

## 2nd exercises for SIM'2019

### Ex. 1

There is 5 white and 10 black balls in a bowl. Ball is lifted, color checked, and returned to bowl. This is done 10 times. What is the probability to receive a) at least one white ball, b) five white balls?

### Ex. 2

Let  $U$  have uniform distribution between  $(-1, 1)$ , so  $f_U(u) = 1/2$ . What is the distribution of transformed variable  $V = U^2$ ?

### Ex. 3

Download the datafile `two-variable.dat` and make report (including, e.g., statistics of the two variables (columns), dependence, plots...)

### Ex. 4

a) Derive log-likelihood function for model where  $Y_1, \dots, Y_n$  are i.i.d and follow Poisson distribution  $\mathcal{P}(\lambda)$ .

b) Make figure of  $l(\lambda)$  in cases where (i)  $n = 10$  and  $\bar{y} = e$ , (ii)  $n = 10$  and  $\bar{y} = 25$ .

### Ex. 5

a) Formulate maximum likelihood equations for  $n$  i.i.d observations from Poisson distribution.

b) Derive maximum likelihood estimate for parameter  $\lambda$  in ML equations in case a)

### Ex. 6

a) Show that mean  $\bar{y}$  is the MLE for  $\mu$  when  $Y_i$  are i.i.d and follow  $\mathcal{N}(\mu, 1)$ .

b) Make figure of  $l(\mu)$  when  $\bar{y} = 3$  and (i)  $n = 20$ , (ii)  $n = 40$ .