

Probability Calculus 2019/2020, Homework 3 (three problems)

Name and Surname Student's number

In the problems below, please use the following: as k – the sum of digits in your student's number; as m – the sum of the two largest digits in your student's number; and as n – the smallest digit in your student's number plus 1. For example, if an index number is 609999: $k = 42$, $m = 18$, $n = 1$.

Please write down the solutions (transformations, substitutions etc.), and additionally provide the final answer in the space specified (the answer should be a number in decimal notation, rounded to four digits).

6. Bob shoots at cans with a rifle. The chance that he will hit a can in a single trial amounts to $\frac{1}{n+1}$, the results of the shoots are independent of each other. If a can is hit, it might become punctured – this happens with probability $\frac{m}{m+1}$. Calculate the probability that Bob hit a can exactly $m - 2$ times in k trials, and the can was punctured at least 3 times in the process.

ANSWER:

Solution:

7. There are k numbered boxes. There are $2m(n + 8)$ black balls and a certain amount of white balls in box number 1. In each of the remaining boxes, there are $n + 8$ black balls and m white balls. We decide on which box we will draw a ball from with the roll of a k -sided asymmetric die, for which the chance of rolling a one amounts to $1 - \frac{1}{m}$, and the remaining outcomes are all equally probable. Knowing that the events $A = \{ \text{a white ball was drawn} \}$ and $B = \{ \text{a ball was drawn from box number 3} \}$ are independent, find how many white balls there are in box 1.

ANSWER:

Solution:

8. John uses an app to arrange appointments for clients. Each day, independently from the functioning in other days, the app may fail (this happens with probability $\frac{2(n+2)^2}{k(m+5)(m+1)}$). In such a case, John calls a helpdesk, and the failure will be fixed during the following night. $n + 2$ persons, including Sophie, work at the helpdesk, and a randomly chosen worker answers John's call. Using the Poisson theorem, approximate the probability that John will talk to Sophie at least n times during a period of $k(m + 5)$ days.

ANSWER:

Solution: