"FRAPPY"

The following problem is taken from an actual Advanced Placement Statistics Examination. Your task is to generate a complete, concise statistical response in 15 minutes. You will be graded based on the AP rubric and will earn a score of 0-4. After grading, keep this problem in your binder for your AP Exam preparation.

A survey organization conducted telephone interviews in December 2008 in which 1,009 randomly selected adults in the United States responded to the following question.

> At the present time, do you think television commercials are an effective way to promote a new product?

Of the 1,009 adults surveyed, 676 responded "yes." In December 2007, 622 of 1,020 randomly selected adults in the United States had responded "yes" to the same question. Do the data provide convincing evidence that the proportion of adults in the United States who would respond "yes" to the question changed from December 2007 to December 2008 ?

Part 2 – Complete a comparable CI. Do the TOH and CI, provide the same inference conclusion? Explain

Scoring:

P_{07} = true proportion in 2007 that said "YES" commercials are effective to promote products

P_{08} = true proportion IN 2008 " " " " Products

E P I

$H_0: P_{07} = P_{08}$

$H_A: P_{07} \neq P_{08}$ $\alpha = 0.05$

E P I

Test: 2 sample Z test for Proportions

Conditions

Random: Random Samples taken each year

Independent:
- The 2 samples are independent since they are different yrs.
- $1009 \leq \frac{1}{10}$ (all adults in 2007)
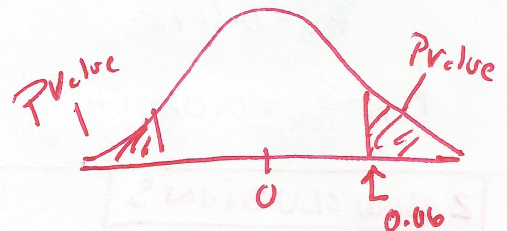- $1020 \leq \frac{1}{10}$ (all adults in 2008)

E P I

Normal (use $\hat{P_c}$)
- 2007: $0.64(1009) = 646 \geq 10$ ✓
  $0.36(1009) = 363 \geq 10$ ✓
- 2008: $0.64(1020) = 653 \geq 10$ ✓
  $0.36(1020) = 367 \geq 10$ ✓

MECHANICS

2007	2008
$X = 676$	$X = 622$
$n = 1,009$	$n = 1,020$
$\hat{P}_{07} = 0.66997$	$\hat{P}_{08} = 0.6098$

$\hat{P}_{07} - \hat{P}_{08} = 0.06017$

$\hat{P_c} = 0.6397 \left(\dfrac{676+622}{1009+1020} \right)$

Test Statistic $Z = 2.82$

$P value = 2 \cdot P(Z > 2.82) = 0.0048$

Total: ___/4

TOH (CONT)

Conclusion   Since the Pvalue (0.0048) is less than $\alpha = 0.05$, we reject Ho. We have convincing evidence there is a difference of opinion between 2007 and 2008 who would answer "YES" To the Question - "Commercials are effective to promote products."

COMPARE A 2 tail TOH To a CI:

For a 2 TAIL TOH w/ $\alpha = 0.05 \longrightarrow$ 95% CI

Parameters — P_{07} & P_{08} defined the same

TEST — 2 sample Z interval for difference of proportions

Conditions — Random & Indepent the same

Normal: 2007:   676 > 10 ✓   333 > 10 ✓   ⎤ Can use the
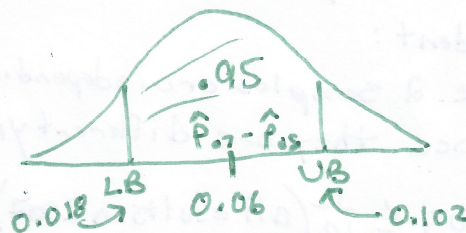   2008:   622 > 10 ✓   348 > 10 ✓   ⎦ X values for successes & failures

Mechanics

$\hat{P}_{07} = 0.66997$

$\hat{P}_{08} = 0.6098$

$\hat{P}_{07} - \hat{P}_{08} = 0.06017$

CI [0.018, 0.102]

Z CONCLUSIONS	INFERENCE CONCLUSION
WE ARE 95% confident that the true difference in proportions has increased from 2007 to 2008 in opinions who say "commercials are effective to promote products" is between 1.8% and 10.2%.	BASED ON $\alpha = 0.05$, OUR CI Supports the TOH conclusion because "0" is NOT IN OUR 95% CI [0.018, 0.102]. Therefore we would reject Ho