Problem 1: A researcher is trying to determine if there is some relation between personality and favorite type of pizza. The researcher takes a collection of people and breaks them into three categories of people: kind people, unkind people, and 'monsters'. Their favorite type of pizza topping from a select list is recorded. The tallies are found below.

	Kind Person	Unkind Person	'Monster'	Total
Cheese	14	12	12	38
Pepperoni	15	19	14	48
Buffalo Chicken	16	14	12	42
Veggie	12	16	9	37
Pineapple	5	9	24	38
Total	62	70	71	203

The expected values for the various entries are found in the table below.

	Kind Person	Unkind Person	'Monster'
Cheese	11.61	13.10	13.29
Pepperoni	14.66	16.55	16.79
Buffalo Chicken	12.8276	14.48	14.69
Veggie	11.30	12.76	12.94
Pineapple	11.61	13.10	13.29

The chi-squared contributions are summarized in the table below.

	Kind Person	Unkind Person	'Monster'
Cheese	0.492	0.092	0.125
Pepperoni	0.008	0.363	0.464
Buffalo Chicken	0.783	0.0159	0.493
Veggie	0.043	0.823	1.120
Pineapple	3.763	1.283	8.631

(a) There are missing entries in the tables above. Fill in these missing entries.

(b) Use a χ^2-test with significance level 1% to determine if there is a relationship between personality type and favorite pizza topping. Be sure to state your null and alternative hypotheses, degrees of freedom, test statistic, p-value, and conclusions.

We have

$$\begin{cases} H_0 : \text{there is no association between personality and pizza topping} \\ H_a : \text{there is an association between personality and pizza topping} \end{cases}$$

We have degrees of freedom $(row - 1)(col - 1) = 4 \cdot 2 = 8$. To find X^2, we sum the values in the last table to find $X^2 = 18.4989$. This gives $0.01 < p < 0.02$. Because $p > \alpha$, there is not sufficient evidence to suggest that there is an association between one's personality and favorite pizza topping.