Professor Joyce Jacobsen

Economics 300
Summer 2010

Assignment #6

Due Monday 6/21/10 by 6 p.m. in the Econ 300/QAC201 slot in the Economics Alcove

Please show the calculations used to arrive at your answers. Round final answers to the second decimal place if necessary.

A. An economist collects a random sample of 1000 observations and then loses the records of the last 400. This leaves only 600 observations from which to calculate the sample mean. What is the efficiency of this, relative to what could have been obtained from the whole sample?

B. You go to the store to buy a scale. There are four scales to choose from, all costing the same. You know exactly what you weigh today. When you test the scales by stepping on them repeatedly, each scale shows some error (in pounds):

scale:	A	B	C	D
bias:	none	4	-3	2
standard deviation:	4	none	3	2

Which scale has the smallest mean squared error? Would you want to buy this one? Why or why not?

C. A mail survey is to be undertaken to estimate the proportion of households that currently own a personal computer. However, households in rural areas are less likely to fill out and return the survey, as the following table shows:

	total population (target)		subpopulation who would respond	
household type	f	f/N	f	f/N
urban	75,000,000	.75	8,500,000	.85
rural	25,000,000	.25	1,500,000	.15
	N = 100,000,000	1.00	N = 10,000,000	1.00

Two types of random sample survey are proposed:

a. high volume, with 10,000 households sampled, and no follow-up. The overall response rate would be 10% as given by the table, yielding 1000 replies.

b. high quality, with 100 households sampled, and enough follow-up (phone calls, visits, bribes, etc.) to get a 100% response rate.

1) In estimating π, the proportion rural in the population, does either survey have a sample proportion P that is unbiased?

2) Which survey has the smallest mean squared error (greatest accuracy)?

3) Suppose a sample survey with enough follow-up to guarantee 100% response was prohibitively expensive. So a compromise was suggested: Sample 500 households, with enough follow-up to get a response rate of 30% for urban returns and a response rate of 20% for rural returns. What is the mean squared error of this compromise survey?

D. The book argues (e.g., the answer to problem 7-14) that it is more important for an estimator to be accurate than to be precise. Give an example that illustrates this. Can you think of a case that goes against what the book says, i.e., a case where it is more important to be precise than to be accurate? What is special (if anything) about the case of the scales considered above in **B**?

E. Suppose that two economists estimate μ, the average expenditure of American families on beer. The two estimates, U and V, are statistically independent and unbiased. The second economist is less careful than the first, so the standard deviation of V is 3 times as large as the standard deviation of U. When asked how to combine U and V to get a publishable overall estimate, three proposals are made:

a. $W_1 = \frac{1}{2} U + \frac{1}{2} V$ (the simple average)

b. $W_2 = \frac{3}{4} U + \frac{1}{4} V$ (a weighted average)

c. $W_3 = U$ (drop the less accurate estimate)

1) Which are unbiased estimators?

2) Show which one is the best estimator, making the appropriate calculations.