STT200 4-13-09 a

WE CAN AT THIS POINT REEL OF LOTS OF TEST:

eg A. $H_0: \mu = \mu_0$ $H_1: \underline{\mu > \mu_0}$

TEST STATISTIC (REJ $H_0$ IF T.S. IS LARGE) $\dfrac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} \overset{\text{IF } H_0}{\sim} Z$ $n \not\approx 0$

eg B. $H_0: \mu_1 = \mu_2$ (TREAT, CONTROL) $H_1: \mu_1 \neq \mu_2$

TEST STATISTIC $\dfrac{\bar{X}_1 - \bar{X}_2}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}} \overset{\text{IF } H_0}{\sim} Z$

REJ $H_0$ IF TEST STAT IS FAR FROM ZERO

BUT WE'LL NOT GO DOWN THIS PATH

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INSTEAD CH 26 CHI SQUARE METHOD!

Ch 19 + 20 FOCUSED ON TESTS

(a) $H_0: p = p_0$ $H_1: p > p_0$

(b) $H_0: p = p_0$ $H_1: p < p_0$

(c) $H_0: p = p_0$ $H_1: p \neq p_0$.

TEST STATISTIC SAME IN ALL CASES:

$$\frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}} \sim Z$$

$n \not\approx 0$

$p \not\approx 0$

$q \not\approx 0$

(a) REJECT $H_0$ IF TEST STATISTIC TOO LARGE

(b) REJECT $H_0$ IF TEST STATISTIC TOO SMALL

(c) TEST STATISTIC TO <u>FAR</u> FROM 0.

# CH 26 CHI SQ

THREE SUCH CHI SQ TESTS IN YOUR READINGS.

(1) TYPIFIED BY

|  | 1 | 2 | 3 | 4 |  |
|---|---|---|---|---|---|
| $H_0$: | 8 | 27 | 12 | 8 | TOT 55 |
| MODEL(?) | $55/4$ | $55/4$ | $55/4$ | $55/4$ |  |

EXPECTED

$H_1$: $H_0$ NOT TRUE

NOTE: EVERY EXP'D COUNT $\geq 5$.

RULE OF ENABLING APP OF CHI-SQ

CHI-SQ STATISTIC

$$\sum_1^4 (OBS - EXP)^2 / EXP$$

CHI-SQ STAT FOR THIS DATA:

$$\frac{(8-\frac{55}{4})^2}{55/4} + \frac{(27-\frac{55}{4})^2}{55/4} + \frac{(12-\frac{55}{4})^2}{55/4} + \frac{(8-\frac{55}{4})^2}{55/4} = 17.8$$

THIS THEN CAN BE PUT INTO $\chi^2$ TABLE (CHI-SQ) DF $= 4-1 = 3$


DF (DEG FREEDOM)

THIS APP DF $C-1$ $= \#$ CATEGORIES $- 1$

$\chi^2$ STAT = 17.8

P VALUE = RIGHT TAIL PR.

| df | .1 | .05 | .025 | .01 | .005 |
| --- | --- | --- | --- | --- | --- |
| 4-1=3 (THIS APP) | 6.2 | 7.8 | 9.3 | 11.3 | 12.8 |

VALUE OF $\chi^2$ STAT

P << .005 OF TABLE

CONCLUSION: EITHER MODEL IS WRONG OR AN EVENT OF PR << .005 OCCURRED.

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ANOTHER EXAMPLE OF SAME TYPE.

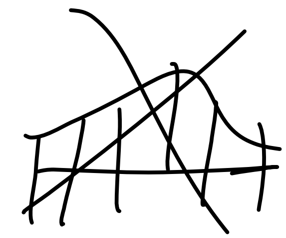
MODEL CUSTOMERS MAKE MENU CHOICES

| | ITEM 1 | ITEM 2 | ITEM 3 | |
| --- | --- | --- | --- | --- |
| EXP COUNTS | 30 | 40 | 30 | SAMPLE OF 100 |
| TODAY YOU RUN THIS MODEL SAMPLING OF 100 CUSTOMERS | 36 | 32 | 32 | 100 SAMPLE OBS COUNTS |

EXPECTED COUNTS

30 40 30 (EXP 35) ← n LARGE COMES IN HERE

OBS 36 32 32 SAMPLE DATA (100)



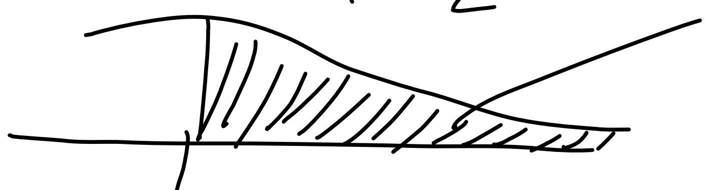
$$\chi^2 \text{ STAT} = \sum \frac{(OBS - EXP)^2}{EXP}$$

DF = # CELLS − 1 = 3 − 1 = 2

$$= \frac{(36-30)^2}{30} + \frac{(32-40)^2}{40} + \frac{(32-30)^2}{30}$$

$$= \frac{36}{30} + \frac{64}{40} + \frac{4}{30} = 1.2 + 1.6 + \text{SMALL} = 2.8$$

DF = 3 − 1 = 2



2.8 STAT

| DF | $\boxed{.10}$ | .05 |
| --- | --- | --- |
| 3−1=2 | 4.6 | 5.9 ... |

P-VALUE SOMETHING LARGER THAN .10

NOT MUCH EVIDENCE AGAINST $H_0$

SECOND TYPE OF $\chi^2$ TEST.

$$\chi^2_{STAT} = \frac{\left(10 - \frac{19 \cdot 21}{42}\right)^2}{\left(\frac{19 \cdot 21}{42}\right)} + \cdots + \frac{\left(12 - \frac{23 \cdot 21}{42}\right)^2}{\left(\frac{23 \cdot 21}{42}\right)}$$

HOMOGENEITY (INDEPENDENCE)

SAY

| | 1 SWEATSHIRT | 2 NOT |
|---|---|---|
| MEN | 10 | 11 |
| WOMEN | 9 | 12 |

$H_0$: SAME RATES OF CHOICE FOR MEN AS FOR WOMEN.

IF <u>INDEP</u>

$p(SS)$

$p(m) \quad p(m)p(SS)$

COUNTS. $\frac{\#m}{\#TOT} \frac{\#SS}{\cancel{\#TOT}} \cancel{TOT}$

EXPECTED COUNTS IF SEX <u>INDEP</u> OF SWEATSHIRT.

| | SS | NOT | |
|---|---|---|---|
| m | $\boxed{\frac{19 \cdot 21}{42}}$ | $\frac{23 \cdot 21}{42}$ | 21 |
| W | | | 21 |
| | 19 | 23 | 42 |

OR JUST $21 - \frac{19 \cdot 21}{42}$

$23 - \frac{23 \cdot 21}{42}$

$DF = (R-1)(C-1) = (2-1)(2-1) = 1$

ANOTHER EXAMPLE

| | | |
|---|---|---|
| | OBS 14 | 62 TOT |
| TOT | 39 | TOT 112 |

TEST (INDEP)

| | | |
|---|---|---|
| | | 62 |
| 39 | | 112 |

$$\frac{39 \cdot 62}{112}$$

obs exp

$$\text{CALC } \chi^2 = \sum \frac{(OBS - EXP)^2}{EXP} = \frac{\left(14 - \frac{39 \cdot 62}{112}\right)^2}{\exp\left(\frac{39 \cdot 62}{112}\right)} + \cdots$$