

Discrete mathematics I. exam paper (13. January 2021.)

Name:

Neptun code:

Scoring: Each question in Part 1 is worth **1 mark** and each proof question in Part 2 is worth **3 marks**.

Grade boundaries

In order to pass the exam (i.e. to achieve a **grade of at least 2**) you need to receive at least **6 marks** from **Part 1** and at least **4 marks from Part 2 (proof questions)**. For higher grades, **in addition to this**, you also need to achieve the following total scores:

grade 3: total score of at least **12**;

grade 4: total score of at least **15**;

grade 5: total score of at least **18**.

Part 1: Short questions

1. Write down three properties of the operation of set intersection. **(1 mark)**
2. Define what a function is. **(1 mark)**
3. Define what it means for a binary relation $R \subseteq A \times A$ to be symmetric. **(1 mark)**
4. What does it mean for a function $f : X \rightarrow Y$ to be surjective? **(1 mark)**

5. Write down De Moivre's formula for the multiplication of complex numbers in polar form. **(1 mark)**
6. Write down the theorem about the number of combinations with repetition. **(1 mark)**
7. Write down the theorem about the inverse of the composition of relations (second statement of the theorem 'Properties of composition of relations'). **(3 marks) (1 mark)**
8. Define what is called an equivalence relation. **(1 mark)**
9. Define the absolute value of a complex number. **(1 mark)**
10. Write down the Binomial theorem. **(1 mark)**

11. Define what is called a graph. **(1 mark)**

12. Write down the theorem about the sum of all degrees in a graph. **(1 mark)**

Part 2: Proofs

P1 Prove that the composition of relations is associative (first statement from the theorem 'Properties of composition of relations'). **(3 marks)**

P2 Write down and prove four properties of the conjugation and/or absolute value of complex numbers. **(3 marks)**

P3 Write down and prove the theorem about the number of combinations with repetition of a finite set. **(3 marks)**