R 8

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1   9.26 True or False

(a) The generalized likelihood ratio statistic LR is always less than or equal to 1.

(b) If the p-value is 0.03, the corresponding test will reject at the significance level 0.02.

(c) If a test rejects at a significance level of 0.06, then the p-value is less than or equal to 0.06.

(d) The p-value of a test is the probability that the null hypothesis is correct.

(e) If a χ^2 test statistic with 4 degrees of freedom has a value of 8.5, the p-value is less than 0.05.

2   9.35

Under a standard genetic model, the genotypes AA, Aa, and aa occur with probabilities $(1-\theta)^2$, $2\theta(1-\theta)$, θ^2 for some $0 \leq \theta \leq 1$. A sample of 190 people reveals that 10 have type AA, 68 have type Aa, and 112 have type aa. Develop a test for the null hypothesis that the data we observe comes from this model.

1. If we assume the data comes from the model, what is the MLE estimate of θ? Recall the pmf of a multinomial distribution is

$$\frac{n!}{X_1! \cdots X_k!} \, p_1^{X_1} \cdots p_k^{X_k}.$$

2. what is the generalized likelihood ratio statistic?

3. What is the Pearson chi-squared statistic?

4. Use the table below to estimate the p-value of the data. At a significance level of 0.05, would we accept or reject the null hypothesis that the data comes from our model?

TABLE 3 Percentiles of the χ^2 Distribution-Values of χ_P^2 Corresponding to P

df	$\chi_{.005}^2$	$\chi_{.01}^2$	$\chi_{.025}^2$	$\chi_{.05}^2$	$\chi_{.10}^2$	$\chi_{.90}^2$	$\chi_{.95}^2$	$\chi_{.975}^2$	$\chi_{.99}^2$	$\chi_{.995}^2$
1	. 000039	. 00016	. 00098	. 0039	. 0158	2.71	3.84	5.02	6.63	7.88
2	. 0100	. 0201	. 0506	. 1026	. 2107	4.61	5.99	7.38	9.21	10.60
3	. 0717	. 115	. 216	. 352	. 584	6.25	7.81	9.35	11.34	12.84
4	. 207	. 297	. 484	. 711	1.064	7.78	9.49	11.14	13.28	14.86
5	. 412	. 554	. 831	1.15	1.61	9.24	11.07	12.83	15.09	16.75
6	. 676	. 872	1.24	1.64	2.20	10.64	12.59	14.45	16.81	18.55
7	989	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48	20.28
8	1.34	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09	21.96
9	1.73	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67	23.59
10	2.16	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21	25.19