

### Exercise Set 1

**Exercise 1.1** A graph is called self-complementary if it is isomorphic to its own complement.

- (1) Show that when  $G$  is self-complementary on  $n$  vertices, we have  $n \equiv 0$  or  $n \equiv 1 \pmod{4}$ . (3 Punkte)
- (2) Find all self-complementary graphs with at most 4 vertices. (3 Punkte)

**Exercise 1.2** 10 people had to choose their favourite books from a given set of 23 titles. Each person chose 7 books. Show that some book was chosen by at least 4 people. (6 Punkte)

**Exercise 1.3** Assume we have 4100 people. Each person created a list of his favourite years, choosing from years 1 to 2025, and making sure that the list contains at least 7 years. Assume furthermore that each year was selected by the same number of people. Show that for each year there exist three people who chose this year as one of their favourite and are all born on the same day of the week. (6 Punkte)

**Exercise 1.4** Give an example of a  $d$ -regular graph with  $n$  vertices if  $0 \leq d \leq n - 1$ , and one of the following holds:

- (1)  $d$  is even;
- (2)  $d$  is odd, but  $n$  is even.

(6 Punkte)

**Abgabe der Hausübungen:??**