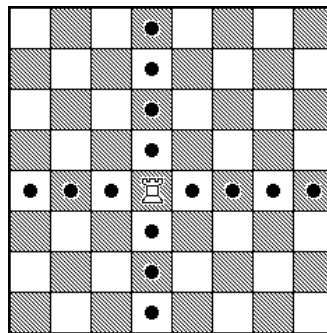

Mathematical Methods for Computer Science I

Fall 2020

Series 1 – Hand in before Monday, 28.09.2020 - 12.00

1. In some course at the University of Fribourg this Fall, there are 12 exercise sheets with 5 exercises per sheet. In order to be allowed to the exam, students should solve at least 3 exercises on at least 9 exercise sheets.
 - a) How many different selections of exercises can a student make in order to be admitted to the exam with minimal effort (that is, by solving exactly three exercises of exactly nine exercise sheets each)?
 - b) A student randomly chooses 27 of the exercises and solves exactly those. What is their chance of getting admitted to the exam?
2. The chessboard has the size 8×8 . Two rooks on a chessboard are called threatening each other if they are situated in the same vertical or horizontal row.
 - a) In how many different ways can one put two (undistinguishable) rooks on the chessboard so that they don't threaten each other?
 - b) In how many different ways can one put eight (undistinguishable) rooks on the chessboard so that they don't threaten each other?
 - c) In how many different ways can one put two white and two black rooks on the chessboard so that no two rooks of different colors are threatening each other?



3. Let p_k be the probability that among given k people there are two with the same birthday. (For simplicity, assume that all years have 365 days.)
 - a) Compute p_k .
 - b) Reformulate the problem in terms of sets and maps.
 - c) Express p_{k+1} in terms of p_k .
 - d) Find the smallest k such that p_k is bigger than 50%.
4.
 - a) In how many different ways can one form two volleyball teams, the blue one and the red one, from the given 12 players?
 - b) In how many different ways can one form two volleyball teams from the given 12 players without yet deciding which team plays in which colors?
 - c) How many different bracelets can one make out of $n \geq 2$ different stones? The bracelet has no lock and must contain all n stones.
5.
 - a) How many different natural divisors does the number 60 have? (*Hint*: $60 = 2^2 \cdot 3 \cdot 5$. What can the prime factorization of a divisor of 60 look like?)
 - b) Let n be a natural number. Show that the number of different divisors of n is odd if and only if n is a complete square, that is, $n = k^2$ for some integer k .

please see overleaf

- You can work in pairs.
- There will be a total of 12 exercise sheets for the fall Semester. In order to be allowed to the exam, students who take this course as *Mathematical Methods for Computer Science I* have to get their solution to 9 exercise sheets *accepted*. A solution gets accepted if it shows that you worked thoroughly on at least three problems on the sheet.
- Completed homework assignments are to be handed in before Monday noon, either via Moodle or in the appropriate box next to the room 2.52.
- Visit the website
<https://homeweb.unifr.ch/liechtli/pub/mmcs/mmcs20-21.html>
for the information on the course and the exams.
- For questions concerning the lectures and the exam please contact Livio Liechi: livio.liechi@unifr.ch. For questions concerning the homework please contact Naomi Bredon: naomi.bredon@unifr.ch.