# Homework 8 Math 11, UCSD, Winter 2018 (Not to be turned in, but important for the final exam)

Reading: Chapter 24.

### Exercise 1

For each of the following situations, state whether you'd use a chi-square goodness-of-fit test, a chi-square test of homogeneity, a chi-square test of independence, or some other statistical test:

1. A brokerage firm wants to see whether the type of account a customer has (Silver, Gold, or Platinum) affects the type of trades that customer makes (in person, by phone, or on the Internet). It collects a random sample of trades made for its customers over the past year and performs a test.

2. That brokerage firm also wants to know if the type of account affects the size of the account (in dollars). It performs a test to see if the mean size of the account is the same for the three account types.

3. The academic research office at a large community college wants to see whether the distribution of courses chosen (Humanities, Social Science, or Science) is different for its residential and nonresidential students. It assembles last semester's data and performs a test.

# Exercise 2

After getting trounced by your little brother in a children's game, you suspect the die he gave you to roll may be unfair. To check, you roll it 60 times, recording the number of times each face appears. Do these results cast doubt on the die's fairness?

Face	Count
1	11
2	7
3	9
4	15
5	12
6	6

1. If the die is fair, how many times would you expect each face to show?

2. To see if these results are unusual, will you test goodness-of-fit or homogeneity/independence?

3. State your hypotheses.

- 4. Check the conditions.
- 5. How many degrees of freedom are there?

1

- 6. Find  $\chi^2$  and the *p*-value.
- 7. State your conclusion.

### Exercise 3

A company says its premium mixture of nuts contains 10% Brazil nuts, 20% cashews, 20% almonds, and 10% hazelnuts, and the rest are peanuts. You buy a large can and separate the various kinds of nuts. On weighing them, you find there are 112 grams of Brazil nuts, 183 grams of cashews, 207 grams of almonds, 71 grams of hazelnuts, and 446 grams of peanuts. You wonder whether your mix is significantly different from what the company advertises.

1. Explain why the chi-square goodness-of-fit test is not an appropriate way to find out.

2. What might you do instead of weighing the nuts in order to use a  $\chi^2$  test?

### Exercise 4

Offspring of certain fruit flies may have yellow or ebony bodies and normal wings or short wings. Genetic theory predicts that these traits will appear in the ratio 9:3:3:1 (9 yellow, normal: 3 yellow, short: 3 ebony, normal: 1 ebony, short). A researcher checks 100 such flies and finds the distribution of the traits to be 59, 20, 11, and 10, respectively.

1. Are the results this researcher observed consistent with the theoretical distribution predicted by the genetic model?

2. If the researcher had examined 200 flies and counted exactly twice as many in each category -118, 40, 22, 20— what conclusion would he have reached?

3. Why is there a discrepancy between the two conclusions?

# Exercise 5

Two different professors teach an introductory Statistics course. The table shows the distribution of final grades they reported. We wonder whether one of these professors is an "easier" grader.

	Prof. Alpha	Prof. Beta
A	3	9
В	11	12
C	14	8
D	9	2
F	3	1

1. Will you test goodness-of-fit= or homogeneity/independence?

2. Write appropriate hypotheses.

3. Find the expected counts for each cell, and explain why the chi-square procedures are not appropriate.

#### Exercise 6

In some situations where the expected cell counts are too small, as in the case of the grades given by Professors Alpha and Beta in Exercise 5, we can complete an analysis anyway. We can often proceed after combining cells in some way that makes sense and also produces a table in which the conditions are satisfied. Here, we create a new table displaying the same data, but calling D's and F's "Below C":

	Prof. Alpha	Prof. Beta
A	3	9
В	11	12
C	14	8
Below C	12	3

1. Find the expected counts for each cell in this new table, and explain why a chi-square procedure is now appropriate.

- 2. With this change in the table, what has happened to the number of degrees of freedom?
- 3. Test your hypothesis about the two professors, and state an appropriate conclusion.

#### Exercise 7

A subtle form of racial discrimination in housing is "racial steering." Racial steering occurs when real estate agents show prospective buyers only homes in neighborhoods already dominated by that family's race. This violates the Fair Housing Act of 1968. According to an article in Chance magazine (Vol. 14, no. 2 [2001]), tenants at a large apartment complex recently filed a lawsuit alleging racial steering. The complex is divided into two parts: Section A and Section B. The plaintiffs claimed that white potential renters were steered to Section A, while African-Americans were steered to Section B. The table displays the data that were presented in court to show the locations of recently rented apartments. Do you think there is evidence of racial steering?

	<b>New Renters</b>		
	White	Black	Total
Section A	87	8	95
Section B	83	34	117
Total	170	42	212