Data Structures and Algorithms

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Syllabus

1. Basic concepts, computational complexity (1/3), iterators(1/2)

2-3. Computational complexity (2/3), lists, stack, queue, iterators(2/2)

4. Design of efficient algorithms: divide-and-conquer, dynamic programming, greedy algorithms, computational complexity (3/3), linear and binary search

5-6. Sorting: sorting by comparisons (insertionSort, quickSort, mergeSort), basic priority queue, heapSort, radix sort, sorting complexity, comparators

7. Priority queue, hash tables.

8-9. Binary search tree, hashing, red-black tree, B-tree.

10. Advanced data structures: binomial heaps, Fibonacci heaps, data structures for disjoint sets.

11-12. Graph algorithms: search (breadth-first , depth-first), minimum spanning tree, single source shortest paths, all pairs shortest paths

13. String matching: naive, Rabin-Karp algorithm, with finite automaton, Knuth-Moris-Pratt algorithm. Unification algorithms.

14. Selected topics: Huffman codes, knapsack problems, geometry algorithm

15. NP-completeness: P and NP classes, NP-hard and NP-complete problems

Literature

- Basic literature:
  - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, “Introduction in algorithms”. The MIT Press; 2 edition (September 1, 2001), 1184 pages,
  - Kenneth A. Berman, Jerome L. Paul, “Algorithms: Sequential, Parallel, and Distributed”, Course Technology; 1 edition (October 11, 2004), 992 pages.
  - Robert Sedgewick, Kevin Wayne, „Algorithms” (4th Edition), Addison-Wesley Professional, 976 pages, 2011
- Additional literature:
  - Harel D., Algorithmics. The Spirit of Computing, Addison Wesley, 2004.
  - Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley, 1983.

Lecture and classes acceptance

- The lecture and classes create the course group.
  - Lecture: 2h/week (30h/semester)
  - Classes: 2h every second week (15h/semester)
- **The condition for admission to the exam is passing the classes.**
- The conditions for passing the classes and scoring points will be given by the **teacher of classes.**
- Points gained during the classes are peculiarly **added** to the points from the exam.
- Components of the final evaluation:
  - MAXE – maximum points from the exam
  - MAXC – maximum points from the classes
  - pktE from range (0,MAXE) – number of points from the exam
  - pktC from range (0,MAXC) - number of points from the classes
  - Final assessment based on the percentage range of the formula: min(100, pktE/MAXE*90+pktC/MAXC*25)
- The laboratory is a separate course with an independent assessment.
  - Laboratory tasks will be correlated with lectures and classes.

- Participation in thematically related competitions (algorithmic battles, etc.) may result in a higher grade or exemption from the exam.

Laboratory acceptance

- 12 lists of task of 100 points (total 1200 points).
- Student has to pass minimum 10 lists (for minimum 10 point)
- A list of task has dates:
  - Week X when you have to solve the list for 100 points.
  - On week Y=X+1 (rare Y=X+2) you can earn for solving the list 80 points.
  - On week Z=X+2 (rare Z=X+3) you can earn for solving the list 50 points.
  - **After week Z it is assumed you does not solve the list (do not pass the list).**
  - To pass the laboratory you need to get a minimum of 50% of points from the task lists.
  - More details will be given during laboratories.

Materials for the course

- http://eportal.pwr.edu.pl/
- Login as for JSOS account for PWr
- You are automatically enrolled using information from JSOS
- Find course „Data Structures and Algorithms - DK”