STT 200 3pm 2-24-10

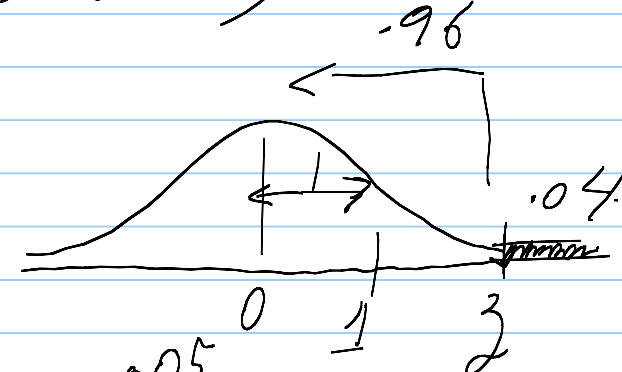
Note Title 2/24/2010

MORE ON CH 20 & 21 (PER SUPPLEMENT)

1. $P(Z > z) = 0.04$ FIND z

RANDOM NORMAL $\mu = 0$ $\sigma = 1$

POSSIBLE z-SCORE



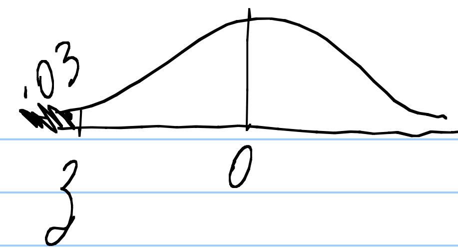
$P(Z > z)$ z .05

1.7 ← $\boxed{0.9599}$ ← LOOK FOR .96 PROB

SO $z = 1.75$

i.e. MEANS $P(Z > 1.75) \sim .04$

2. FIND z WITH $P(Z < z) = 0.03$



z .08

.03

$\boxed{0.0301} \rightarrow -1.8$

FIND $z = -1.88$

SO $P(Z < -1.88) = 0.031$

3. SAMPLE $n = 400$ SURGERIES FIND 32 REQUIRE REPEAT

TEST: INVOLVES p = POPULATION RATE REQUIRING ".

(ASIDE) PERHAPS IN PAST ~ 6% REQUIRED REPEAT.

OR " NEW POLICY OR INSURANCE REQUIREMENTS

HAVE SET 6% GOAL.

SET UP AS TEST.

(PAST 6%) $H_0: p = .06$ (JUST LIKE THE PAST)

$H_a: p > 0.06$ (WORRY THAT RATE OF REPEAT IS INCREASING)

KNOW THIS: A TEST TENDS TO STAY WITH H_0 UNLESS THERE IS OVERWHELMING EVIDENCE AGAINST H_0.

WHAT IS P-VALUE OF FINDING 32 REPEATS IN 400?

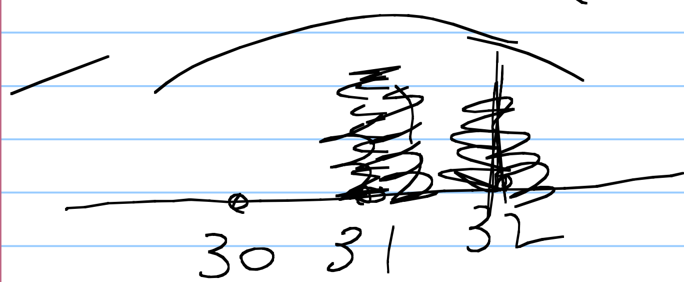
$$\hat{p} = \frac{32}{400} = .08$$

EVIDENCE AGAINST $H_0: p = 0.06$ IS SUMMARIZED

IN P-VALUE $P(X \geq 32)$ IF $p = (p_0) = 0.06$

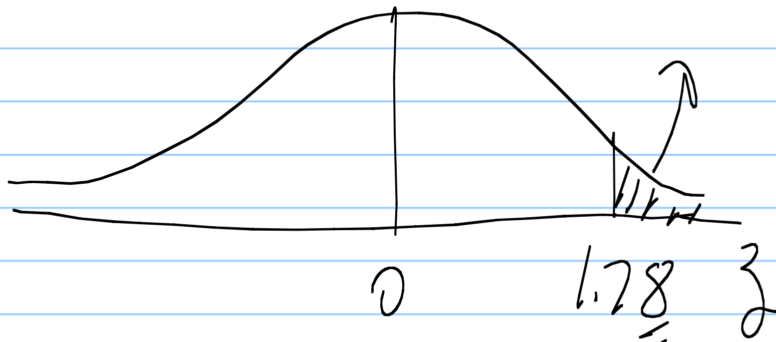
MEANING: IF $p = .06$ (H_0) WHAT IS CHANCE WE'D FIND ≥ 32 IN 400 (EVIDENCE AS STRONG OR STRONGER AGAINST H_0 THAN WHAT WE FOUND).

$$\text{P-VALUE} = P(\underbrace{X}_{\#\text{REPEATS}} \geq 32) \underset{\text{CALC FOR } p = 0.06}{\approx} P\left(Z > \frac{32.5 - \overset{n}{400} \, \overset{p_0}{0.06}}{\sqrt{\underset{n}{400} \, \underset{p_0}{0.06} \, \underset{\text{FIX}}{0.94}}}\right)$$



$$= P\left(Z > \frac{8.5}{20\sqrt{.06 \cdot .94}}\right)$$

$$= P(Z > 1.78) = 1 - .9625 = .0375$$



$\leftarrow .9625$

z	$.08$
1.7	$.9625$

CALC USING $\hat{p}$ INSTEAD OF X (BUT WITHOUT CONTINUITY 0.5)

$$P(\hat{p} \geq 0.08) \approx P\left(Z > \frac{\hat{p} - 0.06}{\sqrt{.06 \cdot .94/400}}\right)$$

WHAT WE FOUND TO BE $\hat{p}$

$$\frac{\hat{p} - 0.06}{\sqrt{p_0 q_0 / 400}} \cdot \frac{n}{n} = \frac{X - 24}{\sqrt{400\, p_0 q_0}}$$

$\hat{p}$ ← p_0

$\frac{400}{400}$

↑ DID ABOVE EXCEPT WE PUT -0.5 IN NUMERATION

SO IF WE IGNORE 0.5 CONTINUITY CORRECTION YOU CAN DO P-VALUE EITHER AS $P(X \geq 32) \sim P\left(Z > \frac{32 - 400 \cdot .06}{\sqrt{400 \cdot .06 \cdot .94}}\right)$

OR (VERY SAME) $P(X \geq 32) \sim P\left(Z > (.08 - .06) \Big/ \sqrt{\frac{.06 \cdot .94}{400}}\right)$

IN FORMULAS - $P(X \geq 32) \cong P\left(Z > \frac{32 - np_0}{\sqrt{np_0 q_0}}\right)$

$P(\hat{p} \geq 32/400) \sim P\left(Z > \frac{.08 - p_0}{\sqrt{p_0 q_0 / n}}\right)$ IDENTICAL

$\uparrow$
.08

4. A JOURNAL REQUIRES P-VALUE < 0.0001 TO PUBLISH

i) H_0: MED HAS NO EFFECT.

H_A: MED HAS DESIRED EFFECT.

TO PUBLISH YOU OBSERVED EFFECT MUST BE RARER THAN 1/10000 — MEANING IT WOULD RARELY BE SEEN IN SAMPLE DATA IF H_0: MED NO EFFECT IS CORRECT.

NOW IMAGINE ALL PAPERS REPORTING ON MEDS HAVING NO VALUE BUT MAKING THE P-VALUE < 0.0001 CRITERION.

OF ALL SUCH STUDIES H_0 IS SATISFIED

SO P(MED PASSES ABOVE CRITERION) ~ .0001.

∴ 1/10000 VALUELESS MED'S STUDIES CAN PASS THIS BARRIER TO PUBLICATION.

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5. SAMPLE OF 900 X-RAY ORDERS FINDS 80 FOR WHICH ADDITIONAL IMAGES ARE REQUESTED.

TEST $H_0: p = .12$ $(p_0 = .12)$

$H_A: p < .12$ eg WE'VE "IMPROVED" THE FORM USED BY RADIOLOGIST.

SIT ON .12 (OUR H_0)

UNLESS WE GET CONVINCING EVIDENCE ($p << 0.12$)

HOW? P-VALUE << SMALL

P-VALUE = P(EVIDENCE MORE EXTREME AGAINST H_0)

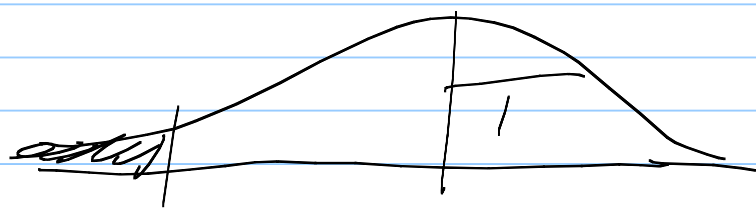
$= P(X \le 80) \approx P\left(Z < \frac{80 - 900(.12)}{\sqrt{900 \cdot .12 \cdot .88}}\right)$ NO CONTINUITY CORRECTION

$\leftarrow$ REVERSED BECAUSE $H_A << H_0$

$= P\left(Z < \frac{80 - 108}{30\sqrt{.12 \cdot .88}}\right) = P(Z < -2.87)$

=

.02



−2.87

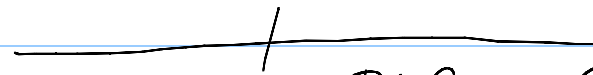
−2.8 $\boxed{.0021}$

P-VALUE = .0021

IS THIS SMALL ENOUGH TO REJECT H_0

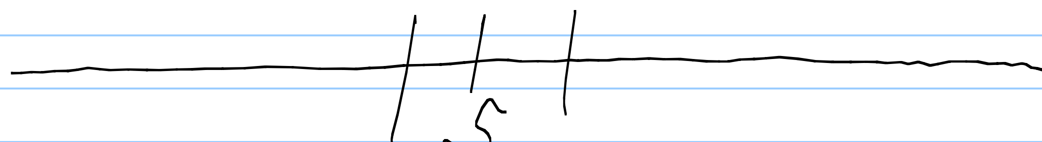
IT DOES SEEM 2/1000 IS SUFFICIENT EVIDENCE AGAINST H_0 SO LETS ROLL OUT THE NEW FORM!

6. DESIGN A TEST TO "CALL ELECTION."



p = FRACTION VOTED REPUBLICAN.

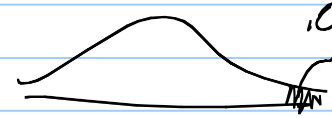
LET'S IMPOSE
TYPE 1 ERROR
PROBABILITY .01



$p_0 = .48$ $\qquad p_1 = .52$

$P(Z > z_0) = .01$

So $z_0 = 2.33$



2.3 $\qquad$ .03 $\qquad \boxed{.9901}$

WHEN
$p = .48$

TYPE 2 ERROR

IMPOSE .01 ALSO

THIS TIME

$P(Z < z_1) = .01$

WHEN $p = .52$

.03

$-2.3 \quad \boxed{.01}$

$z_1 = -2.33$

$$\text{SO REQ'D } n = \left(\frac{\sqrt{.48 \cdot .52}\,|2.33| + \sqrt{.52 \cdot .48}\,|-2.33|}{.52 - .48} \right)^2$$

3000+?

$$\text{AND } C = 2.33\sqrt{n \cdot .48 \cdot .52} + 0.5 + n(.48)$$

0 1 2

$\boxed{0 \; 1}\boxed{2 \; 3}$