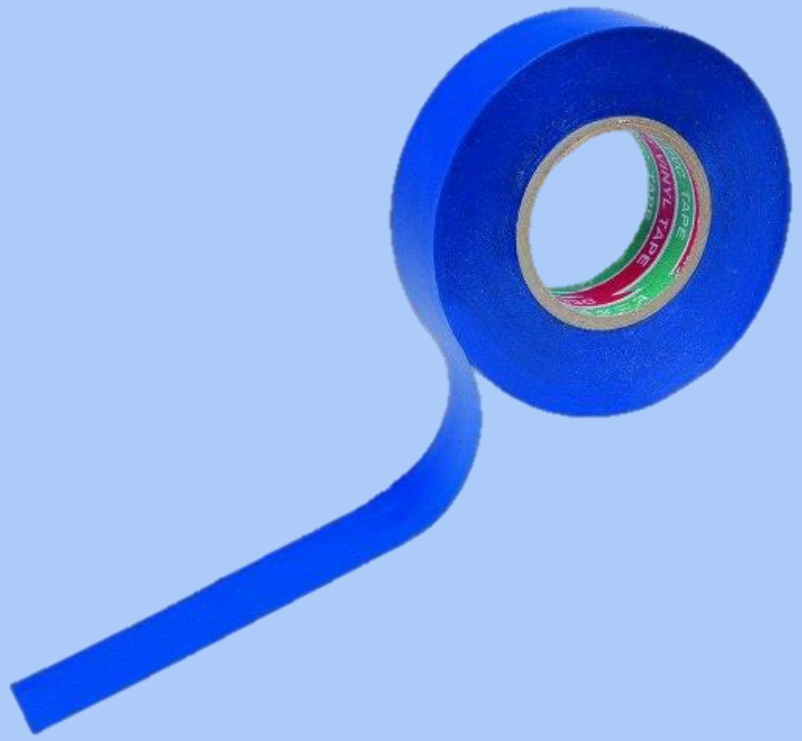


Task №1

Prepared by Maksim Shilikhin,
Team «Isolenta»

Our team:

- Polina Parinova(капитан)
-Angelina Zhuravleva
- Ilia Vasiliev
-Sergey Glebov
-Maksim Shilihin
-Elisaveta Zarezina

Task № 1. Invent Yourself: Good guesses

- In 1906, Francis Galton observed a contest where 800 farmers guessed an animal's weight. To his surprise, the median of the guesses was within 0.8% of the true measured weight. What is the chance of obtaining such a good match by coincidence? Select an interesting and important parameter, measure it directly, and give a group of human observers the task to guess the value of the parameter. Discuss the results of your experiments.

Our Condition of the problem

- Conduct an experiment similar to the Galton experiment in 1906, but with changed parameters. Build a theoretical model of your experiment and on its basis explain the similarities and differences between experiments.

Structure of Research:

- Our aim: To study the phenomenon described in this task;

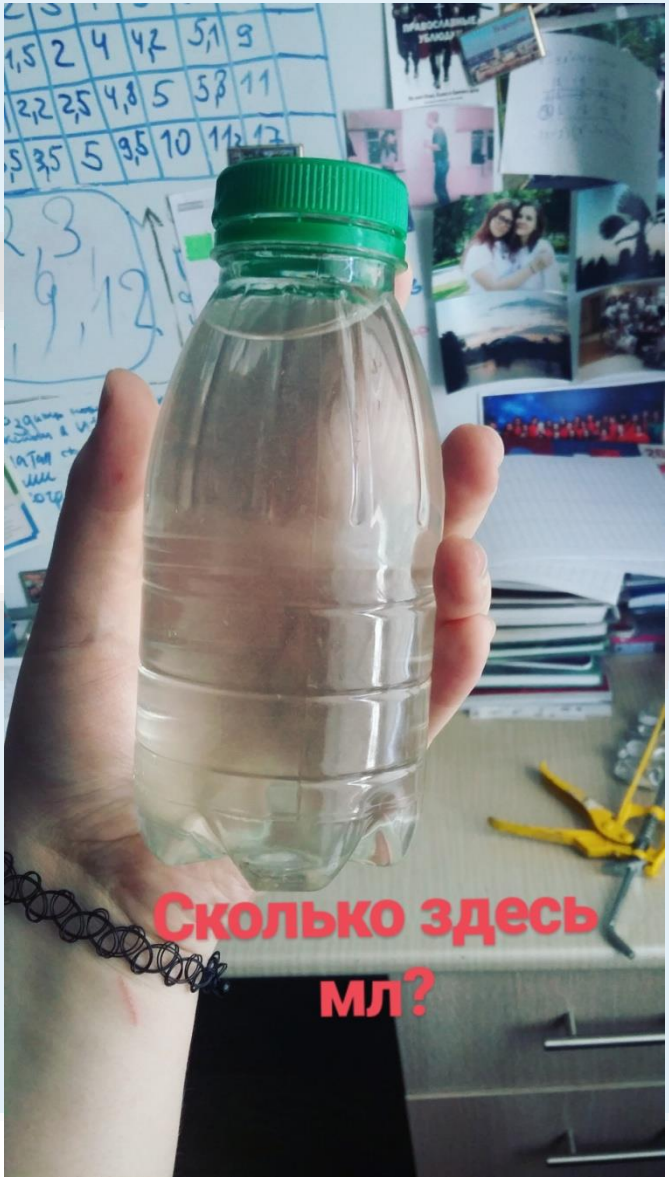
Our objectives:

- 1)To carry out an experiment, selecting an important quantitative characteristic of an object and phenomenon;
- 2) To analyze the results of the experiment and explain them theoretically;
- 3)To draw a conclusion.

Solution of the problem

To carry out the experiment, the water in the bottle was taken. It was proposed to determine its volume. The true volume is 300 ml. For the purity of the experiment, the volume could not be determined with the help of a jar.

Bottle



Solution of the problem

During the experiment, 100 people were interviewed. According to the data, a table was created with the values entered. The resulting mean value is 292.6 ml. This value differs from the true by 2.4%, what is significantly accurate.

Justification of the results of the experiment

For an explanation, let us turn to the choice of respondents: it was random. We also could not know what this or that person would answer in advance. Considering that a person with equal probability can make mistakes in both directions, we can regard the named values as random at a certain interval, excluding the values that significantly get out of the data series.

Justification of the results of the experiment

Since these values are continuous random events with equal probability, the law of large numbers is fair to them:

$$\lim_{n\to\infty} P\left(\left|\frac{X_1 + X_2 + X_3 + \ldots + X_n}{n} - a\right| < \varepsilon\right) = 1$$

Where n – number of respondents, X - numbers named by respondents,ε>0 – arbitrarily,α-mathematical expectation of event X.

Justification of the results of the experiment

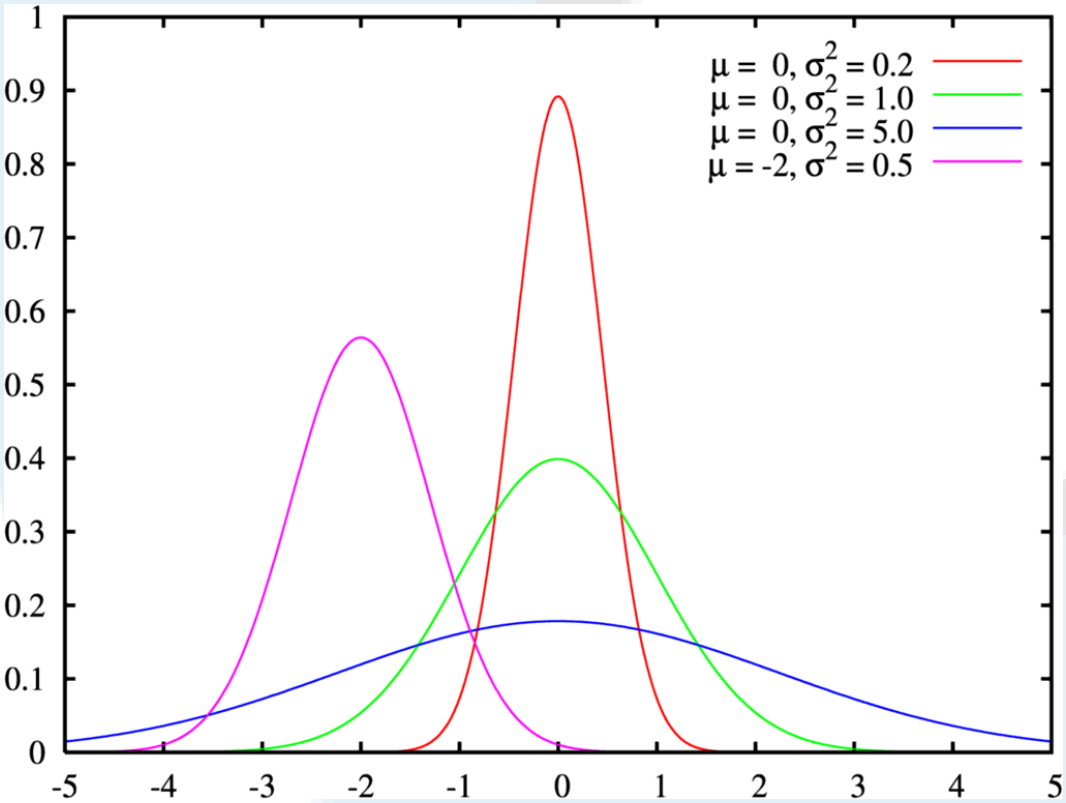
This means, that with a sufficiently large number of measurements, it is almost certain that their average mean is arbitrarily close to the true value of the measured parameter, which is why the experiment produced almost exact values. Based on this law, we can build a diagram or graph of probability density for the normal distribution.

Graph of probability density for the normal distribution.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

This formula describes graphs, where μ is the mathematical expectation (in our case 300), the σ square is the dispersion (in our case it is 1), x – our results of the tests.

Graph of probability density for the normal distribution.

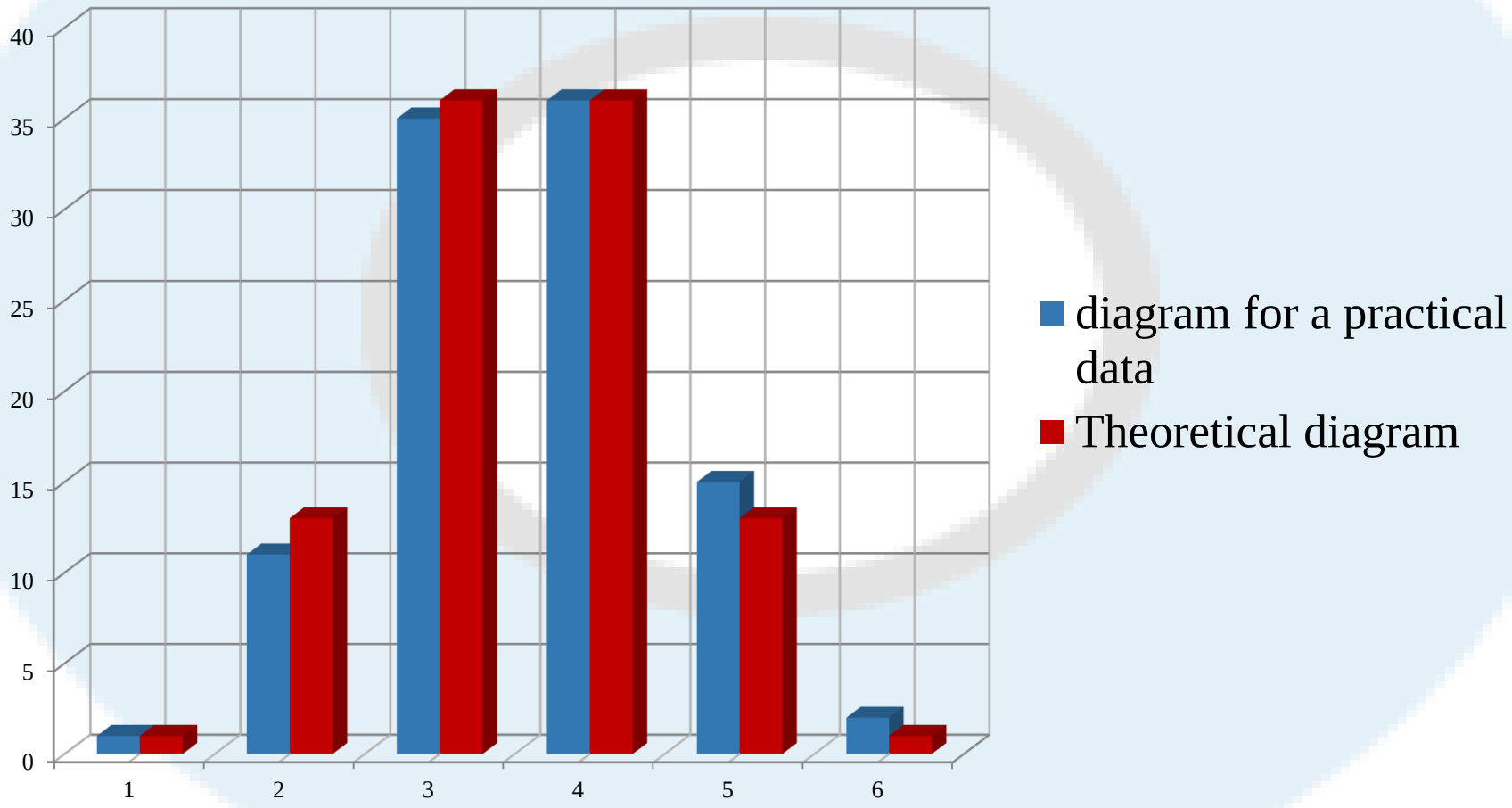


This graphs and formula are inconvenient, so we decided to create diagrams: theoretical and based on experimental data.

Let's select the boundaries of our data: from 0 ml to two true values (600 ml) and divide this interval into 6 equal groups:

№ of group	Boundaries of group(in ml)
1	0-99
2	100-199
3	200-299
4	300-399
5	400-499
6	500-600

Diagrams of probability density for the normal distribution



Justification of the results of the experiment

It should be noted that the more tests we carry out, the more accurately the previously mentioned law will be observed.

Hence, the more respondents will be involved, the more accurate the average result will be. Indeed, in the experiment described in the condition of the problem, there were 800 tests (respondents), and in ours only 100 and the accuracy of the experiment in the task is above we received by 1.6%.

Conclusion

The phenomenon of " Good guesses " was investigated. A direct relationship was obtained between the number of people participating in the experiment and the approximation of the resulting mean to the true value.

Used sources

- https://ru.wikipedia.org/wiki/%D0%A2%D0%B5%D0%BE%D1%80%D0%B8%D1%8F_%D0%B2%D0%B5%D1%80%D0%BE%D1%8F%D1%82%D0%BD%D0%BE%D1%81%D1%82%D0%B5%D0%B9
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Thanks for watching!