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:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Learning outcomes description</th>
<th>Method of assessment</th>
<th>Teaching methods</th>
<th>Learning outcomes reference code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Student possesses knowledge of the analysis of algorithms and the evaluation of their computational complexity.</td>
<td>Written exam, test on classes</td>
<td>Lectures, classes</td>
<td>K1A_W09, K1A_W11</td>
</tr>
<tr>
<td>2</td>
<td>Student possesses detailed knowledge of the following methods of solving problems: dynamic programming, exhaustive search and greedy search methods.</td>
<td>Written exam, test on classes</td>
<td>Lectures, classes</td>
<td>K1A_W15</td>
</tr>
<tr>
<td>3</td>
<td>Student possesses knowledge of basic data structures and operations performed on</td>
<td>Written exam, test on classes</td>
<td>Lectures, classes</td>
<td>K1A_W12</td>
</tr>
</tbody>
</table>
4. Student is able to design and write an 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 problems.
   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:


   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.
   12. Data compression.

20. Examination: yes

21. Primary sources:

22. Secondary sources:


23. Total workload required to achieve learning outcomes

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

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) (date, the Director of the Faculty Unit signature)