Sompling statistics -> Toolog (Wed)

Centeral Limit Theorem -> Friday
Prob: - solving after this

Dice: $S = \{1, 2, 3, 4, 5, 6\}$ (if dice comes whose 4, your get 4Rs. So on for every M: money you make in n tosses averaged by n Some mean Sample mean is itself a random variable Mp! toss 1000 temy My: toss 1000 times

Dice: 5= (1,2,3,4,5,6) Expectation $E[X] = 1 - 1 + 2 \cdot 1 + 3 \cdot 1 + \cdots + 6 \cdot 1 = 3 \cdot 5$ Sample mean

[5, 1, 6, 4, 5, 3, 2, 4 ---]

[x, x, x, x, x, ---] $\overline{\chi} = \chi_1 + \chi_2 + \chi_3 + \dots + \chi_m = 3.8$ $2) \left(1, 2, 6, 4, 1, 3, 4, 5, \dots \right) \xrightarrow{\Lambda} 2.9$

You get 3 Rs if dice falls of 3 f [3,5], 6,4,3, 2 -...] 7 tow much money do we "expect to make "

Some properties of the sample mean: X: <\(\inf(1, 2, 3, 4, 5, 6\)

$$X = X_1 + X_2 + \cdots \times n$$
 is a random variable

$$E[X] = E[X_1 + X_2 + \cdots + X_n]$$

$$= \frac{E[XY] + E[XY] + \cdots + E[XY]}{E[XY] + \cdots + E[XY]}$$

$$= \frac{\sqrt{3\cdot 5}}{\sqrt{3\cdot 5}}$$

$$= 3.5 = E[X]$$

 $= \frac{m(3.5)}{n}$ = 3.5 = E[X] (X : A.V on d[1,2,3,4,5,6]

Expectation of the sample mean is the true expectation.
We saw in coole the histogram of the sample mean

Observation (from histogram) As 'n' increases, the "spread" of the sample mean decrushs Var (X) reduces as "n" increaseg

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Variance: $Var(X) = Var(X_1 + X_2 + \cdots + X_n)$ $= 1 (VarX_1 + VarX_2 + \cdots + VarX_n)$ *conditions
of the property of the prope

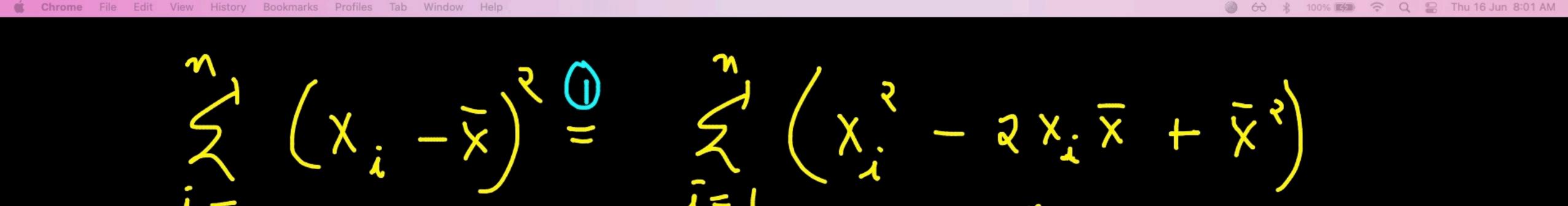
= 1 n. Vale X

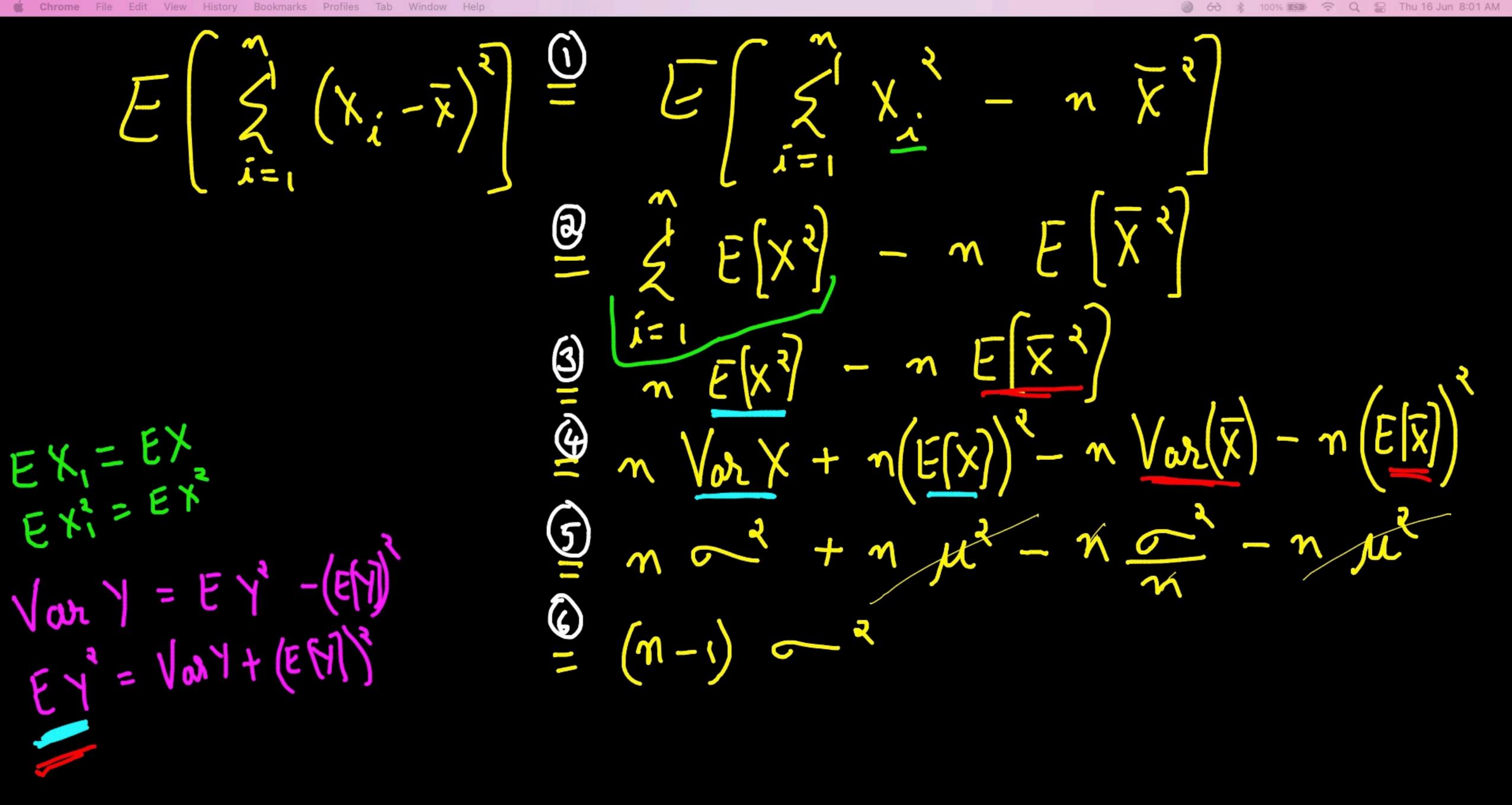
= Var X

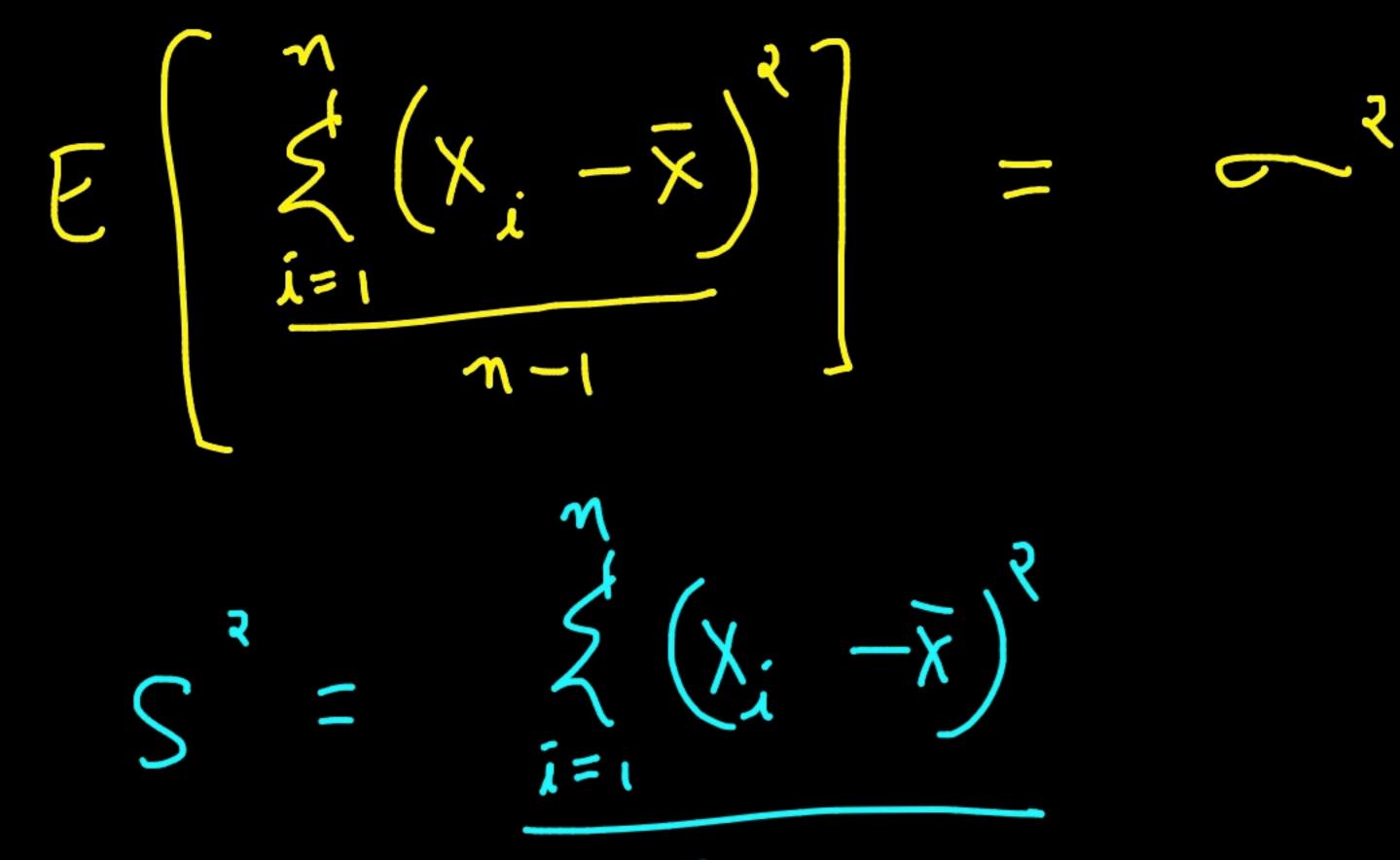
n: num-toes in Coole So for: We saw sample mean X E(X) = E(X) K: clistribution from which we sample Vor(X) = IVor(X)What about sample variance

Variance: $E(X)^{R} \rightarrow Var(X)$ $E[X] = \begin{cases} k P[X = k] \\ k \end{cases}$ $= E[X^2] - (E[X])^2$ Somplemen July (on E(X)) x = X, + X, + ... Xm Somple variance? $S' = (X, -\overline{X}) + (X_2 - X) + \cdots + (X_{n-1})^n$ We want $E[S] = \infty$

We have X as broxy for M $E(X) = \mu$ We have S' as broxy for $E(s^2)$







$$\chi$$
:
$$\mu = E[x] = 2 k P[x=k]$$

$$\mu' = V_{ox}[x] = E(x-E[x])'$$

E[X] = M $Vor(X) = \frac{1}{2}$

E (5?) = or) , when in "expectation" you match what you want, we call it "unbiased"

X, & X, \(\int \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(\) \(X -> Var X Y=3X+6 (Var X, = Var X) Vox(A) = A Vox(X) $Vor \left(\frac{1}{2}x_1 + \frac{1}{4}x_2\right) = \frac{1}{4} Vor x_1 + \frac{1}{4} Vor x_2$ $= \frac{1}{4} 2 V_{ab} x = V_{ab} x$