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DS 3500
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Homework 4: Drake Equation Estimate

$N = R^* (f_p) (n_e) (f_l) (f_i) (f_c) (L)$

N's EV: 7699.219 | N's std: 14299.305

Term	Meaning	Estimate, if possible (using expected value):
R^*	Star formation rate	1.5 - 3.0 EV: 2.25
f_p	Fraction of stars that have planets	Around 1.0 EV: 0.9125
n_e	Among stars having planets, how many of those planets can support life	1 - 5 EV: 3
f_l	Fraction of life-supporting planets that actually develop life	EV: 0.5
f_i	Fraction of planets with life that develop *intelligent* life	EV: 0.5
f_c	Fraction of intelligent life-bearing planets that develop technology that releases detectable signals (such as radio waves) into space	EV: 0.5
L	The length of time (years) during which such civilizations release detectable signals into space. In other words, how many years do advanced civilizations last?	EV: est. 10,000

Types of Distribution:

R^* - normal distribution: The star formation rate is a continuous variable that represents the rate at which stars form in a galaxy. Using a normal distribution allows for a flexible representation of this rate, acknowledging that some galaxies may have higher or lower star formation rates. The mean represents the central tendency, and the standard deviation captures the variability in the star formation rates.

- mean = 2.25 (average of 1.5 and 3)
- std = 0.43 (standard deviation of 1.5 and 3)

f_p - discrete distribution: The fraction of stars with planets is expressed in discrete terms since it's a probability measure. It is given that the fraction of stars that have planets is around 1.0. Given the information, I created a dictionary using 0.85, 0.90, and 0.95 as keys with their probabilities with the number closest to 1.0 with a higher probability than two other keys.

- Dist = `{.85: 0.25, 0.90: 0.25, 0.95: 0.50}`

n_e - uniform distribution: Based on the assumption that, within the given range of 1 to 5, all values within that range are equally likely, meaning assuming uniformity for the fraction of planets that can support life implies that any value within the specified range is equally likely. A uniform distribution is a way of expressing uncertainty when there is no specific reason to favor one value over another within the specified range.

- Min: 1 | Max: 5 - given

f_l, f_i , f_c - uniform distribution- The fractions of variable outcome occurring are probabilities range from 0-1. A uniform distribution is selected to reflect the possible range of values, allowing for an equal likelihood of different estimates.

- Min: 0 | Max: 1 - fractions

L - normal distribution - The length of time during which civilizations release detectable signals is a continuous variable. Assuming a normal distribution allows for a flexible representation of this duration, acknowledging that some civilizations may last longer or shorter periods. For the duration of civilizations releasing detectable signals, it's reasonable to assume a mean value in the order of thousands to tens of thousands of years. There can also be significant variation in the potential lifetimes of civilizations, a standard deviation in the range of a few thousand years might be appropriate. Thus, I chose around a mean of 10,000 years, reflecting a moderately optimistic view of civilization longevity, and a standard deviation of 2,000 years.

- mean = 10000
- std = 2000