Chapter 3

Some Important Sampling Distributions

$$X_1, X_2, \ldots X_n$$

Population

$$X \sim N(\mu, \sigma^2)$$

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$$\overline{X} = \frac{X_1 + X_2 + \ldots + X_n}{n} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$S^2 = \frac{\sum_{i=1}^{n} \left(x_i - \overline{x}\right)^2}{n-1}$$

$$\overline{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right)$$

μ : Population Mean

σ : Population Standard Deviation (S.D.)

$\overline{X}$: Sample Mean

S : Sample Standard Deviation (S.E.)

n : Sample size

For $X \sim N\left(\mu, \sigma^2\right) \quad \Rightarrow \quad \boxed{Z = \frac{X - \mu}{\sigma}}$

Then $\overline{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right) \quad \Rightarrow \quad \boxed{Z = \frac{\overline{X} - \mu}{\sigma / \sqrt{n}}}$

Chapter 3 Conclusion

Distribution of Sample Mean	Distribution of the difference between two Samples Means	Distribution of Sample Proportion
• σ **known** $$Z=\frac{\bar{x}-\mu}{\sigma/\sqrt{n}}\sim N(0,1)$$	• σ_1^2 and σ_2^2 **knowns** $$Z=\frac{(\bar{x}-\bar{y})-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}\sim N(0,1)$$	$$Z=\frac{\hat{P}-P}{\sqrt{\frac{Pq}{n}}}\sim N(0,1)$$
• σ **unknown and** $n>30$ $$Z=\frac{\bar{x}-\mu}{s/\sqrt{n}}\sim N(0,1)$$	• σ_1^2 and σ_2^2 **unknowns and** $n_1,n_2>30$ $$Z=\frac{(\bar{x}-\bar{y})-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}\sim N(0,1)$$	**Distribution of the difference between two Samples Proportions** $$Z=\frac{(\hat{P}_1-\hat{P}_2)-(P_1-P_2)}{\sqrt{\frac{P_1q_1}{n_1}+\frac{P_2q_2}{n_2}}}\sim N(0,1)$$
• σ **unknown and** $n<30$ $$T_{(n-1)}=\frac{\bar{x}-\mu}{s/\sqrt{n}}\sim T(\nu)$$	• σ_1^2 and σ_2^2 **unknowns and** $n_1,n_2<30$ $$S_p^2=\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$$ $$T_{(n_1+n_2-2)}=\frac{(\bar{x}-\bar{y})-(\mu_1-\mu_2)}{S_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}\sim T(\nu)$$	