1. Unrestricted Random Sampling

Twenty sampling units are selected at random (using Tippett's Random Sampling Numbers). The calculations are given below:

Observed counts

y	y^2
12	144
55	3025
16	256
13	169
31	961
90	8100
31	961
62	3844
87	7569
59	3481
28	784
30	900
46	2116
42	1764
29	841
29	841
87	7569
35	1225
84	7056
38	1444
904	53050

$N = 100$ $\quad n = 20$

$(\Sigma) SS(y) = 904$

$\bar{y} = \frac{904}{20} = 45.2$

$(\Sigma^2) SS = \sum_{20} (y-\bar{y})^2$

$= \sum_{20} (y^2) - \bar{y} \sum_{20} (y)$

$= 53050 - 45.2\ (904)$

$= 53050 - 40860.8$

$\Sigma^2 = 12189.2$

$V(y) = \frac{SS}{n-1} \left(\frac{\Sigma^2}{n-1}\right)$

$= \frac{12189.2}{19}$

Variance $= 641.54$

$V(\bar{y}) = \frac{V(y)}{n} \quad \frac{641.34}{20} = 32.08$

$V(\bar{y})$ corrected for finite population $= 32.08 \left(\frac{N-n}{N}\right)$

$= 32.08 \left(\frac{100-20}{100}\right)$

$= 32.08\ (.8) = 25.66$

$SE(\bar{y})$ corrected $= \sqrt{V(\bar{y}) \text{ corrected}} = \sqrt{25.66} = 5.1$

So: $\bar{y} = 45.2 \pm 5.1$

and, as this is the mean count per sampling unit and there are 100 such sampling units, the estimated total is:

$$100\ (45.2 \pm 5.1) = 4520 \pm 510 \quad \text{Odds 2:1}$$

The odds are 19:1 that the true value lies within the range 4520 ± 510 (t)

(For p. 0.95 and 19 d.f., $t = 2.093$) $\qquad 4520 \pm 510\ (2.093)$

4520 ± 1067

Sampling errors

$$\frac{\text{SE of est. total}}{\text{Est. total}} = \frac{1067}{4520} = 23.6\%$$