LAST NAME (Print): KEY

Statistics 111 **Quiz 18**

1. Benford's Law says that in many cases, the first digit in a number (such as a street address) is not uniformly distributed but instead has probabilities as given in the following table:

digit	1	2	3	4	5	6 or more
probability	0.30	0.18	0.13	0.10	0.08	0.21

Check whether Benford's Law holds for 1188 street addresses in Durham. The counts are:

digit	1	2	3	4	5	6 or more
probability	345	197	170	126	101	249

In words, what is your alternative hypothesis?

Durham addresses do not follow Benford's Law.

4.07 What is the value for your test statistic?

The expected values are $E_i = 1188 * p_i$, so $E_1 = 1188 * 0.3 = 356.4$, $E_2 = 213.48$, $E_3 = 154.44$, $E_4 = 118.8$, $E_5 = 95.04$ and $E_6 = 249.48$. The test statistic is

$$ts = \sum \frac{(O_i - E_i)^2}{E_i} = 4.07.$$

11.07 What is your critical value for a 0.05 level test? (Give a number.)

The chi-squared value has 6-1=5 degrees of freedom.

P-value > 0.25 Give a bound or bounds for your P-value.

The test statistic lies between 2.343 and 7.289, so the P-value is between 0.8 and 0.2.

In words, what conclusion do you reach? (Use $\alpha = 0.05$.)

We fail to reject the null; we do not have reason think that Durham addresses do not follow Benford's Law.

2. A random set of 100 professionals are classified according to handedness and job:

	left	right	ambidextrous
CEO	10	18	2
statistician	15	30	5
ecdysiast	10	2	8

In words, what is your alternative hypothesis?

There is some relationship between job and handedness.

20.22 What is the value for your test statistic?

This is a test for independence. The expected values are the row sum times the column sum over the total, and then one sums (Obs - Exp)^2/Exp for all 9 cells.

9.49 What is your critical value for a 0.05 level test? (Give a number.)

This is a chi-squared distribution with 4 df.

In words, what conclusion do you reach?

Reject the null; there is some relationship between handedness and profession.