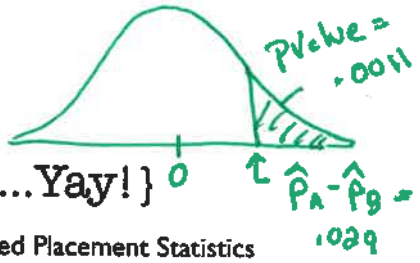
CORRECTED 5/2021



"FRAPPY"

{Free Response AP Problem...Yay!}

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.

LET A = Cardiopump treatment
B = CPR treatment

A French study was conducted in the 1990s to compare the effectiveness of using an instrument called a cardiopump with the effectiveness of using traditional cardiopulmonary resuscitation (CPR) in saving lives of heart attack victims. Heart attack patients in participating cities were treated with either a cardiopump or CPR, depending on whether the individual's heart attack occurred on an even-numbered or an odd-numbered day of the month. Before the start of the study, a coin was tossed to determine which treatment, a cardiopump or CPR, was given on the even-numbered days. The other treatment was given on the odd-numbered days. In total, 754 patients were treated with a cardiopump, and 37 survived at least one year; while 746 patients were treated with CPR, and 15 survived at least one year.

P_A = proportion of patients who survive 1 yr w/ cardiopump
P_B = proportion of patients who survive 1 yr w/ CPR

Scoring:

(a) The conditions for inference are satisfied in the study. State the conditions and indicate how they are satisfied.

(1) I P T
E P I

RANDOM: The treatments were randomly assigned. THE COIN TOSS IS RANDOM TREATMENT ASSIGNMENT TO THE EVEN OR ODD NUMBER DAY OF HEART ATTACK.

NORMAL CONDITION IS MET: [MUST USE pooled $\hat{P}$]

Cardio: (A) $754(0.035) = 26\frac{7}{10}$ ✓ $754(0.965) = 754\frac{7}{10}$ ✓
CPR (B) $746(0.035) = 26\frac{7}{10}$ ✓ $746(0.965) = 720\frac{3}{10}$ ✓

INDEPENDENT B/C THIS IS A well controlled experiment.

(b) Perform a statistical test to determine whether the survival rate for patients treated with a cardiopump is significantly higher than the survival rate for patients treated with CPR.

(b) E I

B1

$H_0: P_A - P_B = 0$
$H_A: P_A - P_B > 0$

OR

$H_0: P_A = P_B$
$H_A: P_A > P_B$

$\alpha = .05$

B2 E I

B2

NAME THE TEST BY NAME OR FORMULA

TWO-SAMPLE Z-TEST FOR $P_1 - P_2$ OR

$$Z = \frac{\hat{P}_A - \hat{P}_B}{\sqrt{\hat{P}_C \hat{Q}_C \left(\frac{1}{N_A} + \frac{1}{N_B}\right)}}$$

where $\hat{P}_C = \frac{X_A + X_B}{N_A + N_B}$

$\hat{P}_C = \frac{37+15}{754+746} \approx .035$

$\hat{P}_A = .049$
$\hat{P}_B = .020$

B3 E I

2-PROP Z TEST
$Z = 3.066$
$P = .0011$

$$Z = \frac{.049 - .020}{\sqrt{(.035)(.965)\left(\frac{1}{754} + \frac{1}{746}\right)}} = 3.06$$

.029

PValue = .0011

$\hat{P}_A - \hat{P}_B = .029$

Total: __/4

OVER →

B3

BECAUSE THE PVALUE (.0011) IS VERY SMALL AND LESS THAN ANY REASONABLE SIGNIFICANCE LEVEL (Such as $\alpha = .05$ or $\alpha = .01$), WE REJECT H_0. WE HAVE STRONG EVIDENCE TO SUPPORT THE CONCLUSION THAT THE PROPORTION OF PATIENTS WHO SURVIVE WHEN TREATED WITH THE CARDIO PUMP IS HIGHER THAN THE PROPORTION OF PATIENTS WHO SURVIVE WHEN TREATED WITH CPR. [THAT IS SURVIVAL RATE IS HIGHER FOR PATIENTS TREATED WITH THE CARDIO PUMP.]