8. Inference about Population Variance

Task 1. Work with "**mice**" dataset http://edu.modas.lu/data . Provide the interval estimations for the variances of all numerical parameters.

Task 2. Data **all_data** contain results of 55 Affymetrix microarray experiments performed on normal and cancer (acute lymphoblastic leukemia – ALL) samples. Rows corresponds to genes, columns – to microarray experiments.

> 2.1. Read the data from xlsx or text file

> 2.2. Calculate variances for each array and plot them.

> 2.3. Calculate variances for each gene in ALL and Normal condition. Calculate now mean of variances in these conditions.

Task 3. Four-o'clocks *Mirabilis jalapa*, are plants native to tropical America. Their name comes from the fact that their flowers tend to open in the late afternoon. Individual plants can have red, white, or pink flowers. Flower color in this species is thought to be controlled by a single gene locus with two alleles expressing incomplete dominance, so that heterozygotes are pink, while homozygotes are white or red. A horticulturist self-pollinates several pink-flowered plants and produces 240 progeny with 55 that are red-flowered, 132 that are pink-flowered and 53 that are white-flowered. Are these data consistent with Mendelian ratios (1:2:1) ?

Task 4. Heron Island in a coral cay in the Great Barrier Reef. Around Heron Island there are 2 color morphs of the reef heron, *Egretta sacra*, a white morph and a dark or blue morph. It is generally accepted that further north there are many more white than dark morphs and vice versa. A preliminary study was carried out to test the hypothesis that the ratio of white and dark herons on the island was 3:1.

> a) A small census found 17 white and 3 dark. Can the assumption of 3:1 ratio be rejected?

> b) What if the census were larger with 170 white morphs and 30 dark?

Task 5. The following table contains data collected on the Hobart and William smith campus in Geneva, NY. The data are numbers of sightings of common bird species in the early morning (6:00-8:00 AM) and in the afternoon (2:00-4:00 PM). Is the distribution of bird species the same at both times of a day?

Species	AM	PM
Starling	51	108
Grackle	22	40
Crow	36	12
Robin	7	15
Gold finch	31	3
Cardinal	14	3

Task 6. A study of kidney damage during organ retrieval for transplantation was conducted in the UK in 1992-1996. In many cases of organ donation, when the kidneys are retrieved the liver is retrieved as well, in a single surgical procedure. When both types of organs were retrieved, the researchers categorized the surgical team, based on the operating surgeon's specialty, as either renal retrieval or liver retrieval team. Was the rate of reported damage to kidneys independent of the type of surgical team? (*Note*: 94% of damaged organs were still transplanted)

Team	Damaged kidneys	Undamaged kidneys	Total
Renal retrieval	454	1692	2146
Liver retrieval	415	2054	2469
Total	869	3746	4615

Task 7*. The Poisson distribution is useful for describing rare, random events such as severe storms. In 98-year period from 1900 to 1997 there were 159 US landfalling hurricanes. Does the number of landfalling hurricanes/year follow a Poisson distribution?

Hurricanes/year	x_i	0	1	2	3	4	5	6
Frequency	f_i	18	34	24	16	3	1	2