

Math 308 Assignment 7

Exercises 3.9

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The null hypothesis is that the difference in proportions is zero. However, performing the permutation test gave a p -value of 0.002, allowing us to reject the null at 1% confidence. Thus, the difference in proportions is statistically significant.

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The p -value is 1, which does not let us reject the null hypothesis that the presence of competition has no value on the height change of the seedlings.

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Null Hypothesis Voting preference is independent of age.

Alternative hypothesis Voting preference depends on age.

Age	Response		
	For	Against	All
18-29	172	52	224
30-49	313	103	416
50+	258	119	377
All	743	274	1017

Table 1: Observed values

Multiplying column marginal fractions by row marginal totals, we can get the expected values:

Age	Response	
	For	Against
18-29	164	60
30-49	304	112
50+	275	102

Table 2: Expected values

Then, we calculate the χ^2 test statistic:

$$c = \sum_{i,j}^{\text{all cells}} \frac{(\text{observed}_{i,j} - \text{expected}_{i,j})^2}{\text{expected}_{i,j}} = 6.33$$

Under the null, C follows a χ^2 distribution with $(3-1) \times (2-1) = 2$ degrees of freedom; i.e. $C \sim \chi^2_2$. So, the p -value is $P(C > c) = \int_c^\infty \frac{e^{-t/2}}{2} dt \approx 0.042$.

Thus, we can reject the null at 5% significance, but not at 1% significance.

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a)

We are testing for homogeneity since we want to know whether the distribution of fin ray counts differs from lake to lake.

b)

Null hypothesis Fin ray distributions are the same from lake to lake.

Alternative hypothesis Fin ray distributions are different from lake to lake.

Habitat	Ray Count						All
	≥ 36	35	34	33	32	≤ 31	
Guadalupe	14	30	42	78	33	14	211
Cedro	11	28	53	66	27	9	194
San Clemente	10	17	61	53	22	10	173
All	71	110	190	230	114	64	779

Table 3: Observed Values

Habitat	Ray Count					
	≥ 36	35	34	33	32	≤ 31
Guadalupe	19	30	51	62	31	17
Cedro	18	27	47	57	28	16
San Clemente	16	24	42	51	25	14

Table 4: Expected Values

$c = \sum_{i,j}^{\text{all cells}} \frac{(\text{observed}_{i,j} - \text{expected}_{i,j})^2}{\text{expected}_{i,j}} = 41.77,$
 where $C \sim \chi^2_{10}$. So, $p = P(C > c) = \int_c^\infty \frac{t^{10/2-1} e^{-t/2}}{2^{10/2} \Gamma(10/2)} dt = \int_c^\infty \frac{t^4 e^{-t/2}}{768} dt = 8 \times 10^{-6}.$ So,
 we can reject the null.

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