Sampling distribution of proportion

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- In a binomial experiment, the probability of success can be approximated by $\frac{x}{n}$ where x is the number of successes we get in n trials.
- let us call $\hat{p} = \frac{x}{n}$
- Now let us look at the distribution of $\hat{p}$
- If we denote failure by 0 & succes by 1

then x = sum of n values consisting of 0s & 1s

$\therefore \frac{x}{n} = \frac{\text{Sum of } n \text{ values}}{n} \rightarrow$ a mean

$\therefore \hat{p} = \frac{x}{n}$ is sampling distribution of mean.

with $E(\hat{p}) = E\left(\frac{X}{n}\right) = \frac{1}{n} E(X) = \frac{np}{n} = p$ (Binomial r.v.)

& $\sigma_{\hat{p}}^2 = \sigma_{X/n}^2 = \frac{1}{n^2} \sigma_X^2 = \frac{npq}{n^2} = \frac{pq}{n}$

$\therefore \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$ is a Z distribution.