

Why your friends . . .

Definitions:

Consider sampling N values X_i of some variable X .

Then the *expectation value* is the average: $E[X] = \frac{1}{N} \sum_i X_i$.

The *variance* is defined as $\text{Var}[X] = \frac{1}{N} \sum_i (X_i - E[X])^2$,

and satisfies $\text{Var}[X] = E[X^2] - (E[X])^2$.

The *standard deviation* is the square root: $\text{std}[X] = \sqrt{\text{Var}[X]}$

Feld 1991:

Node i has degree d_i , i.e., d_i friends.

$$\text{total_fof} = \sum_{\text{nodes } i} \sum_{\text{friends } f \text{ of } i} d_f = \sum_i d_i^2$$

(since each d_f occurs d_f times in the first double sum).

Average fof per person = $\frac{1}{N} \sum_i d_i^2 = E[d^2] = \text{Var}[d] + (E[d])^2$

The average fof per friend = $E[d^2]/E[d] = E[d] + \text{Var}[d]/E[d]$

The variance is positive, so the above is always greater than $E[d]$.

Used: detecting flu, disease inoculation, administrative propaganda