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 the last class (14 May).
- Please send me which tests you want to retake *until 13 May*.
- Each retaken test will replace the original score (for better or worse).
- The retake tests will be from the same topic, but not neccessarily the same kind of question.

1. (20 Feb) Basic properties of sets; basic set operations. Left: $A = \{a, b\}, B = \{A, \{b, e, d\}, \emptyset\} \longrightarrow \cup B = ?, \{a, b\} \in \cup B ?$ Right: $A = \{x, y\}, B = \{A\} \cup \{x, y\} \cup \{x, \{y\}\} \longrightarrow B = ?, \{\{x, y\}\} \subseteq B ?$

2. (27 Feb) Proving/disproving set statements; symmetric difference. Left: Is it true for all A, B sets that $A \setminus (A \setminus B) = A \cap B$? Right: Is it true for all A, B sets that $(B \setminus A) \cup A = A \cup B$?

3. (5 Mar) Relation basics; composition. Left: $R = \{(2,3), (2,4), (3,2), (4,1)\}, S = \{(1,2), (2,3), (3,1)\} \longrightarrow R \circ S = ?$ Right: $R = \{(1,3), (2,1), (3,2)\}, S = \{(1,2), (1,3), (2,1), (4,3)\} \longrightarrow S \circ R = ?$

4. (12 Mar) Properties of relations (reflexive etc.).

- Left: $X = \{1, 2, 3\}, R \subseteq X \times X, R = \{(1, 1), (1, 2), (2, 2), (2, 3), (3, 2), (3, 3)\}.$ Is R reflexive? Is R antisymmetric?
- Right: $X = \{1, 2, 3, 4\}, R \subseteq X \times X, R = \{(1, 2), (2, 1), (2, 2), (2, 4), (3, 3), (4, 2)\}.$ Is R irreflexive? Is R symmetric?

5. (19 Mar) Equivalence relations; partitions.

Left: $X = \{1, 2, 3\}, R = \{(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (3, 3)\}.$ Is R an equivalence relation?

Right: $X = \{a, b, c, d\}, R = \{(a, a), (a, c), (b, b), (c, a), (c, c), (d, d)\}.$ What is the partition for this equivalence relation? 6. (26 Mar) Partial/total orders; minimal/maximal, least/greatest elements; functions; function properties (injective etc.).

Left: $f : \mathbb{R} \to [0, \infty), \ f(x) = |x|.$ Is f injective, surjective, bijective? Right: $A = \{1, 2, 3, 4\}, \ B = \{1, 2, 3\}, \ f \subseteq A \times B, \ f = \{(1, 2), (2, 3), (3, 1), (4, 2)\}.$ Is f a function? If so, is it injective?

7. (9 Apr) Complex numbers: algebraic form; equation solving; converting to polar form.

Left: Convert to polar form: $z = \sqrt{3} + i$. Right: Convert to polar form: z = 1 - i.

8. (23 Apr) Complex numbers: drawing sets; geometric transformations. Left: Draw $\{z \in \mathbb{C} \mid |z - i| \leq 2 \land \operatorname{Im}(z) \geq 0\}$ on the Gaussian plane. Right: Draw $\{z \in \mathbb{C} \mid 1 \leq |z + 1| \leq 2\}$ on the Gaussian plane.

9. (30 Apr) Basic combinatorics (Combinatorics I).

- Left: How many outcomes are possible when rolling a die 4 times if a) order matters; b) order doesn't matter?
- Right: How many 4-digit numbers can be formed from the digits a) 1,2,3,4,5,6,7; b) 0,1,2,3,4; if each digit can be used only once?

10. (7 May) More advanced combinatorics (Combinatorics II, ~first page). Left: From 10 blue and 10 red balls (each are different), how many ways can we choose 5 balls so that at least one of them is blue?

Right: When rolling a die 5 times, how many outcomes are possible which contains one or more even numbers?