

| Faculty of Fundamental Problems of Technology                                                                                                                                                                                                   |   |                           |           |            |         |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------|-----------|------------|---------|---------|
| COURSE CARD                                                                                                                                                                                                                                     |   |                           |           |            |         |         |
| Name in polish                                                                                                                                                                                                                                  | : | <b>Algorytmy On-Line</b>  |           |            |         |         |
| Name in english                                                                                                                                                                                                                                 | : | <b>On-Line Algorithms</b> |           |            |         |         |
| Field of study                                                                                                                                                                                                                                  | : | Computer Science          |           |            |         |         |
| Specialty (if applicable)                                                                                                                                                                                                                       | : |                           |           |            |         |         |
| Undergraduate degree and form of                                                                                                                                                                                                                | : | masters, stationary       |           |            |         |         |
| Type of course                                                                                                                                                                                                                                  | : | optional                  |           |            |         |         |
| Course code                                                                                                                                                                                                                                     | : | E2_W01                    |           |            |         |         |
| Group rate                                                                                                                                                                                                                                      | : | Yes                       |           |            |         |         |
|                                                                                                                                                                                                                                                 |   | Lectures                  | Exercides | Laboratory | Project | Seminar |
| Number of classes held in schools (ZZU)                                                                                                                                                                                                         |   | 30                        | 15        | 15         |         |         |
| The total number of hours of student work-load (CNPS)                                                                                                                                                                                           |   | 60                        | 60        | 60         |         |         |
| Assesment                                                                                                                                                                                                                                       |   | pass                      |           |            |         |         |
| For a group of courses final course mark                                                                                                                                                                                                        |   | X                         |           |            |         |         |
| Number of ECTS credits                                                                                                                                                                                                                          |   | 2                         | 2         | 2          |         |         |
| including the number of points corresponding to the classes of practical (P)                                                                                                                                                                    |   |                           | 2         | 2          |         |         |
| including the number of points corresponding occupations requiring direct contact (BK)                                                                                                                                                          |   | 2                         | 2         | 2          |         |         |
| PREREQUISITES FOR KNOWLEDGE, SKILLS AND OTHER POWERS                                                                                                                                                                                            |   |                           |           |            |         |         |
| In this course, theoretical and practical knowledge of the following lectures is demanded: Algorithms and data structures, Discrete mathematics, Probability analysis. A good knowledge of at least one programming language is also necessary. |   |                           |           |            |         |         |
| COURSE OBJECTIVES                                                                                                                                                                                                                               |   |                           |           |            |         |         |
| <b>C1</b> Acquainting students with basics of on-line analysis                                                                                                                                                                                  |   |                           |           |            |         |         |
| <b>C2</b> Preparing students to designing and analyzing on-line algorithms.                                                                                                                                                                     |   |                           |           |            |         |         |
| <b>C3</b> Preparing students to implementation and testing of on-line algorithms.                                                                                                                                                               |   |                           |           |            |         |         |

### COURSE LEARNING OUTCOMES

The scope of the student's knowledge:

**W1** Understands the difference in cost estimation between the traditional and on-line models.

**W2** Knows basic algorithm introduced at the lecture.

**W3** Knows advanced algorithm introduced at the lecture.

The student skills:

**U1** Knows how to use mathematical knowledge to algorithm analysis.

**U2** Knows how to point out non-optimal solutions in the on-line model.

**U3** Knows how to use randomized algorithms for more effective solutions of given problems.

The student's social competence:

**K1** Understands the need for in-depth analysis of a given algorithmic problem and its importance in the on-line model.

### COURSE CONTENT

#### Type of classes - lectures

|      |                                      |    |
|------|--------------------------------------|----|
| Wy1  | Ski rental and other basic problems. | 4h |
| Wy2  | List reorganization                  | 4h |
| Wy3  | Cache memory.                        | 4h |
| Wy4  | Load balancing.                      | 2h |
| Wy5  | Routing.                             | 2h |
| Wy6  | Adaptive adversaries.                | 2h |
| Wy7  | Algorithms for file allocation.      | 6h |
| Wy8  | The k-server problem.                | 2h |
| Wy9  | Auctions.                            | 2h |
| Wy10 | Comparison of adversarial models.    | 2h |

#### Type of classes - exercises

|     |                                     |    |
|-----|-------------------------------------|----|
| Ćw1 | Ski rental and list reorganization. | 3h |
| Ćw2 | Cache memory.                       | 2h |
| Ćw3 | Load balancing.                     | 2h |
| Ćw4 | Routing.                            | 2h |
| Ćw5 | Adaptive adversaries.               | 2h |
| Ćw6 | File migration.                     | 2h |
| Ćw7 | The k-server problem.               | 2h |

#### Type of classes - laboratory

|      |                                |    |
|------|--------------------------------|----|
| Lab1 | Basic on-line algorithms.      | 5h |
| Lab2 | Cache memory.                  | 5h |
| Lab3 | Analysis of stock market data. | 5h |

|                                                                                                                                                                                                                |                           |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------|
| Applied learning tools                                                                                                                                                                                         |                           |                                         |
| <ol style="list-style-type: none"> <li>1. Traditional lecture</li> <li>2. Solving tasks and problems</li> <li>3. Solving programming tasks</li> <li>4. Consultation</li> <li>5. Self-study students</li> </ol> |                           |                                         |
| EVALUATION OF THE EFFECTS OF EDUCATION ACHIEVEMENTS                                                                                                                                                            |                           |                                         |
| Value                                                                                                                                                                                                          | Number of training effect | Way to evaluate the effect of education |
| F1                                                                                                                                                                                                             | W1-W3, K1-K1              |                                         |
| F2                                                                                                                                                                                                             | U1-U3, K1-K1              |                                         |
| F3                                                                                                                                                                                                             | U1-U3, K1-K1              |                                         |
| $P = \%*F1 + \%*F2 + \%*F3$                                                                                                                                                                                    |                           |                                         |
| BASIC AND ADDITIONAL READING                                                                                                                                                                                   |                           |                                         |
| 1.                                                                                                                                                                                                             |                           |                                         |
| SUPERVISOR OF COURSE                                                                                                                                                                                           |                           |                                         |
| dr Mirosław Korzeniowski                                                                                                                                                                                       |                           |                                         |

RELATIONSHIP MATRIX EFFECTS OF EDUCATION FOR THE COURSE  
On-Line Algorithms

WITH EFFECTS OF EDUCATION ON THE DIRECTION OF COMPUTER SCIENCE

| Course training effect | Reference to the effect of the learning outcomes defined for the field of study and specialization (if applicable) | Objectives of the course** | The contents of the course**     | Number of teaching tools** |
|------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------------|----------------------------|
| W1                     | K2_W01 K2_W02 K2_W04                                                                                               | C1                         | Wy1-Wy10                         | 1 4 5                      |
| W2                     | K2_W01 K2_W02 K2_W03 K2_W04                                                                                        | C1                         | Wy1-Wy10                         | 1 4 5                      |
| W3                     | K2_W01 K2_W02 K2_W03 K2_W04                                                                                        | C1                         | Wy1-Wy10                         | 1 4 5                      |
| U1                     | K2_U09 K2_U12 K2_U13                                                                                               | C2 C3                      | Ćw1-Ćw7<br>Lab1-Lab3             | 2 3 4 5                    |
| U2                     | K2_U08 K2_U12 K2_U13                                                                                               | C2 C3                      | Ćw1-Ćw7<br>Lab1-Lab3             | 2 3 4 5                    |
| U3                     | K2_U12 K2_U13 K2_U15                                                                                               | C2 C3                      | Ćw1-Ćw7<br>Lab1-Lab3             | 2 3 4 5                    |
| K1                     | K2_K12 K2_K13                                                                                                      | C1 C2 C3                   | Wy1-Wy10<br>Ćw1-Ćw7<br>Lab1-Lab3 | 1 2 3 4 5                  |