

Short Test topics

This list contains the topics of each Short Test, and the actual questions that were on the classes.

- You can retake ≤ 3 of these, of your choice, on 27 May 10:00, in room S 0-220.
- Please send me **until 26 May 12:00** which tests you would like to retake (e.g. 1,3,8) to uray.janos@inf.elte.hu.
- Each retaken test will replace the original score (for better or worse).
- The retake tests will be from the same topic, but **not necessarily the same kind of question**.

1. (23 Feb) Basic properties of sets; basic set operations.

A: $A = \{1, 2\}$, $B = \{1, 2\} \cup \{A\} \cup \{1, \{2\}\} \longrightarrow B = ?$, $\{\{1, 2\}\} \subseteq B?$

B: $A = \{c, d\}$, $B = \{\{c, a, b\}, \emptyset, A\} \longrightarrow \cup B = ?$, $\{c, d\} \in \cup B?$

2. (1 Mar) Proving/disproving set statements; symmetric difference.

A: Is it true for all A, B sets that $(A \setminus B) \cup B = B \cup A$?

B: Is it true for all A, B sets that $B \setminus (B \setminus A) = B \cap A$?

3. (8 Mar) Relation basics; composition.

A: $R = \{(1, 5), (2, 1), (2, 4), (3, 1), (3, 4), (3, 5), (4, 2), (5, 4)\}$
 $\text{rng } R = ? \quad R^{-1}(\{3, 4, 5\}) = ?$

B: $R = \{(1, 1), (1, 5), (2, 1), (2, 3), (3, 1), (3, 2), (3, 3), (5, 2)\}$
 $\text{dmn } R = ? \quad R|_{\{3, 4, 5\}} = ?$

4. (22 Mar) Properties of relations (reflexive etc.). Equivalence relations.

A: $X = \{1, 2, 3, 4\}$, $R \subseteq X \times X$, $R = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 4)\}$.
Is R reflexive? Is R antisymmetric? (Which elements say so?)

B: $X = \{1, 2, 3, 4\}$, $R \subseteq X \times X$, $R = \{(1, 1), (1, 4), (2, 2), (2, 3), (3, 2), (4, 1)\}$.
Is R irreflexive? Is R symmetric? (Which elements say so?)

5. (5 Apr) Partial/total orders; functions; function properties (injective etc.).

A: $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{1, 2, 3, 4\}$, $f \subseteq A \times B$,
 $f = \{(1, 3), (2, 1), (3, 4), (4, 2), (5, 1)\}$. Is it a function? If so, is it injective?

B: $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = |x|$. Is it injective, surjective, bijective?

6. (12 Apr) Complex numbers: calculating in algebraic form and polar form.
(You will be given a sin-cos-table between 0 to $\pi/2$.)

A: Convert to polar form: $z = -3\sqrt{3} + 3i$.

B: Convert to polar form: $z = -2\sqrt{2} - 2\sqrt{2}i$.

7. (19 Apr) Complex numbers: drawing sets; geometric transformations.

A: Draw $\{z \in \mathbb{C} \mid 1 \leq |z - 2| \leq 2\}$ on the Gaussian plane.

B: Draw $\{z \in \mathbb{C} \mid |z + i| \leq 2 \wedge \operatorname{Re}(z) \geq 0\}$ on the Gaussian plane.

8. (26 Apr) Basic combinatorics (Combinatorics I, roughly first half).

A: a) In how many ways can we order the letters of EIGHT?

b) In how many ways can we order the letters of ELEVEN?

B: a) How many 3-digit numbers can be constructed from the digits 1,2,3,4,5?

b) ... if each digit can be used only once?

9. (3 May) More advanced combinatorics (Comb. I rest + Comb. II ~first half).

A: When rolling a die 4 times, how many possible outcomes contain at least one odd number?

B: From 10 red and 6 blue balls, how many ways can we choose 4 balls so that at least one of them is red?

10. (17 May) Binomial theorem, pigeonhole principle, inclusion-exclusion

A: In the expansion of $\left(x + \frac{1}{x}\right)^6$, what is the term that does not contain x (i.e. only a constant number)?

B: In the expansion of $(x^2 + 2x)^{10}$, what is the coefficient of x^{18} ?