Stat/Surv 440: More Sample Problems for Stat 440 Fall '07 Final

#1. Suppose that a sample has been designed with two strata, $h = 1, 2$, with stratum population sizes $N_1 = 10000$ and $N_2 = 20000$, and sample sizes $n_1 = 200$, $n_2 = 300$. Suppose that the sampled data yield the following estimates:

$$\bar{y}_1 = 12, \quad \bar{x}_1 = 1, \quad \hat{S}^2_{y,1} = 2, \quad \hat{S}^2_{x,1} = .36, \quad \hat{S}_{xy,1} = .5$$

$$\bar{y}_2 = 20, \quad \bar{x}_2 = 3, \quad \hat{S}^2_{y,2} = 4, \quad \hat{S}^2_{x,2} = .64, \quad \hat{S}_{xy,2} = 1$$

Find a good, approximately unbiased estimator for the target parameter $\bar{y}_U/\bar{x}_U$ based on the sample with this displayed data, and estimate your estimator's variance.

#2. Using the same data as in **#1**, find a good, approximately unbiased estimator for the target parameter $\log(\bar{Y}_{U_1})$ based on the sample with this displayed data, and estimate your estimator's variance.

#3. A small probability sample ($n = 9$) is taken from a study frame: the weights are known, and take the distinct values $w_i = 1/\pi_i = 1000, 4000,$ or 8000, and the combinations of weights and sampled attribute values y_i are

y values	5	2	3	4	2	3	1	8	5
w/1000	1	1	1	1	4	4	4	8	8

(a). Find the Horvitz-Thompson estimator for the frame total of y_i attribute values, based on these data.

(b). Find the Horvitz-Thompson variance formula for this estimator if you know that $\pi_{ij} = \pi_i \pi_j$ whenever $i \neq j$. Could the Sen-Yates-Grundy variance estimator be used here for the same purpose ? Why or why not ?

#4. In a survey sample with some nonresponse, we form 4 adjustment classes or poststrata $h = 1, 2, 3, 4$ and find

Stratum h	1	2	3	4
$\sum_{i \in s_h} w_i$	1500	3000	2000	4000
$\sum_{i \in s_h} w_i r_i$	1200	2500	1500	2000
Known Pop. Total N_h	1400	2400	1900	2500
$\sum_{i \in s_h} w_i r_i y_i$	130	170	120	150

How would you estimate the population total t_y (a) if the N_h values were not known, and (b) if they are known ? Give some justification.