

Part 2: Free Response

Communicate your thinking clearly and completely.

The pesticide diazinon is in common use to treat infestations of the German cockroach, *Blattella germanica*. A study investigated the persistence of this pesticide on various types of surfaces. Researchers applied a 0.5% emulsion of diazinon to glass and plasterboard. After 14 days, they placed 18 cockroaches on each surface and recorded the number that died within 48 hours. On glass, 9 cockroaches died, while on plasterboard, 13 died.

8. Construct and interpret a 95% confidence interval for the difference in the two population proportions.

WE CONSTRUCT A 95% CONFIDENCE INTERVAL FOR $P_1 - P_2$, WHERE P_1 IS THE PROPORTION OF COCKROACHES THAT DIE ON DIAZINON TREATED PLASTERBOARD AND P_2 IS THE PROPORTION THAT DIE ON DIAZINON TREATED GLASS.

ASSUME THE COCKROACHES WERE RANDOMLY ASSIGNED.

$$\text{NOTE THAT } n_1 \hat{p}_1 = 13 \geq 5 \quad n_2 \hat{p}_2 = 9 > 5 \\ n_1 \hat{q}_1 = 5 \geq 5 \quad n_2 \hat{q}_2 = 9 > 5.$$

THE TI-84 2PROPZINT = (-.0879, .5323)

WE ARE 95% CONFIDENT THAT THE DIFFERENCE IN ^{THE} PROPORTION OF COCKROACHES THAT DIE ON DIAZINON TREATED PLASTERBOARD AND THE PROPORTION OF THOSE THAT DIE ON DIAZINON TREATED GLASS IS IN THIS INTERVAL.

9. Chemical analysis of the residues of diazinon suggests that it may persist longer on plasterboard than on glass because it binds to the paper covering on the plasterboard. The researchers therefore expected the mortality rate to be greater on plasterboard than on glass. Conduct a significance test to assess the evidence that this is true.

WE WILL TEST $H_0: P_1 = P_2$ VS. $H_A: P_1 > P_2$

THE TI-84 2-PROP Z TEST GIVES: $Z = 1.36$, $P\text{-VAL} = .0857$.

THIS P-VALUE IS SIGNIFICANT AT THE 10% LEVEL, SO WE HAVE MODERATELY STRONG EVIDENCE AGAINST H_0 .

THAT IS WE HAVE SOME EVIDENCE AGAINST THE CLAIM THAT THERE IS NO DIFFERENCE IN THE MORTALITY RATES ON DIAZINON TREATED PLASTERBOARD AND GLASS, IN FAVOR OF THE CLAIM THAT THE MORTALITY RATE IS GREATER ON PLASTERBOARD.

Mars Inc., makers of M&M candies, claims that they produce plain M&Ms with the following distribution:

Brown: 30%	Red: 20%	Yellow: 20%
Orange: 10%	Green: 10%	Blue: 10%

A bag of plain M&Ms was selected randomly from the grocery store shelf, and the color counts were as follows:

Brown: 16	Red: 11	Yellow: 19
Orange: 5	Green: 7	Blue: 3

10. You want to conduct an appropriate test of the manufacturer's claim for the proportion of yellow M&Ms. Identify the population parameter of interest. Then state hypotheses.

WE WILL TEST WHETHER p , THE PROPORTION OF YELLOW PLAIN M&M'S, IS DIFFERENT FROM THE MANUFACTURER'S CLAIM:

$$H_0: p = .2$$

$$H_A: p \neq .2$$

11. State and verify the conditions for performing the significance test.

• OUR BAG OF M&M'S IS RANDOMLY SELECTED. ASSUME A BAG IS AN SRS FROM ALL PLAIN M&M'S

• $n, \hat{p}_1 = 19 > 5$
 $n, \hat{q}_1 = 42 > 5$ } → SO THE SAMPLING DISTⁿ OF \hat{p} IS APPROXIMATELY NORMAL.

12. Calculate the test statistic and the P-value.

THE TI-84 1-PROP Z TEST GIVES

$$Z = 2.1766$$

$$P\text{-VALUE} = .0295$$

13. What do you conclude about the manufacturer's claim? Explain.

SINCE THE P-VALUE IS LOW ($< 5\%$) WE HAVE SIGNIFICANT EVIDENCE AGAINST H_0 . THAT IS WE HAVE STRONG STATISTICAL EVIDENCE TO SUPPORT THE CLAIM THAT THE ACTUAL PROPORTION OF YELLOW M&M'S IS DIFFERENT FROM THE MANUFACTURER'S CLAIM.

14. Based on this sample, construct and interpret a 90% confidence interval for the proportion of yellow M&M candies produced by Mars.

THE TI-84 1-PROP Z INT = (0.21395, .409)

WE ARE 90% CONFIDENT THAT THE PROPORTION OF PLAIN YELLOW M&M'S PRODUCED BY MARS, INC. IS IN THIS INTERVAL.

I pledge that I have neither given nor received aid on this test.