

# Matematyka dyskretna i matematyczne podstawy informatyki - opis przedmiotu

| Informacje ogólne   |                                                               |
|---------------------|---------------------------------------------------------------|
| Nazwa przedmiotu    | Matematyka dyskretna i matematyczne podstawy informatyki      |
| Kod przedmiotu      | 11.0-WK-MATD-MDMPI-Ć-S14_pNadGenS3ESS                         |
| Wydział             | <a href="#">Wydział Matematyki, Informatyki i Ekonometrii</a> |
| Kierunek            | Mathematics                                                   |
| Profil              | ogólnoakademicki                                              |
| Rodzaj studiów      | drugiego stopnia z tyt. magistra                              |
| Semestr rozpoczęcia | semestr zimowy 2018/2019                                      |

| Informacje o przedmiocie        |                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Semestr                         | 1                                                                                                                                   |
| Liczba punktów ECTS do zdobycia | 7                                                                                                                                   |
| Typ przedmiotu                  | obowiązkowy                                                                                                                         |
| Język nauczania                 | polski                                                                                                                              |
| Sylabus opracował               | <ul style="list-style-type: none"><li>dr hab. Ewa Drgas-Burchardt, prof. UZ</li><li>dr hab. Elżbieta Sidorowicz, prof. UZ</li></ul> |

| Formy zajęć |                                            |                                           |                                               |                                              |                     |
|-------------|--------------------------------------------|-------------------------------------------|-----------------------------------------------|----------------------------------------------|---------------------|
| Forma zajęć | Liczba godzin w semestrze<br>(stacjonarne) | Liczba godzin w tygodniu<br>(stacjonarne) | Liczba godzin w semestrze<br>(niestacjonarne) | Liczba godzin w tygodniu<br>(niestacjonarne) | Forma zaliczenia    |
| Ćwiczenia   | 30                                         | 2                                         | -                                             | -                                            | Zaliczenie na ocenę |
| Wykład      | 30                                         | 2                                         | -                                             | -                                            | Egzamin             |

## Cel przedmiotu

Differing and counting combinatorial objects. Using these capabilities, in order to estimate the size of the data and resources needed to solve the problem and study its complexity.

## Wymagania wstępne

Completed vocational mathematical or technical studies.

## Zakres tematyczny

### Lecture

- Elements of combinatorics: counting methods for labeled and unlabeled combinatorial objects, Polya’s Enumeration Theorem, extremal set theory (12 h).
- Elements of graph theory: connectivity, matchings, Hall’s Theorem, Hamiltonian cycles, vertex and edge colorings, planarity, extremal graph theory questions, Turans’s Theorem, Ramsey’s Theorem (6 h).
- The probabilistic method of Erdős (6 h).
- Elements of counting theory: transition functions, automata, Turing machines, formal languages, Church's assertions (6 h).

### Class

- Elements of combinatorics:
  - combinatorial object recognition in the practical problems, the concept of functions operating on finite sets, which are free, injective, "on", decreasing, non-increasing, the usage of well-known formulas to count the identified objects (5 h),
  - application of Inclusion-Exclusion Principle and Pigeonhole Principle, double counting of labeled combinatorial objects (5 h),
  - application of Polya’s Enumeration Theorem in order to count unlabeled combinatorial objects (4 h).
- Elements of graph theory:
  - recognition of notions of graph theory in practical tasks, application of well-known algorithms to solve these tasks (2 h),
  - estimation of small Ramsey numbers, proving theorems on Ramsey graphs and numbers by usage of the classical techniques presented during the lectures (2 h).
- The probabilistic method of Erdős: proving the facts on the combinatorial structures by usage of the naive method, the expected value method and Local Lovás Lemma (6 h).
- Elements of the theory of computation: constructing programs for Turing machines, computability test function (4 h).
- Test completion (2h).

## Metody kształcenia

Conversation lecture, traditional lecture, discussion exercises.

## Efekty uczenia się i metody weryfikacji osiągnięcia efektów uczenia się

| Opis efektu | Symbole efektów | Metody weryfikacji | Forma zajęć |
|-------------|-----------------|--------------------|-------------|
|-------------|-----------------|--------------------|-------------|

| Opis efektu                                                                                                                                                                                                                                                                                                                                                                                   | Symbole efektów                                                                                                                             | Metody weryfikacji                                                                                                                        | Forma zajęć                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| A student is able to name and define the basic concepts of discrete mathematics and theory of computation.                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• <a href="#">K_W01</a></li> <li>• <a href="#">K_W12</a></li> </ul>                                  | <ul style="list-style-type: none"> <li>• dyskusja</li> <li>• egzamin - ustny, opisowy, testowy i inne</li> <li>• praca pisemna</li> </ul> | <ul style="list-style-type: none"> <li>• Wykład</li> <li>• Ćwiczenia</li> </ul> |
| A student is able to perform proofs in the field of discrete mathematics and theory of computation, in which, if necessary, he/she applies the concept of probability space or linear space.                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• <a href="#">K_W06</a></li> <li>• <a href="#">K_U01</a></li> <li>• <a href="#">K_U14</a></li> </ul> | <ul style="list-style-type: none"> <li>• dyskusja</li> <li>• egzamin - ustny, opisowy, testowy i inne</li> <li>• praca pisemna</li> </ul> | <ul style="list-style-type: none"> <li>• Wykład</li> <li>• Ćwiczenia</li> </ul> |
| A student is able to use the methods of mathematical analysis, algebra and probability to test the convergence of sequences and series, to solve systems of linear equations, to axiomatic recognize of groups, to test the independence of events and random variables and study their characteristics in order to solve tasks in the field of discrete mathematics and theory calculations. | <ul style="list-style-type: none"> <li>• <a href="#">K_W03</a></li> </ul>                                                                   | <ul style="list-style-type: none"> <li>• dyskusja</li> <li>• egzamin - ustny, opisowy, testowy i inne</li> <li>• praca pisemna</li> </ul> | <ul style="list-style-type: none"> <li>• Wykład</li> <li>• Ćwiczenia</li> </ul> |
| A student is able to decide with which objects in the field of discrete mathematics and theory of computation, the solution of the practical problem can be identified.                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• <a href="#">K_U13</a></li> </ul>                                                                   | <ul style="list-style-type: none"> <li>• dyskusja</li> <li>• egzamin - ustny, opisowy, testowy i inne</li> <li>• praca pisemna</li> </ul> | <ul style="list-style-type: none"> <li>• Wykład</li> <li>• Ćwiczenia</li> </ul> |
| A student understands the significance of intellectual honesty, both in their own and in other people's activities; demonstrate ethical behavior.                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• <a href="#">K_K03</a></li> </ul>                                                                   | <ul style="list-style-type: none"> <li>• aktywność w trakcie zajęć</li> <li>• dyskusja</li> </ul>                                         | <ul style="list-style-type: none"> <li>• Wykład</li> <li>• Ćwiczenia</li> </ul> |

## Warunki zaliczenia

Methods: D - participation in the discussions during the course P1 - essay P2 - written exam PU2 - oral exam S - self-esteem

Assessment of individual classes:

1. Checking of preparedness of students and their activity during exercise (D, S).
2. Colloquium with the tasks of different difficulty, allowing to evaluate whether the students have achieved specified learning outcomes in terms of skills and competencies (P1).
3. Conversation during the lectures in order to verify the effects of higher levels of education in terms of knowledge and skills (D, S).
4. Written exam to verify the learning outcomes in terms of knowledge and skills (P2).
5. Oral exam, which allows complete student's written [removed]PU2).

The grade of the module consists of the assessment exercise (50%), exam grade (P2 + PU2) (50%). The condition of the exam is to get a positive assessment of the exercises.

The prerequisite to obtain a positive evaluation of the module is the positive evaluation of the exercise and the exam.

## Literatura podstawowa

1. W. Lipski, W. Marek, Analiza kombinatoryczna, PWN, Warszawa, 1989.
2. C.H. Papadimitriou, Złożoność obliczeniowa, WNT, Warszawa 2002 (seria Klasyka Informatyki).
3. Diesel, Grach Theory, Springer-Verlag, Heidelberg, Gradule Test In Mathematics, Vol. 173.
4. Kościelski, Teoria obliczeń, WUW, Wrocław, 1997.

## Literatura uzupełniająca

1. Z. Palka, A. Ruciński, Wykłady z kombinatoryki, cz. I, WNT, Warszawa, 1998.
2. W. Lipski, Kombinatoryka dla programistów, WNT, 2005.
3. K.A. Ross, Ch.R.B. Wright, Matematyka dyskretna, PWN, Warszawa, 1996.
4. R.J. Wilson, Wprowadzenie do teorii grafów, PWN, 1998.

## Uwagi

Zmodyfikowane przez dr Alina Szelecka (ostatnia modyfikacja: 30-06-2018 07:59)