

Data Structures and Algorithms – using JAVA

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Data Structure course

- The course is organized in the following manner
 - 2 hours lectures
 - 1 hour tutorial
 - 2 hours lab exercises
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Data Structures course

- The tutorials and lab exercises are closely coordinated with the lectures
 - The material covered in each lecture is later covered in the tutorials from implementation point of view using Java
 - Lab exercises extend the tutorials where each student implements the assigned exercises
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Lab exercises purpose

- Lab exercises main focus is to teach the students to learn
 - How to implement certain data structures
 - How to use already implemented data structures
 - Learn how to use Java powerful library of already implemented data structures
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Organization

- The course is organized using moodle as a courseware tool
 - The course is organized in weeks and each week the students can download both the lectures and the tutorials
 - Also for each week there are materials for laboratory exercises accompanied with assignments
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Lab work and Assignments

- The lab work consists of:
 - examples of already implemented problems
 - partial solutions of problems
 - assignments for lab and home work
 - Assignments
 - each week the students are obliged to upload the solution for the given problem
 - this is later evaluated and together with the projects make up a part of the final grade
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Lab exercises

Following are the lab topics and exercises that are given for each topic:

- Java examples and repetition
 - Asymptotical complexity of Java programs
 - Basic data structures (arrays and lists)
 - Abstract data types
 - Stack, Queue, Dequeue
 - Lists (different kinds of lists)
 - Hash tables
 - Binary trees
 - Heap
 - Search trees
 - Graphs
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Lab exercises

- Lab 1: Java examples and repetition
 - Usage of data structures
 - Sum up $1 + 1/2 + 1/3 + \dots$
 - Implement the class RationalNumber with its methods and attributes
 - Lab 2: Asymptotical complexity of Java programs
 - Given short programs with loops and calling other methods with given complexity
 - Calculate the complexity
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Lab exercises

□ Lab 3: Basic data structures

- Given the implementations of CustomArray and LinkedList
- Implement additional methods for this structures
- Usage of this DS

□ Lab 4: Abstract data types

- Implementation of Abstract Data Type using Java Interfaces
 - Implementation of the interface Cardfile
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Lab exercises

□ Lab 5: Stack, Queue, Dequeue

- Given are the interface and the implementation of Stack, Queue and Dequeue
- Usage of the Stack in implementation of recursive algorithms
- Adding methods to the Data structures

□ Lab 6: Lists (different kinds of lists)

- Explanation of the different kinds of lists
 - Implementation of Double Linked Lists with given methods
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Lab exercises

- Lab 7: Hash tables
 - Given the interface, implementations and the usage of the hash table
 - Implement the hashCode() method
 - Lab 8: Binary trees
 - Given the Binary Tree Implementation
 - Implement inorder and preorder traversal
 - Implementation of Tree ADT
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Lab exercises

- Lab 9: Heap
 - Given the Heap data structure
 - Implement the HeapSort algorithm
 - Lab 10: Search trees
 - Given the implementation of BinarySearchTree
 - Implement the method deleteElement
 - Implement AVT tree
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Lab exercises

- Lab 11: Graphs
 - Given the implementation of Graph
 - Implement the following methods:
 - public Iterator nodes ();
 - public Iterator edges ();
 - public Iterator neighbors (graph.Node node);
 - public Iterator connectingEdges (graph.Node node);
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Conclusion

- The course was very well structured and the exercises were shown to be very successful
 - Usage of Moodle was a good choice as the students were very pleased of its simplicity
 - The main focus on the exercises was not only to learn how to implement the DS but also how to use them
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