April 26, 2013

<u>**Today's Agenda**</u>
1. **Chi-square test of independence**
2. **Chi-square test of homogeneity**

Homework
- **Read 4-3 & Ch 14**
- **WebAssign (Due Monday)**
- **Review Ch 3 (Linear Regression)**

<u>T.A.</u> vs. <u>Professor</u>

Grade	A	B	C	D/F			T.A.
Prob.	.32	.41	.20	.07			

91

Grade	A	B	C	D/F		Prof
Count	22	38	20	11		

H_0: The grading distribution of professor is the same as that of the TA.

H_a: The grading distributions are different.

$\alpha = .05$

<u>Conditions</u>
- All observed counts > 1 (See table)
- All expected counts > 5

A	B	C	D/F
29.12	37.31	18.2	6.37

```
L1      L2      L3     2
22    29.12    .32
38    37.31    .41
20    18.2     .2
11    6.37     .07
-----  ------  -----
L2(1)=29.12
```

- Random sample
  - No mention of SRS; proceed w/ caution

Conditions are met for a X^2-GOF Test

Sample of Peanut butter M&Ms

	Color						Row Summar
	blue	brown	green	orange	red	yellow	
	28	13	20	13	7	19	10

S1 = count ( )

H_0: The colors of m&ms are distributed the same across plain, peanut, & P.B.

H_a: The colors of m&ms are <u>not</u> distributed the same across plain, peanut, & P.B.

$\alpha = .05$

χ^2 Test of Homogeneity

- Compares distribution of a categorical variable across several populations

- <u>No</u> <u>Claimed</u> distribution

H_0: Colors of M&Ms are distributed the same across all types.

H_a: Colors of M&M's are <u>not</u> distributed the same across all types.

$\alpha = .05$

χ^2 - Test of Homogeneity

→ compares distributions of one variable across **several** populations.

→ Conditions
- Observed counts ≥ 1
- Expected counts ≥ 5
- $N \geq 10n$ (for each population)
- Randomization is not necessary, <u>unless</u> you want to generalize results to a larger population.

→ Test Statistic

$$\chi^2 = \sum \frac{(O-E)^2}{E}, \quad df = (r-1)(c-1)$$

r = # of row categories
c = # of col. categories

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Conditions
- Independent populations
  $(N \geq 10n)$
- Count Conditions
  - obs. ≥ 1
  - exp. ≥ 5 (20% Rule)

$$E = \frac{(\text{row total})(\text{col total})}{\text{grand total}}$$

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 5.297$$

```
X² =
        5.296952177
P-VALUE =
        .1513002824
                 Done
```

$$p\text{-value} = P(\chi^2 > 5.297)$$
$$= .1513$$

Because p-value > α, we fail to reject H₀.
We have sufficient evidence to conclude that
the distribution of the professor's grades is
the same as that of the T.A.

$$\chi^2 \quad \text{Test of Independence}$$

H₀: There is no association between
_____ and ____ .

Hₐ: There is an association between
_____ and ____ .

→ Random sample from <u>ONE</u> population.

★ Everything else... follow homogeneity procedures.