SYLLABUS

Name: ***Algorithms and Data Structures (MakAu>SI6-I-AADS-19)***
Name in Polish:
Name in English: ***Algorithms and data structures***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

EGZ

Language:

English

Course homepage:

https://platforma.polsl.pl/rau2/course/view.php?id=370

Description:

The course focuses on algorithms and data structures. We present important notions and techniques of algorithm design and analysis.

ECTS: 3
classes:
* total workload: 90 h (60 contact hours + 30 h student's work)
* lecture 30 h
* laboratory 30 h

Student's work: preparation for laboratory and the final exam.

The course develops practical skills.
The course develops engineering competences.
Przedmiot kształtuje umiejętności praktyczne.
Przedmiot kształtuje kompetencje inżynierskie.

lecture:
01 introduction, complexity of algorithms, big O, Ω, Θ notation, best / worst / average complexity
02 simple sorting algorithms
03 fast sorting algorithms
04 vector and amortised cost, hashing
05 binary search trees and similar structures
06 heaps, heapsort
07 mergesort, linear sorting
08 dynamic programming
09 graphs (graph representation, DFS, BFS)
10 shortest paths in graphs
11 graphs: trees, minimal spanning trees (Kruskal's algorithm with disjoint sets)
12 exhaustive search
13 computational complexity problems
14 greedy algorithms
15 pattern search

laboratory:
1. sorting algorithms
2. hashing
3. dynamic programming
4. graphs
5. exhaustive search
6. greedy algorithms

Bibliography:

T. Cormen, C. Leiserson, R. Rivest, Introduction to algorithms, (many editions)
R. Sedgewick, Algorithms in C++
D.E. Knuth, The art of computer programming

Learning outcomes:

Student knows:
W1. fundamental concepts (algorithm, data structure, complexity) K1A_W09
W2. various types of sorting algorithms K1A_W11
W3. the properties and implementation of data structures: K1A_W11 K1A_W12
– associative tables (ordered and unordered)
– priority queues
W4. the paradigms of algorithm construction: K1A_W11
– exhaustive search
– greedy approach
– divide and conquer paradigm
– dynamic programming
W5. graphs and graph algorithms: K1A_W11 K1A_W12
– shortest paths in graphs

– minimal spanning trees
W6. computational complexity classes K1A_W09
W7. pattern search algorithms K1A_W11

Student can:
W7 implement algorithms and discuss their computational complexity K1A_U21
W8. calculate complexity of an algorithm K1A_U09
W9. propose an algorithm and data structure for a problem K1A_W11 K1A_W12
W10. construct an algorithm for a problem K1A_U09

Assessment methods and assessment criteria:

1. A student needs to pass all laboratory classes and the final exam.
2. Laboratory classes
(a) Laboratory classes are graded.
(b) Scale for each laboratory class: 0 – 5, pass threshold: 3.
(c) If all laboratory classes are passed, the final laboratory grade is elaborated as a mean of all laboratory grades, otherwise the final laboratory grade is 2.0.
3. Examination
(a) Positive grades for all laboratories recorded on the Platform of Distant Learning website are a necessary condition to sit the exam.
(b) The exam covers the whole course.
(c) The exam has two parts:
I. a bacic part and
II. an advanced part.
(d) A positive grade in the basic part is a necessary condition to take the advanced part.
(e) The basic part is graded 2 (failed) or 3 (passed).
(f) The scale for the advanced part is: 2 – 5 with pass threshold: 3.
(g) The advanced part is not obligatory. If a student has a positive grade in the bacis part, the default grade in the advanced part is 3.0.
(h) The final exam grade is a mean value of the basic and advanced parts.
4. The final grade is a mean value of the final laboratory grade and final exam grade if both are positive, otherwise the final grade is 2.0.

The syllabus is valid from academic year 2025/26 and its contents cannot be changed during the semester.
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Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	3	2021/2022-L	