Factsheet: Geometric distribution

Michelle Arnetta and Tom Coleman

Summary

A factsheet for the geometric distribution.

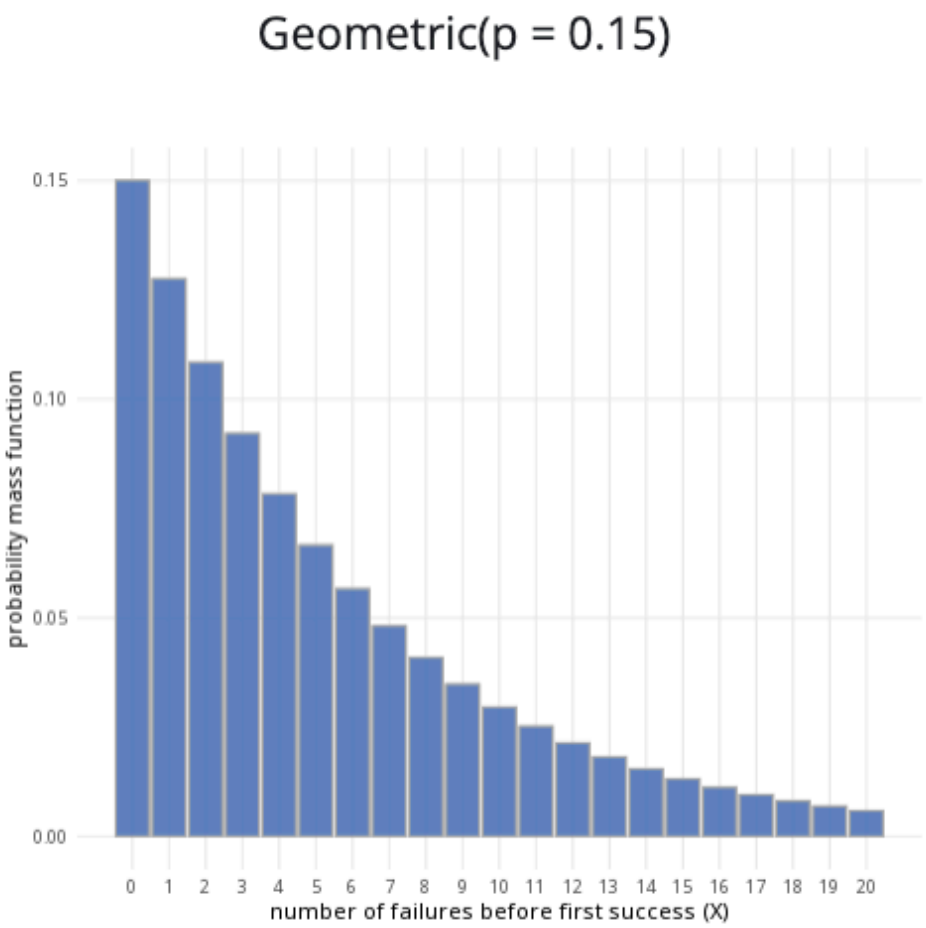

Figure 1: An example of the geometric distribution with $p = 0.15$.

Where to use: The geometric distribution is used to count X, the number of Bernoulli trials until a successful outcome is reached.

Notation: $X \sim \text{Geometric}(p)$

Parameter: p is the real number representing the probability of success in a single trial (where $0 \leq p \leq 1$).

Quantity	Value	Notes
Mean	$\mathbb{E}(X) = \frac{1}{p}$	
Variance	$\mathbb{V}(X) = \frac{1-p}{p^2}$	
PMF	$\mathbb{P}(X = x) = (1-p)^{k-1}p$	
CDF	$\mathbb{P}(X \leq x) = \begin{cases} 1-(1-p)^x & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases}$	

Example: You flip a coin multiple times, and the probability of getting 'heads' is 0.5. You decide to stop flipping the coin once you get a 'heads'. Taking 'heads' as a success, this can be expressed as $X \sim \text{Geometric}(0.5)$. It means the probability of success is 0.5, and you will stop conducting trials after you reach a success.

Further reading

This interactive element appears in Overview: Probability distributions. Please click this link to go to the guide.

Version history

v1.0: initial version created 04/25 by tdhc and Michelle Arnetta as part of a University of St Andrews VIP project.

- v1.1: moved to factsheet form and populated with material from Overview: Probability distributions by tdhc.