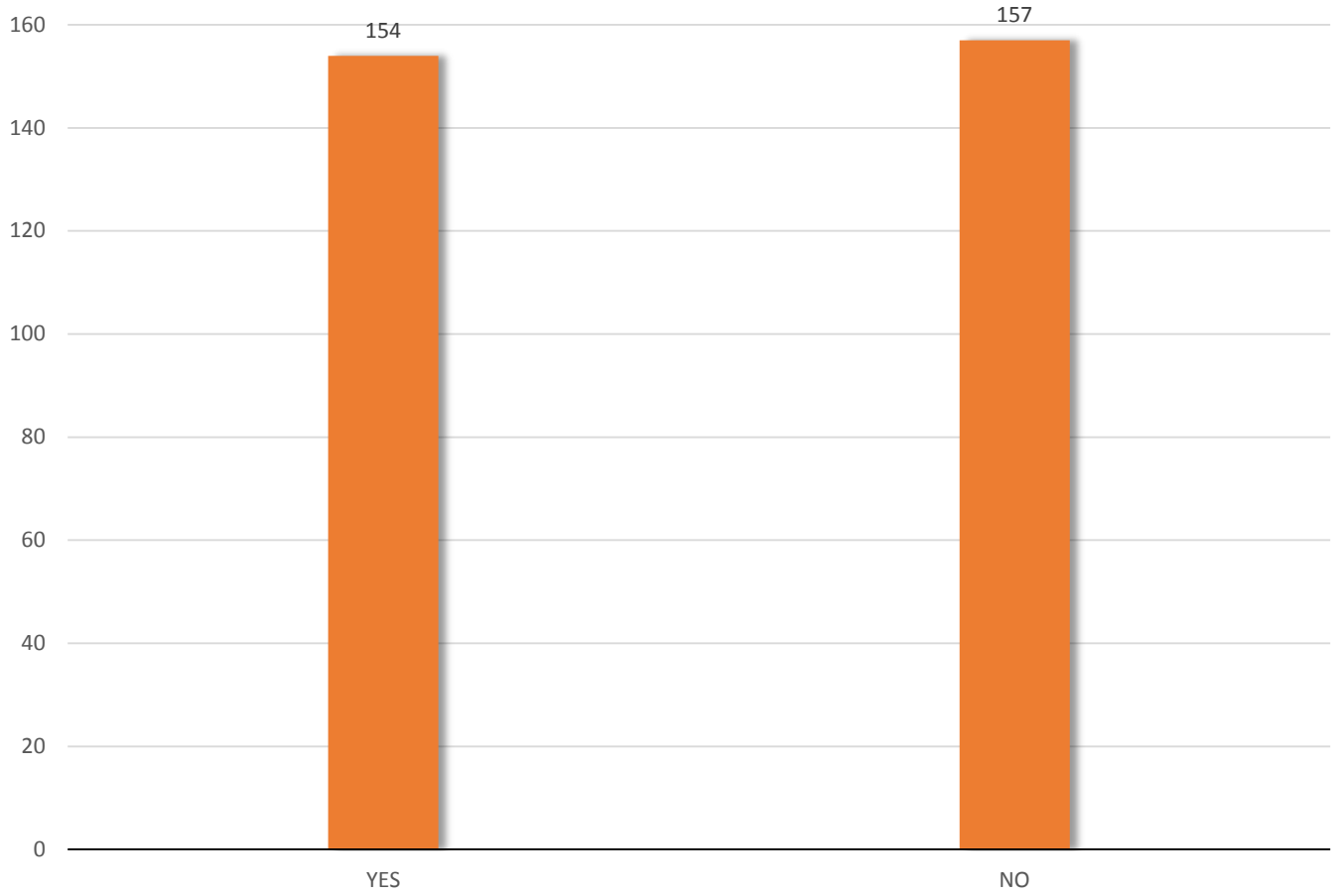
Did you attend a course „Informatics“ at school?



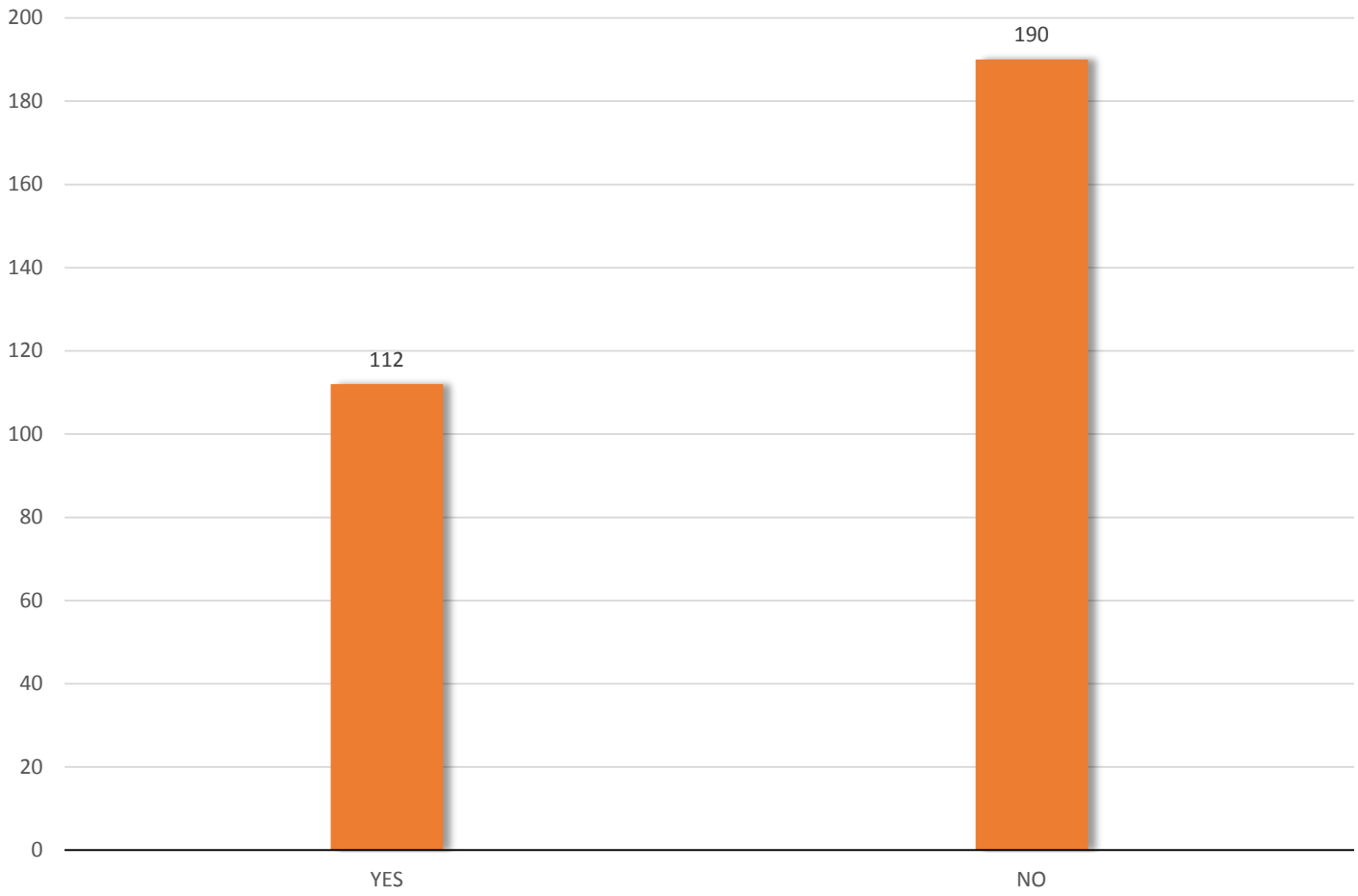
Did you have knowledge of programming bevor studies?



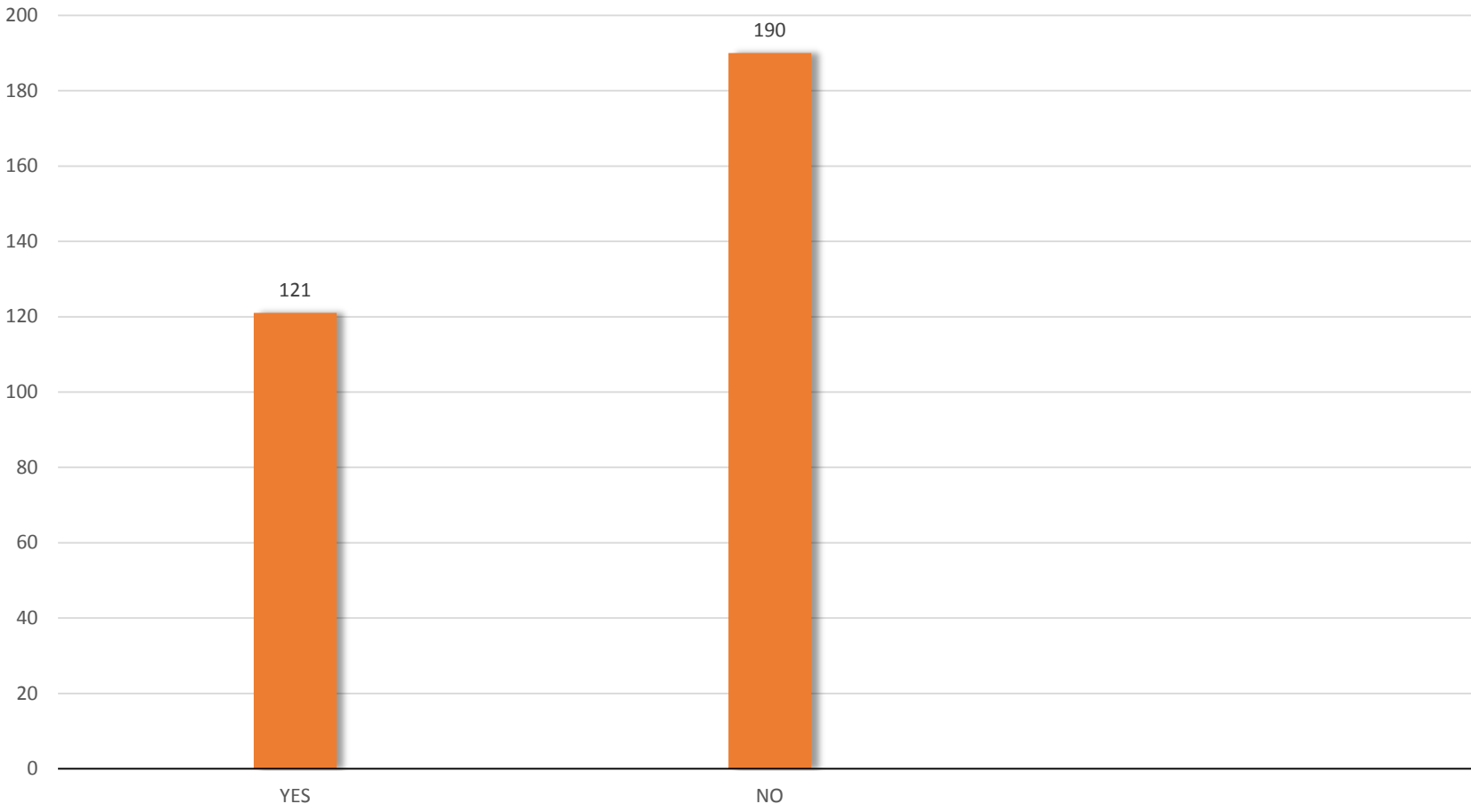
Did you attend an advanced course „Mathematics “ at school?



Do you know what object-oriented programming is?



Do you know some sorting algorithms (e.g. Quicksort)?



Conclusion:

- one course for all new students
  not easy to design

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How many students in WS 2015/16?

426 students enrolled:

- 309 BA informatics
- 117 others (teachers, Biophysics ...)

44 % not interested

Enrolled – but not interested

309 enrolled students in BA Informatics, BUT

- 44% (137 of 309 did not study at all) **1)**
- 13% (41 not successful at the exam)
- 43% (131 successful)

1) Enrolled to wait for another study (e.g. in Medicine, Psychology); Informatics is free to enroll (no upper limit)

Ruduction rate over the weeks

In the beginning:

423 enrolled for assignments and Java lab

1. task: 368 solutions
2. task: 335 solutions
3. task: 299 solutions
4. task: 292 solutions
5. task: 256 solutions
6. task: 232 solutions

Exam:

202 participants (failed: 38, succeeded: 164)

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Course contents ...?

Foundations

Compiler, Syntax, Data ...

Imperative Programming

Statement, variable, algorithm, data type ...

Object-oriented Programming

Abstract data type, class, object; inheritance, polymorphism, generics, exception handling, event handling ...

Java

Objects first?

Website: Contents 1 (excerpt)

Chapter	Slides	Program examples in Java
Part I: Foundations		
I.1 What is informatics?	I.1-1s.pdf, I.1-4s.pdf	
I.2 Computer	I.2-1s.pdf, I.2-4s.pdf	
I.3 Basics of working with computer	I.3-1s.pdf, I.3-4s.pdf	
I.4 Data	I.4-1s.pdf, I.4-4s.pdf	
I.5 Algorithms	I.5-1s.pdf, I.5-4s.pdf	
I.6 Programming languages	I.6-1s.pdf, I.6-4s.pdf	
I.7 Syntax: Grammar, EBNF	I.7-1s.p1.pdf, I.7-4s.p1.pdf I.7-1s.p2.pdf, I.7-4s.p2.pdf	
I.8 Software development	I.8-1s.pdf, I.8-4s.pdf	
Part II: Concepts of imperative languages		
		Programs-Part-II.pdf
II.1 Preliminary note	II.1-1s.pdf, II.1-4s.pdf	
II.2 Compiler, interpreter, virtual machine	II.2-1s.pdf, II.2-4s.pdf	Hello.java
II.3 Essential components of imperative languages	II.3-1s.pdf, II.3-4s.pdf	Temperature.java Keyboard.java
II.4 Standard libraries: Java-API	II.4-1s.pdf, II.4-4s.pdf	
II.5 Choice: conditional statements	II.5-1s.pdf, II.5-4s.pdf	
II.6 Iteration: loop statements	II.6-1s.pdf, II.6-4s.pdf	TemperatureTable.java
II.7 Methods	II.7-1s.pdf, II.7-4s.pdf	Factorials.java

Website: Contents 2 (excerpt)

Part III: Object-oriented concepts and software development		
		Programs-Part-III.pdf
III.1 Basic concepts of object-oriented programming (1): abstract data types, objects, classes	III.1-1s.pdf, III.1-4s.pdf	Stack.java reversing.java reversing2.java
III.2 Object-oriented programming: basic examples	III.2-1s.pdf, III.2-4s.pdf	BracketStructur.java Time.java Schedule.java
III.3 Basic concepts of object-oriented programming (2): class variable and methods	III.3-1s.pdf, III.3-4s.pdf	TimeC.java ScheduleC.java
III.4 Component types	III.4-1s.pdf, III.4-4s.pdf	
III.5 Basic concepts of object-oriented programming (3): inheritance, polymorphism, dynamic binding	III.5-1s.pdf, III.5-4s.pdf	Time2.java
III.6 Basic concepts of object-oriented programming (4): generic classes	III.6-1s.pdf, III.6-4s.pdf	StackForChar.java BuildPairs.java BuildPairsBounds.java StackGen.java
III.7 Chained structures: lists	III.7-1s.pdf, III.7-4s.pdf	IntList.java List.java Stack1.java
III.8 Basic concepts of object-oriented programming (5): interfaces	III.8-1s.pdf, III.8-4s.pdf	ScheduleInt.java ScheduleAbstr.java ReversingNU.java KeyboardIApp.java Print.java
III.9 Exception handling	III.9-1s.pdf, III.9-4s.pdf	Exception.java TryCatch.java TryCatchAll.java Finally.java

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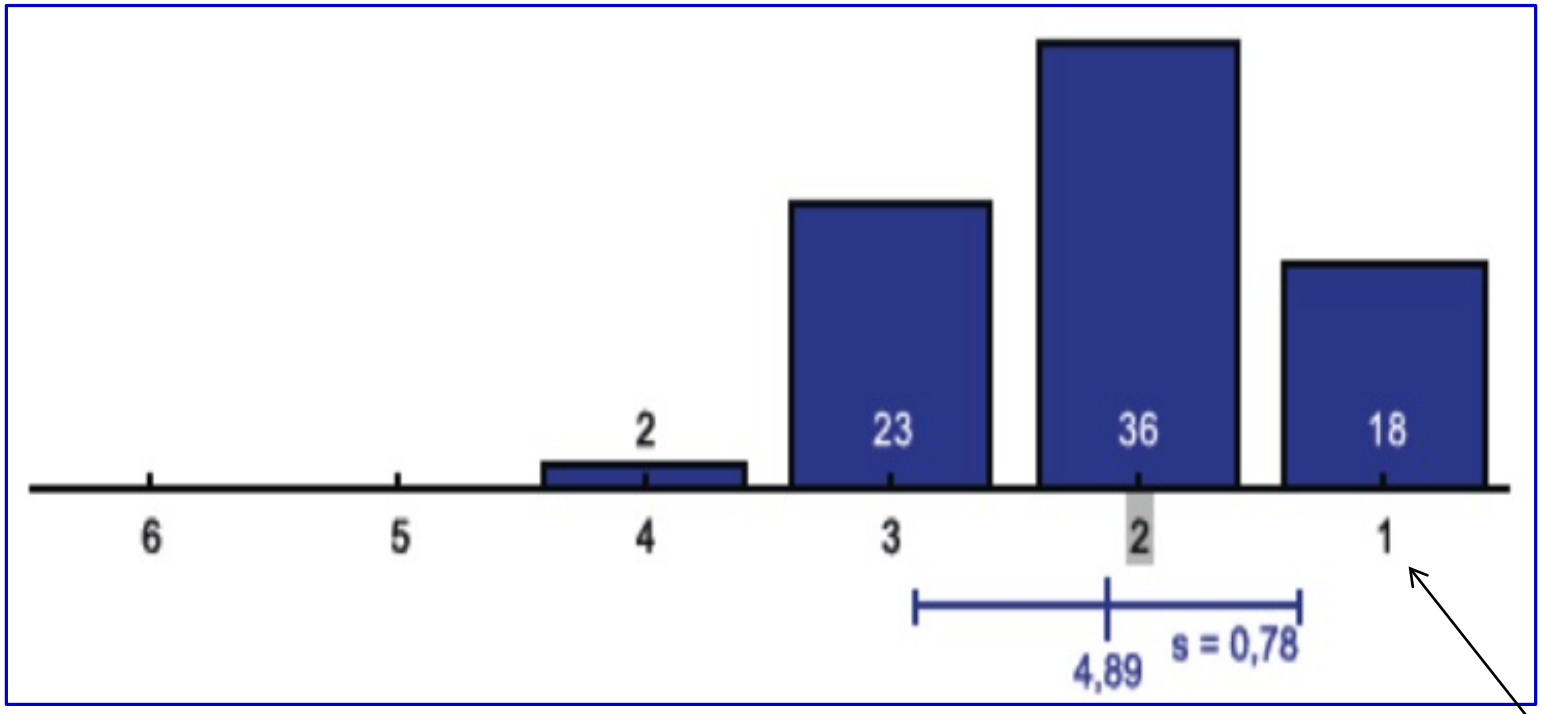
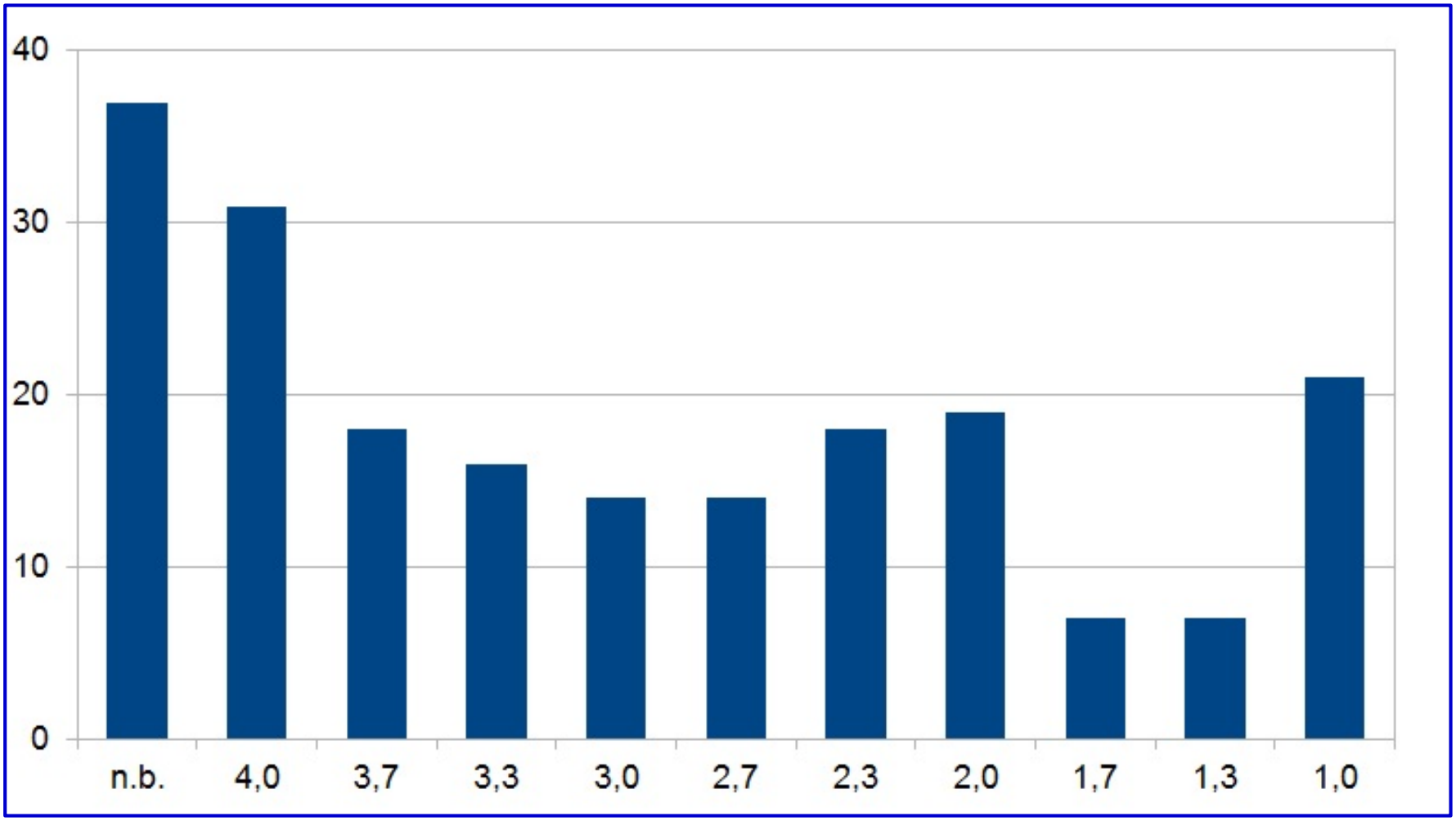
Feedback of students: quality of lecture (anonymous)



Exam: Results



Failed

Best grade

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Summary

- Number of students not clear
- Completely different prerequisites of new students: a compromise for course contents
- Success rate: 43%
- Structure: 3 parts
  - Overview
  - Imperative programming
  - Object-oriented programming

Thank you for attention

Appendix:

Complete contents

Website: Contents 1

Chapter	Slides	Program examples in Java
Part I: Foundations		
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I.6 Programming languages	I.6-1s.pdf, I.6-4s.pdf	
I.7 Syntax: Grammar, EBNF	I.7-1s.p1.pdf, I.7-4s.p1.pdf I.7-1s.p2.pdf, I.7-4s.p2.pdf	
I.8 Software development	I.8-1s.pdf, I.8-4s.pdf	
Part II: Concepts of imperative languages		
		Programs-Part-II.pdf
II.1 Preliminary note	II.1-1s.pdf, II.1-4s.pdf	
II.2 Compiler, interpreter, virtual machine	II.2-1s.pdf, II.2-4s.pdf	Hello.java
II.3 Essential components of imperative languages	II.3-1s.pdf, II.3-4s.pdf	Temperature.java Keyboard.java
II.4 Standard libraries: Java-API	II.4-1s.pdf, II.4-4s.pdf	
II.5 Choice: conditional statements	II.5-1s.pdf, II.5-4s.pdf	
II.6 Iteration: loop statements	II.6-1s.pdf, II.6-4s.pdf	TemperatureTable.java
II.7 Methods	II.7-1s.pdf, II.7-4s.pdf	Factorials.java TimeTable.java
II.8 Expressions, simple operator types	II.8-1s.p1.pdf, II.8-4s.p1.pdf II.8-1s.p2.pdf, II.8-4s.p2.pdf	Unicode.java
II.9 Programming style guides	II.9-1s.pdf, II.9-4s.pdf	
II.10 Arrays	II.10-1s.p1.pdf, II.10-4s.p1.pdf II.10-1s.p2.pdf, II.10-4s.p2.pdf	Echo.java PrimeNumbers.java Months.java
II.11 Recursion, complexity of algorithms	II.11-1s.p1.pdf, II.11-4s.p1.pdf II.11-1s.p2.pdf, II.11-4s.p2.pdf	Power1.java Hanoi.java
II.12 Search and sorting algorithms for arrays	II.12-1s.pdf, II.12-4s.pdf	search.java Quicksort.java merge.java Hash.java

Website: Contents 2

Part III: Object-oriented concepts and software development		
		Programs-Part-III.pdf
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III.8 Basic concepts of object-oriented programming (5): interfaces	III.8-1s.pdf, III.8-4s.pdf	ScheduleInt.java ScheduleAbstr.java ReversingNU.java KeyboardIApp.java Print.java
III.9 Exception handling	III.9-1s.pdf, III.9-4s.pdf	Exception.java TryCatch.java TryCatchAll.java Finally.java TryInTry.java KeyboardTry.java OpeningHours.java
III.10 Software development: requirements analysis and problem definition	III.10-1s.pdf, III.10-4s.pdf	
III.11 Object-oriented software architecture	III.11-1s.pdf, III.11-4s.pdf	
III.12 From concept to implementation	III.12-1s.pdf, III.12-4s.pdf	Maze.java MazeTest.java Mouse.java MouseMaze.java Easel.java SoftFrame.java
III.13 Trees: efficient searching and sorting algorithms	III.13-1s.pdf, III.13-4s.pdf	Tree.java Traverse.java TraverseTest.java
III.14 Applets	III.14-1s.pdf, III.14-4s.pdf	TempApplet.java TempApplet.html
III.15 Events	III.15-1s.pdf, III.15-4s.pdf	EyesApplet.html EyesApplet.java Eyes.java
III.16 Threads & processes	III.16-1s.pdf, III.16-4s.pdf	ThreadBasicTest.java ThreadSleep.java