

TABLE 3.14 SAS Output for Problem 3.13

Fisher's Exact Test		
Cell (1,1) Frequency (F)		21
Left-sided Pr \leq F		0.8947
Right-sided Pr \geq F		0.3808
Table Probability (P)		0.2755
Two-sided Pr \leq P		0.6384

Odds Ratio		2.1000
Asymptotic Conf Limits:	95% Lower Conf Limit	0.3116
	95% Upper Conf Limit	14.1523
Exact Conf Limits:	95% Lower Conf Limit	0.2089
	95% Upper Conf Limit	27.5522

indicates whether the cancer was controlled for at least two years following treatment. Table 3.14 shows SAS output.

- Report and interpret the P -value for Fisher's exact test with (i) $H_a: \theta > 1$, and (ii) $H_a: \theta \neq 1$. Explain how the P -values are calculated.
- Interpret the confidence intervals for θ . Explain the difference between them and how they were calculated.
- Find and interpret the one-sided mid- P -value. Give advantages and disadvantages of this type of P -value.

3.14 A study considered the effect of prednisolone on severe hypercalcaemia in women with metastatic breast cancer (B. Kristensen et al., *J. Intern. Med.* 232: 237-245, 1992). Of 30 patients, 15 were randomly selected to receive prednisolone. The other 15 formed a control group. Normalization in their level of serum-ionized calcium was achieved by 7 of the treated patients and none of the control group. Analyze whether results were significantly better for treatment than for control. Interpret.

Use one-sided Fisher exact test with significance level 0.05

3.15 For Problem 3.14, obtain a 95% confidence interval for the odds ratio using (a) the Woolf (i.e., Wald) interval, (b) Cornfield's "exact" approach, (c) the profile likelihood. In each case, note the effect of the zero cell count. Summarize advantages and disadvantages of each approach.

3.16 Refer to the tea-tasting data (Table 3.8). Construct the null distributions of the ordinary P -value and the mid- P -value for Fisher's exact test with $H_a: \theta > 1$. Find and compare their expected values.

REFERENCE FOR CONTINGENCY TABLES

flows from conditioning on a sufficient the exponential family (Lehmann 1986, 1973), and Suissa and Shuster (1985) in Fisher's test. The controversy over 9, 1979), Berkson (1978), Fisher (1956), (1988a), Pearson (1947), Rice (1988), 1, 1985), and Yates (1984). Yates and ded P -value. Discussion of unconditional and Silva Mato (1994), and Røhmel and d (1998) discussed Bayesian analyses for 2, 2001) surveyed small-sample methods. value, see Berry and Armitage (1995), Hirji 1 Yang (2001), Mehta and Walsh (1992), accrue from alternative proposed P -values. ve the same value for a test statistic, uses partitioned sample space; for tables having contribute to the P -value that are no more Sackrowitz 1992; Kim and Agresti 1995). atistic, and in some cases a Rao-Blackwell- 1 Wells 2002). Ordinary P -values obtained out continuity corrections for discreteness P -value (Pierce and Peters 1999; Strawder-

Mehta and Patel (1983). For ordered cate- onte Carlo estimation of exact P -values, see 99), Diaconis and Sturmfels (1998), Forster tefield (1982). Gail and Mantel (1977) and or the number of tables having certain fixed tended the unconditional approach to a test onditional independence with several 2×2

 2×2 Tables

ent statistic (T, U) , where λ is a nuisance 35) defined U to be ancillary for θ if its distribution of T given U depends only on θ . and $\lambda = (\pi_{1+}, \pi_{+1})$, let $T = n_{11}$ and $U =$ use its distribution depends on θ as well as λ . hapkar (1989) referred to the marginals U as the distribution of the data, given U , depends family of distributions of U for various λ is rnative definition referring to conditional and fficient.

nd interpret a 95% confidence interval o, (b) difference of proportions, and (c) use and type of injury.

- 3.2 Refer to Table 2.5 on lung cancer and smoking. Construct a confidence interval for a relevant measure of association. Interpret.
- 3.3 In professional basketball games during 1980–1982, when Larry Bird of the Boston Celtics shot a pair of free throws, 5 times he missed both, 251 times he made both, 34 times he made only the first, and 48 times he made only the second (Wardrop 1995). Is it plausible that the successive free throws are independent?
- 3.4 Refer to Table 3.10.
 - a. Using X^2 and G^2 , test the hypothesis of independence between party identification and race. Report the P -values and interpret.
 - b. Use residuals to describe the evidence of association.
 - c. Partition chi-squared into components regarding the choice between Democrat and Independent and between these two combined and Republican. Interpret.
 - d. Summarize association by constructing a 95% confidence interval for the odds ratio between race and whether a Democrat or Republican. Interpret.

TABLE 3.10 Data for Problem 3.4

Race	Party Identification		
	Democrat	Independent	Republican
Black	103	15	11
White	341	105	405

Source: 1991 General Social Survey, National Opinion Research Center.

- 3.5 Refer to Table 3.10. In the same survey, gender was cross-classified with party identification. Table 3.11 shows some results. Explain how to interpret all the results on this printout.
- 3.6 In a study of the relationship between stage of breast cancer at diagnosis (local or advanced) and a woman's living arrangement, of 144 women living alone, 41.0% had an advanced case; of 209 living with spouse, 52.2% were advanced; of 89 living with others, 59.6% were advanced. The authors reported the P -value for the relationship as 0.02 (D. J. Moritz and W. A. Satariano, *J. Clin. Epidemiol.* 46: 443–454, 1993). Reconstruct the analysis performed to obtain this P -value.