

Practicals 5. Goodness of fit test

1. Colour preferences of bees were studied. The bees were released one by one to a room with four circles of different colors. The color of the circle to which each bee first landed was recorded. The results were the following: red 10, yellow 25, blue 18, green 6. Do the bees prefer any color?
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 follows: 125, 60, 50, 12. Are the ratios different from those expected under Mendel's rules?
3. The 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 χ^2 with 3 degrees of freedom are required for a significant test at $\alpha = 0.05$ and $\alpha = 0.01$. Which values of χ^2 are required for the same significance levels at 8 degrees of freedom?
6. In the F₁ generation (AA x aa), all individuals were expected to display the dominant phenotype. Three individuals in 2000 had the recessive phenotype. Is this result different from expectation?

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

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

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

Starobno 12°	120
Starobno 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. Are these results significantly different from the expected 3:1 ratio?

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

E. Color 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, the F₂ 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 based on the Mendelian rules?