Zał. nr 4 do ZW 64/2012

FACULTY W-8 / DEPARTMENT……

SUBJECT CARD

Name in Polish: Struktury danych i algorytmy.
Name in English: Data Structures and Algorithms.
Main field of study (if applicable): …….
Specialization (if applicable): ……..
Level and form of studies: 1st/ ~~2nd~~* level, full-time / ~~part-time~~*
Kind of subject: obligatory / ~~optional~~ / ~~university-wide~~*
Subject code INZ0254Wcl
Group of courses YES / ~~NO~~*

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15	30		
Number of hours of total student workload (CNPS)	60	30	90		
Form of crediting	Examination / ~~crediting with grade~~*	~~Examination~~ / crediting with grade*	~~Examination~~ / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark (X) final course	X				
Number of ECTS points	2	1	3		
including number of ECTS points for practical (P) classes	0	0	3		
including number of ECTS points for direct teacher-student contact (BK) classes	1,4	0,7	1,5		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Programming skill in C/C++ language.
2. Ability to prepare the development environment for building applications in C/C++.

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SUBJECT OBJECTIVES

C1 Providing knowledge on basic data structures, including dynamic structures and classic algorithms and algorithmic problem-solving techniques.
C2 Ability to implement data structures, implementation of selected algorithms and the ability to use algorithmic problem-solving techniques.
C3 Awareness of proper behavior in the computer lab.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Knowledge about structures and operation complexity of basic linear structures, trees, heaps and graphs.

PEK_W02 Knowledge about chosen algorithms and its complexity.

Relating to skills:

PEK_U01 Ability to implement selected data structures

PEK_U02 Ability to implement selected algorithms.

PEK_U03 Awareness of a proper behavior in a computer lab.

PROGRAMME CONTENT

Form of classes – lecture		**Number of hours**
Lec 1	Fundamental principles algorithms analysis: correctness, computational complexity (worse-case, expected), amortized analysis (potential method).	2
Lec 2	Basic structures: stack, queue, list.	4
Lec 3	Design of efficient algorithms: divide-and-conquer, dynamic programming, greedy algorithms.	2
Lec 4	Sorting: sorting by comparisons (insertionSort, quickSort, mergeSort), basic priority queue, heapSort, radix sort, sorting complexity.	4
Lec 5	Selection: Hoare's algorithm, Median of Medians algorithm	2
Lec 6	Searching and simple directories: linear and binary searching, binary search tree, hashing.	3
Lec 7	Effective dictionaries: AVL tree, red-black tree, B-tree.	3
Lec 8	Advanced data structures: binomial heaps, Fibonacci heaps, data structures for disjoint sets.	3
Lec 9	Graph algorithms: search (breadth-first , depth-first), minimum spanning tree, single source shortest paths, all pairs shortest paths.	3
Lec 10	String matching: naive, Rabin-Karp algorithm, with finite automaton, Knuth-Moris-Pratt algorithm.	2
Lec 11	NP-completeness: P and NP classes, NP-hard and NP-complete problems	2
	Total hours	30

Form of classes – class		**Number of hours**
Cl 1	Solving simple problems dividing it into smaller subproblems	2
Cl 2	Implementation of selected operations on choosen type of linked list	2
Cl 3	Solving selected problems with use of divide-and-conquer, dynamic programming, greedy algorithms.	2
Cl 4	Analyze of selected sorting algorithms.	2
Cl 5	Analyze of unbalanced and balanced binary search trees	3
Cl 6	Analyze of operation of disjoin set forest.	1
Cl 7	Analyze of algorithms from graph theory	3
	Total hours	15

Form of classes – laboratory		Number of hours
Lab 1	Instruction about a laboratory, introduction to programming environments.	2
Lab 2	Solving simple problems dividing it into smaller subproblems	2
Lab 3	Implementation of stack and queue	2
Lab 4	Implementation of one-way linked list	2
Lab 5	Implementation of two-way linked list	2
Lab 6	Implementation algorithm with use of divide-and-conquer, dynamic programming, greedy algorithms.	4
Lab 7	Implementation and comparison of sorting algorithms	4
Lab 8	Implementation and research of binary search tree.	4
Lab 9	Practical comparison of complexity of BST and hashtable	2
Lab 10	Implementation and use of disjoin-set forest	2
Lab 11	Implementation of graphs representation in memory	2
Lab 12	Implementation selected algorithms from graph theory.	2
	Total hours	30

Form of classes – project		Number of hours
Proj 1		
Proj 2		
Proj 3		
Proj 4		
…		
	Total hours	

Form of classes – seminar		Number of hours
Sem 1		
Sem 2		
Sem 3		
…		
	Total hours	

TEACHING TOOLS USED
N1. Lecture N2. The course web page with references to literature and course related stuff. N3. Exercises. N4. Software infrastructure for programmers.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), E – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	K1INF_U14	Appropriate behavior of the students in the lab. (Lab1-Lab15)

F2	K1INF_U01	Solving and presenting solutions to programming tasks using a variety of data structures (Lab2-Lab15). Implementation of a list of 11 tasks, each list is worth 10 points. A total of 110 points can be obtained.
E1	K1INF_U01	Points gained in the laboratory represent 30% of the final mark, but the condition of taking a part in the exam is to obtain a minimum of 44 points from the lab.
E2	K1INF_W04 K1INF_U01	Points gained during the exercise represent 30% of the final, but only count as an additional component of the assessment E3.
E3	K1INF_W04	The exam consists of about 20 different types of tasks and the degree of difficulty, which is 70% of the final assessment.
E		E=E1+MIN(70, E2+E3) Final evaluation: • 5.5 – <95%; 100%> • 5.0 – <90%; 95%) • 4.5 – <80%; 90%) • 4.0 – <70%; 80%) • 3.5 – <60%; 70%) • 3.0 – <50%; 60%) • 2.0 – <0%; 50%)

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction in algorithms". The MIT Press; 2 edition (September 1, 2001), 1184 pages,
[2] Kenneth A. Berman, Jerome L. Paul, "Algorithms: Sequential, Parallel, and Distributed", Course Technology; 1 edition (October 11, 2004), 992 pages.

SECONDARY LITERATURE:

[1] Harel D., Algorithmics. The Spirit of Computing, Addison Wesley, 2004.
[2] Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley, 1983.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

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AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

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AND SPECIALIZATION ……..

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
PEK_W01	**K1INF_W04**	C1	Lec1-2,4,6-9,11 Cl2,5,6	N1-3
PEK_W01	**K1INF_W04**	C1	Lec1,3-4,9-11 Cl1,3,4,7	N1-3
PEK_U01	**K1INF_U01**	C2	Lab3-5,8,10,11 Cl2,5,6	N2-4
PEK_U02	**K1INF_U01**	C2	Lab2,6-7,12 Cl1,3,4,7	N2-4
PEK_U03	**K1INF_U14**	C3	Lab1	N3

** - enter symbols for main-field-of-study/specialization educational effects

*** - from table above