(faculty stamp) **COURSE DESCRIPTION**

1. Course title: ALGORITHMS AND DATA STRUCTURES	**2. Course code:** AaDS
3. Validity of course description: 2018/2019	
4. Level of studies: 1st cycle of higher education	
5. Mode of studies: intramural studies	
6. Field of study: Informatics	
7. Profile of studies: general academic	
8. Specialty: -	
9. Semester: II and III	
10. Faculty teaching the course: Institute of Informatics	
11. Course instructor: prof. dr hab. inż. Sebastian Deorowicz	
12. Course classification: common courses	
13. Course status: obligatory	
14. Language of instruction: English	
15. Pre-requisite qualifications: It is assumed, that the student has an elementary knowledge of mathematics at the secondary level the knowledge of problems presented in subjects of 1st cycle of higher education: Fundamental of Computer Programming.	
16. Course objectives: The aim of the course is to introduce students into advanced topics of algorithms and data structures. We present algorithms for sorting, searching, operating on graphs, trees and the computational complexity of algorithms. We discuss selected data structures: binary trees, heaps, priority queues. Students after this course should be able to analyze the complexity of algorithms, adapt known algorithms for new problems etc. Topics are illustrated with many examples.	

17. Description of learning outcomes:

No.	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1	Student possesses knowledge of the analysis of algorithms and the evaluation of their computational complexity.	Written exam, test on classes	Lectures, classes	K1A_W09, K1A_W11
2	Student possesses detailed knowledge of the following methods of solving problems: dynamic programming, exhaustive search and greedy search methods.	Written exam, test on classes	Lectures, classes	K1A_W15
3	Student possesses knowledge of basic data structures and operations performed on	Written exam, test on classes	Lectures, classes	K1A_W12

	them.			
4	Student is able to design and write algorithm and evaluate its time complexity.	Written exam, test on classes	Lectures, classes	K1A_U08, K1A_U12
5	Student is able to select and apply existing algorithms to solve specific problem.	Written exam, test on classes	Lectures, classes	K1A_U01, K1A_U21

18. **Teaching modes and hours**
Lecture: 30 h., **Class:** 30 h., **Laboratory:** -.

19. Syllabus description:

Lectures:

Introduction, complexity of algorithms. Pessimistic and average complexity, big O notation. Examples of evaluation the complexity of algorithms. Paradigms of divide and conquer, dynamic programming and greedy method. Simple sorting algorithms. Heaps and their use: heap sort, priority queues. Determination of k smallest/largest elements. A lower bound for the time complexity of sorting algorithm that is based on comparisons.

Class:

1. Selected elements of discrete mathematics.
2. Evaluation of the computational complexity of simple algorithms.
3. Simple sorting algorithms.
4. Quick sort algorithm and determination of k-th smallest element.
5. Dynamic programming.
6. Tree data structures.
7. Exhaustive search.
8. Greedy algorithms.
9. Graphs algorithms.
10. Hash tables.
11. Generating combinatorial objects.
12. Data compression.

20. Examination: yes

21. Primary sources:

1. L. Banachowski, K. Diks, W. Rytter, Algorytmy i Struktury Danych, WNT, Warszawa, 1996.
2. T.H. Corman, C.E. Lejserson, R.L. Rivest, Wprowadzenie do Algorytmów, WNT, Warszawa, 1997.
3. Z.J. Czech, S. Deorowicz, P. Fabian, Algorytmy i Struktury Danych, Wydawnictwo Politechniki Śląskiej, Gliwice 2007.
4. E.M. Reingold, J. Nievergelt, N. Deo, Algorytmy Kombinatoryczne, PWN, Warszawa, 1985.

22. Secondary sources:

1. N. Wirth, Algorytmy + Struktury danych = Programy, WNT, Warszawa, 2000.
2. L. Banachowski, A. Kreczmar, Elementy Analizy Algorytmów, WNT, Warszawa, 1982.
3. S. Alagić, M.A. Arbib, Projektowanie Programów Poprawnych i Dobrze Zbudowanych, WNT, Warszawa, 1982.
4. A.V. Aho, J.D. Ullman, Projektowanie i Analiza Algorytmów Komputerowych, PWN, Warszawa, 1983.
5. J. Bentley, Perełki Programowania, WNT, Warszawa, 1986.
6. W. Lipski, Kombinatoryka dla Programistów, WNT, Warszawa, 1987.
7. L. Banachowski, A. Kreczmar, W. Rytter, Analiza Algorytmów i Struktur Danych, WNT, Warszawa, 1987.
8. D. Harel, Rzecz o Istocie Informatyki. Algorytmika, WNT, Warszawa, 1992.
9. R.L. Graham, D.E. Knuth, O. Patashnik, Matematyka Konkretna, PWN, Warszawa, 1996.

23. Total workload required to achieve learning outcomes

No.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30 / 30
2	Classes	30 / 30
3	Laboratory	- / -
4	Project	- / -
5	BA/ MA Seminar	- / -
6	Other (exam)	0 / 30
	Total number of hours	60 / 90

24. Total hours: 150

25. Number of ECTS credits: 2 (sem. II) + 3 (sem. III)

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 0

26. Comments:

Approved:

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(date, Instructor's signature)

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(date, the Director of the Faculty Unit signature)