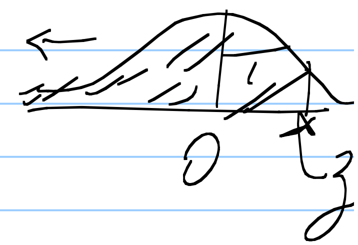
STT 200   3pm & 5:30pm   2-17-10.

Note Title   2/17/2010

Ch 20. ABOUT "TESTS OF HYPOTHESES."

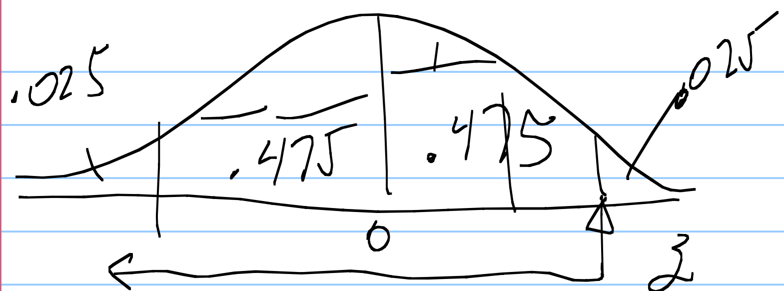
① LEARN USE OF TABLE OF STANDARD NORMAL

WHICH LINKS VALUE z WITH $P(Z \leq z) =$ 

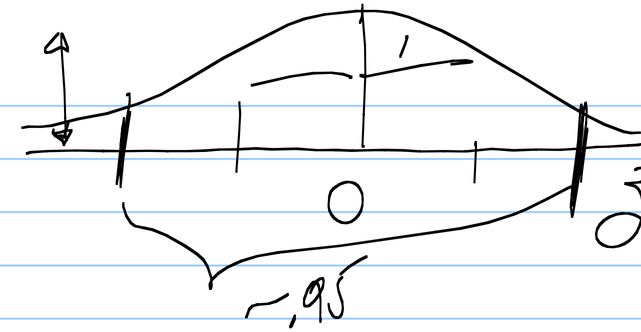
eg $z = 1.96$

z	$.06$
1.9	$P(Z < 1.96) = 0.9750$

RULE OF THUMB:



2 SD FROM MEAN



$.025 + .95 = 0.975$

CK TABLE

	$.00$
2.0	0.9772

for $z \leq 2.00$

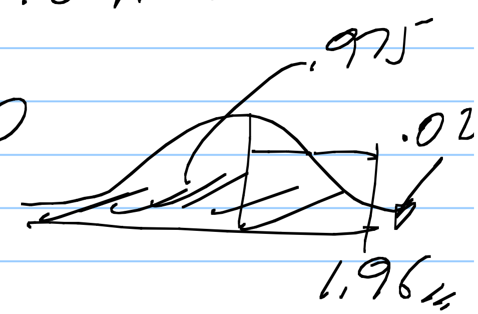
$.950$
$.025$
$.975$

ITS CLEAR THAT 2.0 RULE OF THUMB IS NOT ACCURATE TO 4 DECIMALS.

HOW ABOUT 1.96

z	$.06$
1.9	0.9750

INDEED



SO 1.96 IS THE BETTER RULE OF THUMB.

eg IN CI. $P\left(p \text{ IN } \boxed{\hat{p} \pm 1.96\sqrt{\hat{p}\hat{q}/n}}\right) \to .95$ as $n \to \infty$

APPLICATION: HOW UNUSUAL IS GETTING 73H IN 100 TOSSES.

WE FOCUS ON P(#H ≥ 73 IN 100 TOSSES).

DEPENDING ON THE APPLICATION WE MAY BE FOCUSED ON LEFT TAIL eg $P(X \le 27)$ X = #FEMALE BIRTHS,

OR RIGHT TAIL eg $P(X \ge 73)$ X = #MALE BIRTHS.

OR TWO TAILED eg $P(X \ge 73 \text{ or } X \le 27)$

EXAMPLE ①. DRUG COMPANY. BP REDUCER.

X = # IN $n=100$ WHOSE BP DROPS BY SOME FIXED INCREMENT — IT CAN HAPPEN.

SAY BACKGROUND INFO SAYS AROUND 15% DROP BP. (NO MEDS). FROM A SAMPLE OF $n=100$ SUPPOSE WE FIND THAT 26 HAVE BP DROP.

H_0 NULL HYPOTHESIS $p = 0.15$

IF TRUE THE MED IS DOING NOTHING.

H_A ALTERNATIVE HYPOTHESIS. $p > 0.15$ eg $p = 0.149999$.

IF TRUE THE MFG OF MED MAYBE GETS STUDY RESULTS PUBLISHED.

SOME JOURNALS WILL NOT PUBLISH UNLESS

P-VALUE < 0.00001

SEEN IN OUR DATA

IN THIS CASE P-VALUE = P(# BP DROP IN 100 ≥ 26 IF $p = .15$)

H_0.

CHECK WHETHER P-VALUE ≤ 0.00001.

(COUNT) NAIVE BEST TO USE 25.5 CONTINUITY CORRECTION

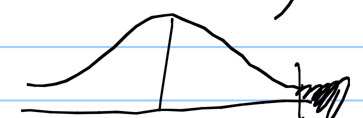
$$P(X \geq 26) \approx P\left(Z \geq \frac{26-15}{\sqrt{100 \cdot .15 \cdot .85}}\right) = P(3.\underline{\underline{0}}8)$$

\# IN 100 WHOSE BP DROPS

Ck $np \geq 10$ $100(.15) = 15 \geq 10$

$nq \geq 10$ $100(.85) = 85 \geq 10$.

$\equiv$



z	$.0\underline{\underline{8}}$
-3.0	$\boxed{0.0010}$

CONCLUSION: P-VALUE = 0.0010

P-VALUE IS (ALWAYS) THE PROBABILITY THAT
THE NULL HYPOTHESIS MODEL WOULD HAVE
(BY LUCK OF THE DRAW) PRODUCED DATA AS BAD
FOR H_0 AS YOUR DATA IS.

BETTER SAID: HOW RARE IS IT IN DIRECTION
AGAINST H_0.

H_0: $p = .15$ (MED MAKES NO CHANGE)
H_A: $p > .15$ (MED INCR FREQ. OF BP DROPS
TO A LEVEL ABOVE .15)

EXAMPLE 2, SHIPMENT. p = FRACTION DEFECTIVE.

WE'VE CONTRACT W/ SHIPPER "MAY REJECT SHIPMENT IF TEST OF $H_0: p = 0.1$ $H_A: p > 0.1$. UNACCEPTABLE TO PURCHASER HAS $\underline{P}$-VALUE ≤ 0.001 FOR $n = 400$."

SUPPOSE YOU FIND $X = 37$ ACCEPT SHIPMENT $37 < 40$. $np = 40$

SUPPOSE FIND $X = 80$.

$\underline{P}$-VALUE IS $P(X \geq 80 \text{ IF } p = .1) \simeq P\left(Z > \frac{80-40}{\sqrt{400 \cdot .1 \cdot .9}}\right)$

$= P\left(Z > \frac{40}{20(.3)}\right) = P\left(Z > \frac{2}{.3}\right) = P(Z > 6.66)$

TINY OFF TABLE REJECT SHIPMENT!

FOR $z \sim \infty$ $\quad P(Z > z) \sim \dfrac{e^{-z^2/2}}{z\sqrt{2\pi}}$

P-VALUE IS $\sim \dfrac{e^{-6.66^2/2}}{6.66\sqrt{2\pi}}$ SMALL!!

$\pi = 3.14159\ldots$