TAKEHOME EXAM ECON 7800 FALL 2000

ECONOMICS DEPARTMENT, UNIVERSITY OF UTAH

Problem **22.** [Rao97, pp. 16–17] *You want to know how many people smoke marijuana. In order to get a honest response, you list the following two questions:*

- *Do you smoke marijuana?*
- *Does your telephone number end with an even digit?*

You ask the respondent to toss a coin and answer the first question if head turns up, and answer the second question if tail turns up. Since you do not know which question the respondent is answering, the privacy of the information is maintained.

• **a.** *1 point Assuming the probability that the telephone number ends with an even digit is λ, and the probability that the person smokes marijuana is π, what is the probability that the answer to this combined question is yes?*

Date of exam Due Date is Thursday, November 30, 9:10 am.

Answer. Let's call the probability of a yes answer τ. Then $\tau = \frac{1}{2}\pi + \frac{1}{2}\lambda$. □

• **b.** *1 point Assume you make such a survey and $\frac{1}{3}$ of the respondents answer yes. You also sample 300 numbers from the telephone book and it turns out that exactly $\frac{1}{2}$ of the telephone numbers end in an even digit. What is your estimate of π?*

Answer. From the above formula you get $2\tau = \pi + \lambda$, which gives $\pi = 2\tau - \lambda$. Inserting $\tau = \frac{1}{3}$ and $\lambda = \frac{1}{2}$ the answer is $\pi = \frac{1}{6}$. □

Problem 23. *Show that the expected value of the empirical distribution of a sample is the sample mean.*

Problem 24. *4 points Discuss the concepts of unbiasedness and consistency. How are they defined, are there unbiased estimators which are inconsistent, and consistent estimators which are biased? Give examples. What is the practical significance of these two groups of estimators?*

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Maximum number of points: 6.

References

[Rao97] C. Radhakrishna Rao, *Statistics and truth: Putting chance to work*, second ed., World Scientific, Singapore, 1997. 1

Economics Department, University of Utah, 1645 Campus Center Drive, Salt Lake City, UT 84112-9300, U.S.A
E-mail address: ehrbar@econ.utah.edu
URL: http://www.econ.utah.edu/ehrbar