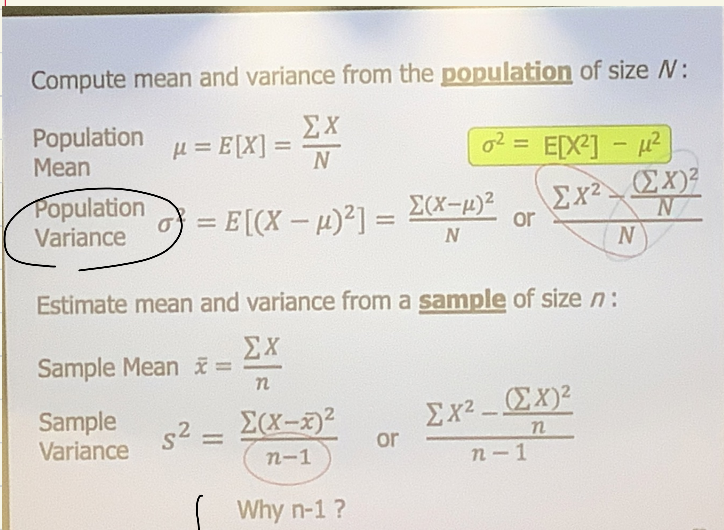
constant



if this is n $\quad s^2 = \frac{\sum(X-\bar{x})^2}{n} = \frac{1}{n}\left(\sum X^2 - \frac{(\sum X)^2}{n}\right)$

for unbiased estimate, we expect the mean of s^2 to be equal to σ^2

$$E[s^2] = E\left[\frac{1}{n}\left(\sum X^2 - \frac{(\sum X)^2}{n}\right)\right]$$

if $Y = \sum X$
$E(Y^2) = \sigma_y^2 + \mu_y^2$

$$= \frac{1}{n}\left(\sum E[X^2] - \frac{E[(\sum X)^2]}{n}\right)$$

$\sigma^2 + \mu^2$ from prev slide

$$= \frac{1}{n}\left(n\sigma^2 + n\mu^2 - \frac{E[(\sum X)^2]}{n}\right)$$

$$= \frac{1}{n}\left(n\sigma^2 + n\mu^2 - \frac{Var[\sum X] + E[\sum X]^2}{n}\right)$$

$$E[s^2] = \frac{1}{n}\left(n\sigma^2 + n\mu^2 - \frac{\sum Var[X] + \sum E[X]^2}{n}\right)$$

$$= \frac{1}{n}\left(n\sigma^2 + n\mu^2 - \frac{n\sigma^2 + (n\mu)^2}{n}\right)$$

$$= \frac{1}{n}\left(n\sigma^2 + n\mu^2 - \sigma^2 - n\mu^2\right) = \frac{1}{n}(n-1)\sigma^2$$

something about this becoming biased. ? idk

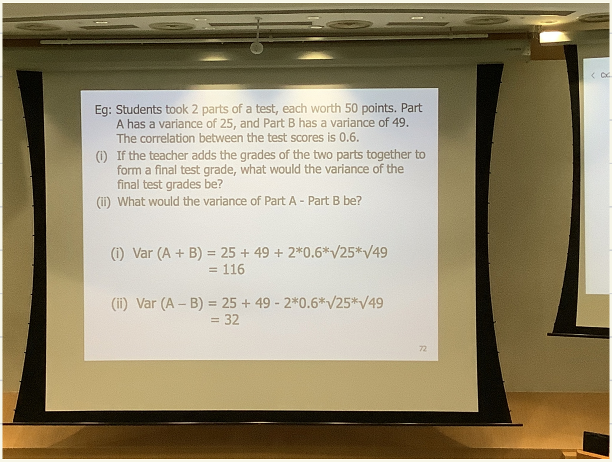
- linear transformation of variable
- variance sum law I
  - ↳ linear combo of 2 independent variables

if $t = 5x + 10y$ ← daily income difference d

mean $= 5(\bar{x}) + 10(\bar{y})$

variance $= 5\sigma^2$

???


Eg: Students took 2 parts of a test, each worth 50 points. Part A has a variance of 25, and Part B has a variance of 49. The correlation between the test scores is 0.6.
(i) If the teacher adds the grades of the two parts together to form a final test grade, what would the variance of the final test grades be?
(ii) What would the variance of Part A - Part B be?
(i) Var (A + B) = 25 + 49 + 2*0.6*√25*√49
= 116
(ii) Var (A – B) = 25 + 49 - 2*0.6*√25*√49
= 32
72