September 6, 2006

Solutions: Chapter 13

Problem 1. Test

H_0: same genotype frequencies for diabetics and normal using the chi-square test of homogeneity.

	Diabetic	Normal	Total
Bb or bb	12 (7.85)	4 (8.15)	16
BB	39 (43.15)	49 (44.85)	88
Total	51	53	104

Observed X^2=5.10, df=1, P-value $P = 0.024$. Reject H_0. Diabetics have genotype BB less often.

The exact Fisher test uses Hg(104,51,$\frac{16}{104}$) as the null distribution of the test statistic $N_{11} = 12$. One-sided P-value

1-hygecdf(11,104,16,51)=0.0225

two-sided P-value $P = 0.045$. Normal approximation Hg(104,51,$\frac{16}{104}$) $\approx$ N(7.85,3.41), $Z = \frac{12-7.85}{\sqrt{3.41}}$=2.245, two-sided P-value $P = 0.025$.

Problem 3. a) H_0: no association of the disease and the ABO blood group:

	O	A	AB	B	Total
Moderate	7 (10.4)	5 (9.8)	3 (2.0)	13 (6.2)	28
Minimal	27 (30.4)	32 (29.7)	8 (6.1)	18 (18.8)	85
Not present	55 (48.6)	50 (47.5)	7 (9.8)	24 (30.0)	136
Total	89	87	18	55	249

Observed X^2=15.37, df=6, P-value $P = 0.018$. Reject H_0.

b) H_0: no association of the disease and the MN blood group:

	MM	MN	NN	Total
Moderate	21 (16.7)	6 (9.4)	1 (1.9)	28
Minimal	54 (51.3)	27 (28.9)	5 (5.8)	86
Not present	74 (81.1)	51 (45.7)	11 (9.2)	136
Total	149	84	17	250

Observed X^2=4.73, df=4, P-value $P = 0.42$. Can not reject H_0.

Problem 6. Goodness of fit chi-square test for H_0: boys proportions $p_{12} = p_{22} = p_{32} = 0.513$, same sex ratio for three father's activities. (Here 0.513 is obtained as $105.37/(105.37 + 100) = 0.513$.)

	Girl	Boy	Total
Flying fighter	51 (45.15)	38 (43.84)	89
Flying transport	14 (15.22)	16 (14.78)	30
Not flying	38 (42.62)	46 (41.38)	84
Total	103	100	203

Observed X^2=2.75, df=3, P-value $P = 0.43$. Can not reject H_0.

Problem 17. a) H_0: no relation between blood group and disease in London:

	Control	Peptic Ulcer	Total
Group A	4219 (4103.0)	579 (695.0)	4798
Group O	4578 (4694.0)	911 (795.0)	5489
Total	8797	1490	10287

Observed X^2=42.40, df=1, P-value $P = 0.000$. Reject H_0. Odds ratio $\hat{\Delta} = 1.45$.

b) H_0: no relation between blood group and disease in Manchester:

	Control	Peptic Ulcer	Total
Group A	3775 (3747.2)	246 (273.8)	4021
Group O	4532 (4559.8)	361 (333.2)	4893
Total	8307	607	8914

Observed X^2=5.52, df=1, P-value $P = 0.019$. Reject H_0. Odds ratio $\hat{\Delta} = 1.22$.

c) H_0: London Group A and Manchester Group A have the same propensity to Peptic Ulcer:

	C and A	PU and A	Total
London	4219 (4349.2)	579 (448.8)	4798
Manchester	3775 (3644.8)	246 (376.2)	4021
Total	7994	825	8819

Observed X^2=91.3, df=1, P-value $P = 0.000$. Reject H_0.

H_0: London Group O and Manchester Group O have the same propensity to Peptic Ulcer:

	C and O	PU and O	Total
London	4578 (4816.5)	911 (672.5)	5489
Manchester	4532 (4293.5)	361 (599.5)	4893
Total	9110	1272	10382

Observed X^2=204.5, df=1, P-value $P = 0.000$. Reject H_0.

Problem 19. H_0: same frequencies ratio for High-Anxiety and Low-Anxiety groups:

	Wait Together	Wait Alone	Total
High-Anxiety	12	5	17
Low-Anxiety	4	9	13
Total	16	14	30

The exact Fisher test uses Hg(30,17,$\frac{16}{30}$) as the null distribution of the test statistic $N_{11} = 12$.

One-sided P-value: 1-hygecdf(11,30,16,17)=0.036.

Two-sided P-value $P = 0.071$.

Approximate chi-square test.

Observed X^2=4.69, df=1, two-sided P-value $P = 0.03$.