Mathematical Modelling Encyclopedia

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Preface

This is a Quarto book.

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1 Introduction

This is a book created from markdown and executable code.

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2 Jargons

2.1 Probability, rate, proportion[1]

A **probability** is between 0 and 1 and is the chance (or risk) that an event (death, infection, etc…) happens. In general this probability is defined ***over a period of time*** and will necessarily increase as the duration of this period of time increases.

A **rate** is an instantaneous measure of change per unit time (Selvin 2004), the frequency at which an event happens. It is thus always positive and always expressed per unit of time (like speed km/h or m/s). Rate can be > 1. Mathematically, it is the limit of the above-mentioned probability when the duration of the period of time tends towards zero (i.e. very small, i.e. instantaneous measure).

A **proportion** is the ratio of a numerator and a denominator and by definition is between 0 and 1.

What is the difference between **proportion** and **probability**? Consider this example:

A bag is filled with 100 balls, of which 30 are blue and 70 are green. Without looking, you pull out a ball, write down the color, then put it back to the bag. You repeat the action 10,000 times. The number of times you pulled out a blue ball is 3011.

- The proportion of blue balls in the bag is $30/100 = 0.3$
- A **Frequentist** say: The probability of pulling out a blue ball is $3011/10{,}000 = 0.3011$ because you did experiment in long-run (10,000 times).
- A **Bayesian** say: The probability of pulling out a blue ball is 0.3 because you know that you have a proportion of 0.3 blue balls in the bag.

[1] by Marc

2.2 Discrete and continuous

2.3 Dynamic and static

2.4 Deterministic and stochastic

2.5 Mechanistic model and statistic model

3 Summary

In summary, this book has no content whatsoever.

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References

Selvin, Steve. 2004. "Measures of Risk: Rates and Probabilities." In, 1–39. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195172805.003.01.