Experimental Probability [1]

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Experimental probability refers to the probability of an event occurring when an experiment was conducted.

In such a case, the probability of an event is being determined through an actual experiment. Mathematically,

$$\text{Experimental probability} = \frac{\text{Number of event occurrences}}{\text{Total number of trials}}$$

For example, if a dice is rolled 6000 times and the number '5' occurs 990 times, then the experimental probability that '5' shows up on the dice is 990/6000 = 0.165.

On the other hand, theoretical probability is determined by noting all the possible outcomes theoretically, and determining how likely the given outcome is. Mathematically,

$$\text{Theoretical probability} = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

For example, the theoretical probability that the number '5' shows up on a dice when rolled is 1/6 = 0.167. This is because of the 6 possible outcomes (dice showing '1', '2', '3', '4', '5', '6'), only 1 outcome (dice showing '5') is favorable.

As the number of trials keeps increasing, the experimental probability tends towards the theoretical probability. To see this, the number trials should be sufficiently large in number.

Experimental probability is frequently used in research and experiments of social sciences, behavioral sciences, economics and medicine.

In cases where the theoretical probability cannot be calculated, we need to rely on experimental probability.

> For example, to find out how effective a given cure for a pathogen in mice is, we simply take a number of mice with the pathogen and inject our cure.
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> We then find out how many mice were cured and this would give us the experimental probability that a mouse is cured to be the ratio of number of mice cured to the total number of mice tested.
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> In this case, it is not possible to calculate the theoretical probability. We can then extend this experimental probability to all mice.

It should be noted that in order for experimental probability to be meaningful in research, the sample size must be sufficiently large.

In our above example, if we test our cure on 3 mice and all of these are cured, then the experimental probability that a mouse is cured is 1. However, the sample size is too small to conclude that the cure works in 100% of the cases.

Links
[1] https://explorable.com/experimental-probability
[2] https://explorable.com/users/siddharth