

# ex4 (Hypothesis Testing)

Playing H or T with a friend.  
I lost 55% of tosses.  
 $\alpha = 0.01$ ,  $N > 40$   
At what  $n$  do I need to  
decide that he is manipulating  
the coin?

$H_0$ : He is not manipulating  
the coin toss.  
 $H_a$ : He is manipulating the  
coin toss.

1. part

If  $p\text{-value} < \alpha (0.01) \rightarrow H_a$  is true

Bernoulli trial

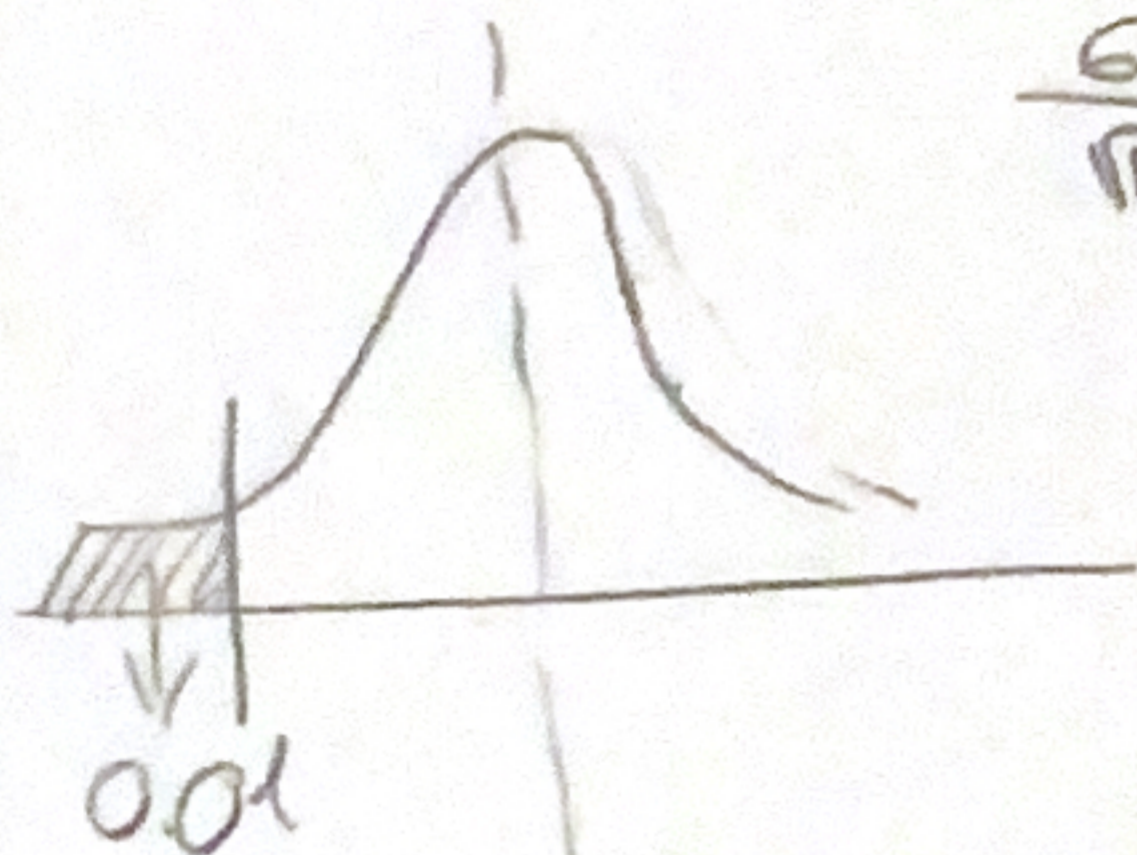
$X$	1: win	$1/2$	$E[X] = 1 \cdot \frac{1}{2} + 0 \cdot \frac{1}{2} = \frac{1}{2}$
	0: loss	$1/2$	$E[X^2] = 1^2 \cdot \frac{1}{2} + 0^2 \cdot \frac{1}{2} = \frac{1}{2}$

$H_0$  says these are probs

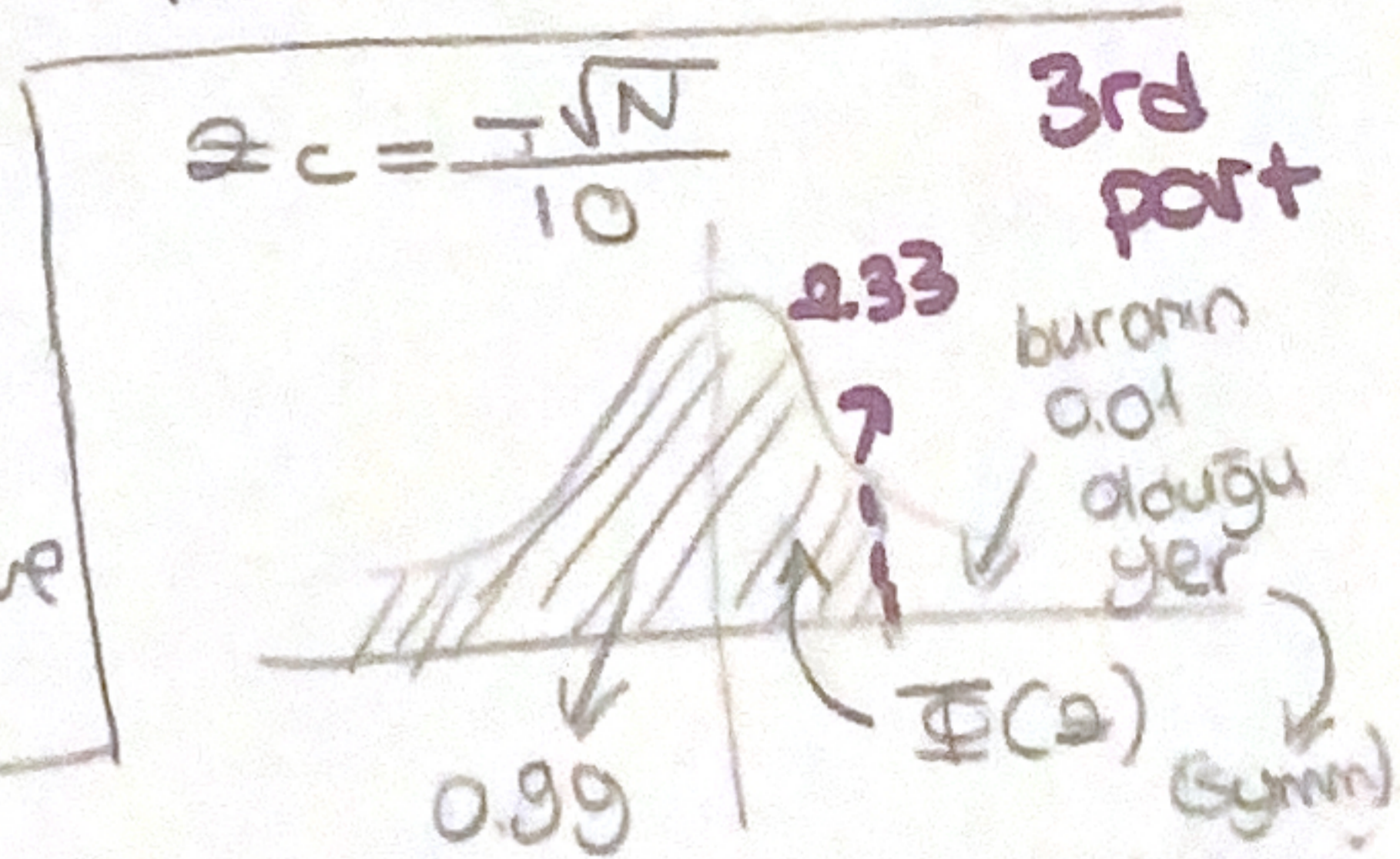
$\sigma^2 = E[X^2] - E[X]^2 = 1/4$   
 $\sigma = 1/2$

$\mu = 1/2$   $\sigma = 1/2$   $\bar{x} = \frac{x_1 + x_2 + \dots + x_N}{N}$   $\mu_{\bar{x}} = \mu$   $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{N}}$   
 $\bar{x} = 0.45$

Find  $z$  value =  $\frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{N}}} = \frac{0.45 - 0.5}{1/2 \sqrt{N}} = \frac{-\sqrt{N}}{10} = z$  **2nd part**



Find critical  $z$  value where area under curve is 0.01



$z$	0.00	0.01	0.02	0.03
0.0				
0.1				
⋮				
2.3				0.9901

we know area, we lookup  $z$

$z_c = -\frac{\sqrt{N}}{10}$   
left tail use (+) for right

$2.33 = \frac{\sqrt{N}}{10}$   
when  $z$  is this  $H_a$  is true  
 $N = 543$