Binomial: $P(X) = \binom{n}{X}\left(p^X\right)\left(q^{n-X}\right);\mu = E(\bar{x}) = \sum xp(x) = np$; $\sigma^2 = \sum (x-\mu)^2 p(x) = E(x^2) - E(p(x));V = E(x-\mu)^2 = E(x^2) - E^2(x)$ fixed number of independent trials with contsant probability of well-defined success

Hypergeometric: $P(X) = \frac{\binom{a}{x}\binom{b}{n-x}}{\binom{a+b}{n}}$; $n := trials$; $x := successes$; $a := total\ successes$; $b := total\ failures$; $\mu = n\left(\frac{a}{a+b}\right)$; $\sigma^2 = n\left(\frac{a}{a+b}\right)\left(1-\frac{a}{a+b}\right)\left(\frac{a+b-n}{a+b-1}\right)$ without replacement

Negative Binomial: $P(x) - \binom{x+r-1}{r-1}(P)^r(1-P)^x$;

Continuous Distro: $E(x) = \int xf(x)dx;V = E(x-\mu)^2$;

Standard Normal: $\mu = 0;\sigma = 1;z = \frac{X-\mu}{\sigma}$

Central Limit Theorem: $z = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$: sample mean, not individual data

Confidence Interval: $\mu = \bar{X} \pm z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$; for 95% $z_{\alpha/2} = 1.96$; Minimum sample size needed for interval estimate: $n = \left(\frac{z_{\alpha/2}\sigma}{E}\right)$; If σ is unknown &$n < 30$: $\bar{X} \pm t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$;

Is σ known? Yes: $z = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$; No: Is n ≥ 30? Yes: $z = \frac{\bar{X}-\mu}{\frac{s}{\sqrt{n}}}$; No: $t = \frac{\bar{X}-\mu}{\frac{s}{\sqrt{n}}}$

Z-proportion: $z = \frac{\hat{p}-p}{\sqrt{pq/n}}$; $\hat{p} = \frac{X}{n} = sample\ proportion$

Confidence Interval for a Variance: $\frac{(n-1)s^2}{\chi_r^2 ight} < \sigma^2 < \frac{(n-1)s^2}{\chi_l^2 eft}$; $\chi^2 = \frac{(n-1)s^2}{\sigma^2}$

Prediction Interval: $\bar{x} \pm t_{\alpha/2}(s)\sqrt{1+\frac{1}{n}}$

Type I (α): reject true H_0; Type II(β): accept false H_0

Comparing two means: $z = \frac{(\hat{X}_1-\hat{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$

Comparing two proportions: $z = \frac{(\hat{p}_1-\hat{p}_2)-(p_1-p_2)}{\sqrt{\bar{p}\bar{q}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$; $\bar{p} = \frac{X_1+X_2}{n_1+n_2}$; $\bar{q} = 1-\bar{p}$

F-Test: $F = \frac{s_1^2}{s_2^2}$

Hypothesis Testing: $p > p_0 \mapsto z \geq z_\alpha$; $p < p_0 \mapsto z \leq -z_\alpha$; $p \neq p_0 \mapsto z \geq z_{\alpha/2} or z \leq -z_{\alpha/2}$; When comparing two known variances: $\mu_1 - \mu_2 = p = \Delta$; $z = \frac{\bar{x}-\bar{y}-\Delta_0}{sqrt\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}$; $n_1, n_2 \geq 40$;

Signed Rank Test: $Z = \frac{S_+ - n(n+1)/4}{\sqrt{n(n+1)(2n+1)/24}}$;

Rank Sum Test: $Z = \frac{W-m(m+n+1)/2}{\sqrt{mn(m+n+1)/12}}$

Students are then told that this definition does not mean that an interval has a 95% chance of containing the true parameter value. The reason that this is true, is because a 95% confidence interval will either contain the true parameter value of interest or it will not (thus, the probability of containing the true value is either 1 or 0). However, you have a 95% chance of creating one that does. In other words, this is similar to saying, "you have a 50% of getting a heads in a coin toss, however, once you toss the coin, you either have a head or a tail". Thus, you have a 95% chance of creating a 95% CI for a parameter that contains the true value. However, once you've done it, your CI either covers the parameter or it doesn't