

Course 'Data structures and algorithms – using Java'

Teaching materials and presentation experience

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Agenda

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The course



- Basic course in data structures and algorithms
- 4th semester
- Course delivered via moodle at <http://courses.ii.edu.mk>
- Preceded by a course in programming languages (where Java is introduced) in the 3rd and two more introductory programming courses (1st and 2nd semester)
- 2 hours of lectures + 1 hour tutorial + 2 hours labs
- Lectures and tutorial combined
- English slides with Macedonian presentation

Supporting site (moodle)



The screenshot displays a Moodle course interface. At the top, the course title is 'Структури на податоци - Moodle Frontend'. Below the title, there's a navigation bar with options like 'Turn editing on' and 'Turn student view on'. The main content area is divided into several sections:

- People:** A list of participants, including 'Михе Анастас' and 'Лазовска Елена'.
- Weekly outline:** A list of course activities with dates and descriptions. For example, '20 February - 26 February' includes 'Лекции: Java подготвување', 'Предавања: Вовед во податоци', and 'Предавања: Algorithms and complexity'.
- Latest News:** A list of recent news items, such as '8 Sep, 19:15: Михе Анастас: Рок за 2. проект'.
- Upcoming Events:** A list of upcoming events, including 'Проект 2'.
- Recent Activity:** A list of recent activity, including 'Activity since Tuesday, 12'.

Syllabus



Lectures (2x45min)		Tutorial (1x45min)	
Topic	Reference	Topic	Reference
Algorithm analysis - Model of computer	Preiss, ch.2	Java review	
Asymptotic notation	Preiss, ch.3	Asymptotic analysis of algorithms (measuring)	Preiss, ch.3
Foundational data structures	Watt-Brown ch.3, 4	Java implementations of found. data struct.	Watt-Brown ch.3, 4
Abstract Data Types	Watt-Brown, ch.5	ADT in Java class library	Preiss, ch.5
Stacks and queues	Watt-Brown, ch.6,7	Application of stacks and queues	Preiss, ch.6
Lists	Watt-Brown, ch.8	Design patterns and applications of lists	Preiss, ch.7

Syllabus (cont.)



Lectures (2x45min)		Tutorial (1x45min)	
Topic	Reference	Topic	Reference
Hash tables	Watt-Brown ch.9	Sample Java implementation	Watt-Brown ch.9
Trees	Preiss, ch.9 Watt-Brown, ch.14	Tree Java implementation	Preiss, ch.9
Priority queues and heaps	Preiss, ch.11 Watt-Brown, ch.13	Applications	Preiss, ch.11
Sorting	Sedgewick, part III Preiss, ch.14	Java implementation	Preiss, ch.14
Search trees	Watt-Brown, ch.16 Preiss, ch.10	Applications	Preiss, ch.10
Graphs	Brown-Watt, ch.15 Preiss, ch.16	Representation and algorithms	Brown-Watt, ch.15 Preiss, ch.16
Algorithmic patterns (Brut-force, backtracking, top-down, bottom-up)	Preiss, ch.14	Example algorithms and Java implementations	Preiss, ch.14

Bibliography



- Preiss: Bruno Preiss, Data Structures and Algorithms with Object-Oriented Design Patterns in Java, John Wiley & Sons, also available on line at <http://www.brpreiss.com/books/opus5/> (with email permission to use all resources)
- Watt-Brown: David Watt and Deryck F. Brown, Java Collections, An Introduction to Abstract Data Types, Data Structures and Algorithms, John Wiley & Sons (Material permitted to be used with notices, <http://www.dcs.gla.ac.uk/~daw/books/JC/index.html>)

Evaluation



- Weekly assignments
 - Performed during the labs and uploaded
 - Programming or essay
- Projects
 - More complicated programming and/or essay assignments
- Colloquia (recommended)
 - Consist of practical and theoretical part
 - Each part is passed with minimum 50%
 - Passes both practical parts – no practical (written) exam
 - Passed both theoretical parts – no theoretical (oral) exam
- Practical exam
- Oral exam
- Activity during the course
 - Using the moodle system, for each lecture and tutorial, a topic to discuss its quality will be posted. The students with the most constructive and critical comments will be awarded up to 20 extra points



Points

Element	Qty	Points	Total
Weekly assignments	10	5	50
Projects	2	25	50
Colloquia (practical)	2	50	100
Colloquia (theory)	2	50	100
Activity during the course	(extra)	20	20
Total			320

Element	Qty	Points	Total
Weekly assignments	10	5	50
Projects	2	25	50
Practical Exam	1	100	100
Oral (theory) Exam	1	100	100
Activity during the course	(extra)	20	20
Total			320



About the grading

- Weekly assignments are mandatory
 - Dye date will be announced with each assignment
 - No late submissions
- Projects are mandatory
 - Dye date will be announced with each assignment
 - No late submissions (or lower grading based on the time passed the dye date)
- The course can be passed either through colloquia or written and oral exam.
- Activity during the course is optional, but recommended for the students aiming for higher grades
- The grading will be performed according to the following table

Grading scheme



Points	Grade
291-320	10
256-290	9
221-255	8
186-220	7
151-185	6

Teaching materials



- Power Point presentations
 - Given in English
 - Most of the students did not mind
 - Some commented about the language
- Books listed
- Some additional material in Macedonian, regarding dynamic programming

Assignments



- 10 weekly assignments
 - Supposed to be done during the labs
 - Usually complement the labs
 - Most of them were programming tasks involving a variation of the tasks done at the labs
 - Submission rate was relatively high

Assignments (cont)



Assignment ID	Assignment Title	Submission Type	Due Date	Submission Count
1	Лаборатория: Java-потребитель	Upload a single file	Sunday, 6 March 2006, 11:55 PM	View 14 submitted assignments
2	Лаборатория: Асинхронная работа	Upload a single file	Sunday, 12 March 2006, 11:55 PM	View 10 submitted assignments
3	Лаборатория: Основы подпрограммной структуры - задачи	Upload a single file	Sunday, 19 March 2006, 11:55 PM	View 10 submitted assignments
4	Лаборатория: Асинхронная подпрограммная структура	Upload a single file	Sunday, 26 March 2006, 11:55 PM	View 12 submitted assignments
5	Лаборатория: Stack, Queue, Deque - задачи	Upload a single file	Sunday, 2 April 2006, 11:55 PM	View 14 submitted assignments
6	Лаборатория: Lists - задачи	Upload a single file	Sunday, 9 April 2006, 11:55 PM	View 13 submitted assignments
7	Лаборатория: Hash Tables	Upload a single file	Sunday, 16 April 2006, 11:55 PM	View 14 submitted assignments
8	Лаборатория: vector, Binary tree - задачи	Upload a single file	Sunday, 23 April 2006, 11:55 PM	View 10 submitted assignments
	При подготовке лекции для	Office activity	-	View 10 submitted assignments
	При подготовке лекции для	Office activity	-	View 20 submitted assignments
9	Проект 1: Движок на ориентированном графе	Upload a single file	Sunday, 14 May 2006, 11:55 PM	View 12 submitted assignments
10	Лаборатория: vector - Near структура на подпрограмме	Upload a single file	Thursday, 11 May 2006, 11:55 PM	View 10 submitted assignments
11	Лаборатория: vector - Приближенные данные	Upload a single file	Tuesday, 23 May 2006, 11:55 PM	View 10 submitted assignments
12	Лаборатория: vector - Графы	Upload a single file	Sunday, 28 May 2006, 11:55 PM	View 12 submitted assignments
13	При подготовке лекции для	Office activity	-	View 9 submitted assignments
14	При подготовке лекции для	Office activity	Friday, 23 June 2006, 07:15 AM	View 10 submitted assignments
15	Проект 2	Upload a single file	Friday, 15 September 2006, 11:55 PM	View 14 submitted assignments

Projects



- More advanced assignments
- Require individual work
- Project 1
 - Common to all students
 - Tree of arithmetical expressions
 - Demonstrates the knowledge of several important data structures (from file to tree, then to postfix and finally evaluation)
 - Deliverables include programming code, sample input and output files and essay in .doc.

Projects (cont.)



- Project 2
 - Individual projects
 - Student were asked to choose category of problem that they would like to do
 - 4 categories
 - Programming problems (max 30 points)
 - Visualization applets (max 30 points)
 - Additional programming examples of data structures (max 20 points)
 - Enhancement of the teaching materials (max 15 points)
 - Most often the first and the last were selected

Students' feedback



- The first time this course was delivered using this method
- Also, the first course delivered by the teacher 😊
- Students' feedback was more than welcome
- For each topic presented, a discussion topic was posted in a special forum for the quality of the teaching and the materials

Students' feedback (cont.)



- Almost all topics had some discussion attached
- Most of the comments were proposing integration of more examples into the slides
- Some were concerning errors in the examples with programming code
- Only last couple of topics were with no comments (I suppose the enthusiasm degrades toward the end of the semester)
- All the comments were carefully read by the teaching staff and when necessary a response was posted promptly

Future work



- The course was given to the last generation using the previous curriculum
- In the new one, the Programming languages course is omitted
- This means that the introduction to Java will be done in this course
- Fortunately, the number of hours per week increased to 3 + 2 + 2 (giving 1 more lecture and 1 more tutorial hour)
- The course is changed with the addition of 7 new topics regarding Java fundamentals, that will be covered in the first 3-4 weeks
- On the next year's workshop will share the new experiences 😊

Questions and comments

