Averages: A Simple Treatment

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Consider the following series of 10 ($N_{data} = 10$) numbers (we are being **discrete**:

$$10, 30, 20, 80, 80, 70, 70, 60, 50, 30$$

What is the average of these discrete numbers? That is, what is the average value of x?

$$Average \;=\; \frac{1}{N_{data}}\;[(10) \;+\; (20) \;+\; (30+30) \;+\; (50) \;+\; (60) \;+\; (70+70) \;+\; (80+80)]$$

Now, we can invoke the idea of a *probability* for each value we have to consider. This is the discrete analogue of the probability distribution function that we have considered as a continuous function. $N_{data} = 10$, so we bring that into the summation explicitly for each term.

$$Average \;=\; \left[(10)\frac{1}{10} + (20)\frac{1}{10} + (30)\frac{2}{10} + (50)\frac{1}{10} + (60)\frac{1}{10} + (70)\frac{2}{10} + (80)\frac{2}{10}\right]$$

If we consider the fractions that occur in the sum as probabilities for each discrete value of x, then the average is represented as:

$$Average \;=\; \sum_{i=1}^{N_{data}} \;(value)_i \;\; f((value)_i)$$

In the continuous limit, we replace the summation by an integration.