Discrete mathematics I. - Exam paper
(6 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 (covered in the course/slides) of the operation of set union. **(1 mark)**

2. Define what is called the domain of a binary relation $R \subseteq A \times B$. **(1 mark)**

3. Define what it means for a binary relation $R \subseteq A \times A$ to be transitive. **(1 mark)**

4. Define what an equivalence relation is. **(1 mark)**

5. What does it mean for a function $f : X \to Y$ to be injective? **(1 mark)**

6. Write down the real part and the imaginary part of the complex number $3i$. **(1 mark)**

7. Write down the theorem about the number of permutations with repetition. **(1 mark)**

8. Define what a partial order is. **(1 mark)**

9. Define the argument of a complex number. **(1 mark)**

10. Write down the Binomial theorem. **(1 mark)**

11. Write down the formula for the number of k-variations with repetition of an n-element set. **(1 mark)**

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

Part 2: Proofs

P1 Write down and prove the statement about the associative property of set union. **(3 marks)**

P2 Write down and prove the statement about the inverse of the composition of relations (second statement from the theorem 'Properties of composition of relations'). **(3 marks)**

P3 Write down and prove De Moivre's formula for multiplying complex numbers in polar form. **(3 marks)**