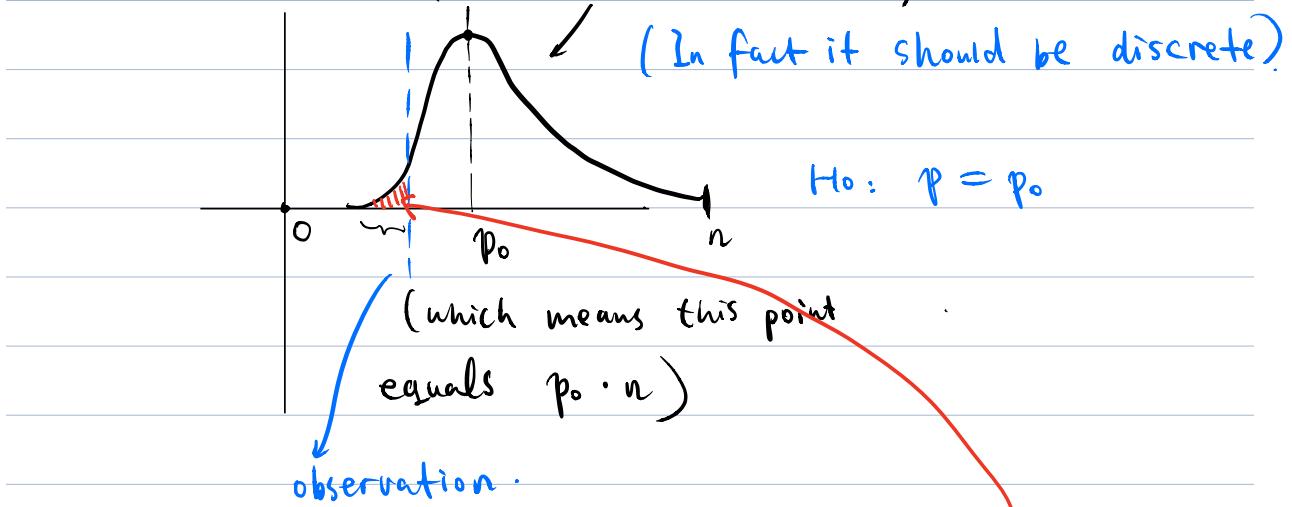


Problem Set 9.

Problem 2, 4, 8, 10, (11, 12, 13), 27, (28)

P2. Null is true. Null distribution, binomial curve.



The p-value is given by the probability of ,
(if the alternative is one-sided.)

- definition: under null hypothesis, the p-value is defined by the probability that the test statistic is the same as, or more extreme than the observed one).

alternative : { one - sided : $H_A: p < p_0$
two - sided : $H_A: p \neq p_0$.

True.

P4. • When p-value is larger, the observation is closer to p_0 .

• By definition of p-value, the observation is not so "extreme" when p-value is larger.

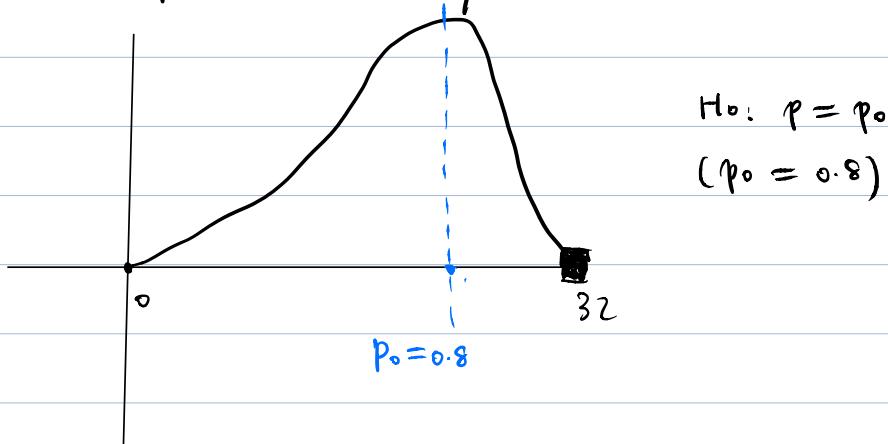
\Rightarrow We tend to not reject the null hypothesis.

• Generally we would use "reject / not reject".

To be more strict, we do not use

"accept the null hypothesis".

P8.



e.g. Suppose we use two-sided alternative:

$$\begin{aligned} \text{p-value} &= 2 \cdot P(X \geq 32). \quad (X \sim \text{Binomial}(32, 0.8)) \\ &= 2 \cdot P(X = 32) \end{aligned}$$

(C-E) False. We never talk about "the probability of H_0/H_A ".

(D). False. We could have the case that the proportion of smiling (in population) is < 1 , but the sample only contains smiling individuals.

(In fact, this prob. is $(p_0)^{32}$)

- In fact, if the alternative is one-sided,
then (B) is definitely true
- (A) is ambiguous.

P10. For both case, significance level = 0.01

\Rightarrow type I error = 0.01

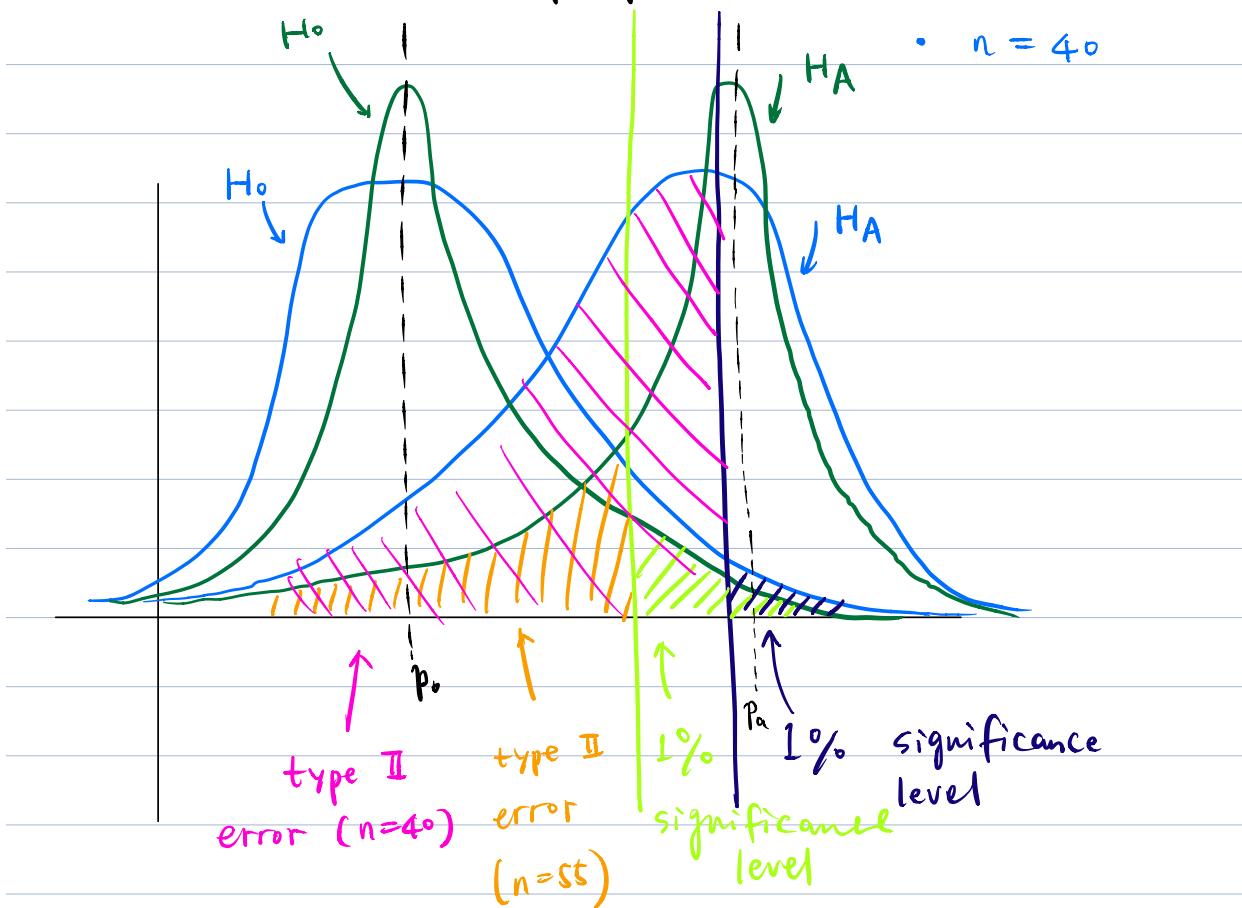
The answer is False.

P₁₁. From the problem it is reasonable to assume that for the two tests we have the same

$$\begin{cases} H_0: p = p_0 \\ H_A: p = p_A. \end{cases}$$

• $n = 55$

• $n = 40$



From the figure we could see that the type II error for $n=55$ is lower than $\underline{n=40}$.

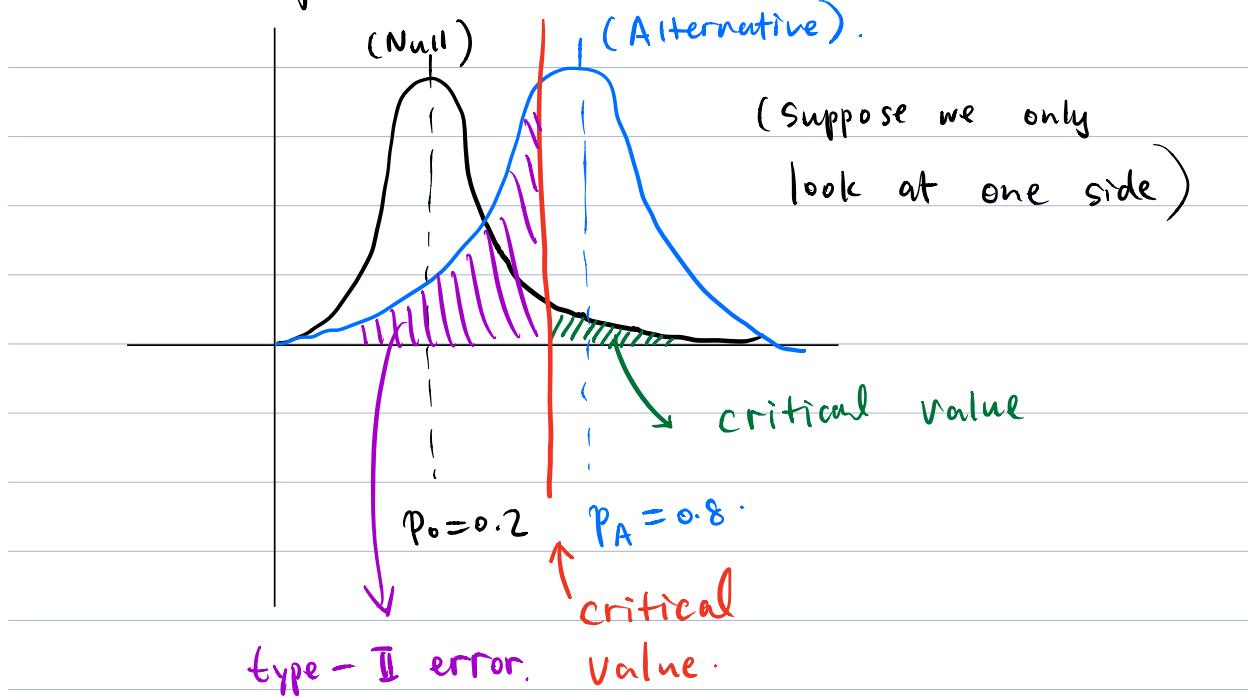
True.

P₁₂. As power = 1 - (type II error rate), the power would be higher for $n=55$. False.

- P13.
- probability of type-I error = significance level.
 - smaller significance level
- \Rightarrow smaller rejection region
- \Rightarrow (under H_A) smaller prob. to reject
- \Rightarrow larger type II error.

True.

P2). When we specify an alternative ($H_A: p = p_A$) type II error is the prob. that we do not reject H_0 under the true model H_A .



This would decrease if we further increase the value of P_A .

In this sense, the answer is true.

P28. Suppose that we fix the significance level, H_0, H_A .

Then the answer is True. (See P₁₁)