

MS Module 8 Difference in population proportions practice exam questions

(The attached PDF file has better formatting.)

A study on a treatment group vs a control group shows

	<i>treatment</i>	<i>control</i>
observations	60	89
successes	41	60

- The null hypothesis is $H_0: p_1 = p_2$, where p_1 and p_2 are the true proportions of success for the two groups.
- The alternative hypothesis is $H_a: p_1 \neq p_2$.
- The difference in population proportions is the proportion of successes for the treatment group minus the proportion of successes for the control group.

Question 1.2: Sample difference in the proportions of success

What is the sample difference in the proportions of success between the two groups?

Answer 1.2: $41 / 60 - 60 / 89 = 0.0092$

Question 1.3: Proportion of success in combined sample

What is the sample proportion of success in the combination of the two groups?

Answer 1.3: $(41 + 60) / (60 + 89) = 0.6779$

(total successes / total observations)

Question 1.4: Variance of the sample difference

What is the variance of the sample difference in the proportions of success between the two groups if the null hypothesis is true?

Answer 1.4: $(0.6779 \times (1 - 0.6779)) \times (1 / 60 + 1 / 89) = 0.006093$

(if null hypothesis is true, use the combined proportion of success for each group)

Question 1.5: Standard deviation of the sample difference

What is the standard deviation of the sample difference in the proportions of success between the two groups if the null hypothesis is true?

Answer 1.5: $0.006093^{0.5} = 0.0781$

(standard deviation = square root of variance)

Question 1.6: Z statistic

What is the z statistic to test the null hypothesis $H_0: p_1 = p_2$?

Answer 1.6: $0.0092 / 0.0781 = 0.1178$

(z statistic = difference in proportions / standard deviation of this difference)

Question 1.7: p value

What is the p value for the two-tailed z test of the null hypothesis $H_0: p_1 = p_2$?

Answer 1.7: $2 \times \Phi(-0.1178) = 0.9062$

Interpolating in the statistical tables:

$$\Phi(0.11) = 0.5438$$

$$\Phi(0.12) = 0.5478$$

$$\Phi(0.1178) = ((0.1178 - 0.11) \times 0.5478 + (0.12 - 0.1178) \times 0.5438) / (0.12 - 0.11) = 0.5469$$

$$2 \times \Phi(-0.1178) = 2 \times (1 - 0.5469) = 0.9062$$