

## Practicals 5. Goodness of fit test

1. Colour preferences of bees were studied. The bees were released one by one to a room with 4 circles of different colours. The colour of circle to which each bee first landed was recorded. The results were following: red 10, yellow 25, blue 18, green 6. Do the bees prefer any colour?
2. The expected phenotype ratio AB:Ab:aB:ab in the F2 generation (AABB x aabb) is 9:3:3:1. The real numbers were as following: 125, 60, 50, 12. Are the ratios different from those expected under Mendel rules?
3. Invertebrate community at a meadow consists of 1200 flies, 200 butterflies, 650 bees and 200 snails. Lizard food preference for these groups of invertebrates is investigated in a research project. 41 flies, 5 butterflies, 30 bees and 2 snails are identified as lizard prey. Do the lizards show any preference for these types of prey?
4. What is the type I error probability corresponding to  $\chi^2 = 5.04$  and  $df = 3$
5. Which values of  $\chi^2$  with 3 degrees of freedom is required for a significant test at  $\alpha = 0.05$  and  $\alpha = 0.01$ . Which values of  $\chi^2$  are required for the same significance levels at 8 degrees of freedom?
6. In F1 generation (AA x aa) all individual were expected to display the dominant phenotype. 3 individuals of 2000 had the recessive phenotype. Is this result different from expectation?

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A. You are a insurance agent running business in car insurance. There is 12000 blue, 5600 red, 1300 yellow and 8700 black car registered in your region. The accident report indicates that 324 blue, 120 red, 20 yellow and 298 black cars were involved in accidents over past 5 years. Would you consider car color as a significant predictor of car accident?

B. 5 kinds of beer were available at a university music festival (with continuous supply so in a theoretically unlimited amount). Beer was served exclusively in 0.5 grasses and the price and the speed of serving did not differ among the beers.

Numbers of glasses consumed are summarized for each beer in a table below:

|                 |     |
|-----------------|-----|
| Starobrnno 12°  | 120 |
| Starobrnno 11°  | 180 |
| Pilsner Urquell | 150 |
| Bernard 12°     | 320 |
| Polička 11°     | 450 |

Is there any significant preference for some beers? Which beers are preferred? Which beer do you prefer?

C. Johann Gregor Mendel performed crossing experiments with red- and white-flowering peas. First he crossed a red flowering dominant homozygote with a white-flowering recessive homozygote. All the offspring were red flowering heterozygotes. Of these he selected two and crossed them again. The offspring consisted of 390 red-flowering plants and 103 white-flowering plants. Is this results significantly different from the expected 3:1 ratio?

D. Sex ratio 1:1 is expected in mammals. Female-biased 6:4 ratio is observed in squirells. Is that significantly different from 1:1 if observed on a sample of 10, 100 and 1000?

E. Colour of fruits of fruits (achenes) in sunflower is a genetically determined trait based on two

co-dominant alleles. That is, dominant homozygotes have black achenes, recessive homozygotes whitish achenes and heterozygotes grey have achenes. In a crossing experiment performed, the F<sub>2</sub> generation of hybrids included 19 black-achened plants, 61 grey-achened plants and 25 whitish-achened plants. Do these counts significantly differ from the 1:2:1 ratio expected on the basis of the Mendelian rules?