## *Referred Solution to Assignment 01*

1.1. Target population: Parade readers
Sample frame: Parade readers or readers of June 12 issue
Sample/Observation unit: one reader

1.4. Target population: potential jurors chosen from a list of county residents who are registered voters or licensed drivers over age 18
Sample frame: a list of residents in Maricopa county, Arizona
Sample/Observation unit: one person

1.6. Target population: women readers of Prevention
Sample frame: readers or readers of September 1992
Sample/Observation unit: one reader

1.7. Target population: cows in a region
Sample frame: a list of farms
Sample unit: a farm
Observation unit: a cow

1.8. Target population: boarding homes for the elderly in Washington state
Sample frame: a list of boarding homes
Sample unit: one home
Observation unit: one menu

2.1. (a) $\bar{y}_U = \frac{1}{N}\sum_{i=1}^{N} y_i = 142.$

(b) Plan 1:

| Sample Number | Sample, $S$ | $\bar{y}_S$ | $P(S)$ |
|---|---|---|---|
| 1 | $\{1,3,5\}$ | $\frac{98+154+190}{3}$ | $\frac{1}{8}$ |
| 2 | $\{1,3,6\}$ | $\frac{98+154+175}{3}$ | $\frac{1}{8}$ |
| 3 | $\{1,4,5\}$ | $\frac{98+133+190}{3}$ | $\frac{1}{8}$ |
| 4 | $\{1,4,6\}$ | $\frac{98+133+175}{3}$ | $\frac{1}{8}$ |
| 5 | $\{2,3,5\}$ | $\frac{102+154+190}{3}$ | $\frac{1}{8}$ |
| 6 | $\{2,3,6\}$ | $\frac{102+154+175}{3}$ | $\frac{1}{8}$ |
| 7 | $\{2,4,5\}$ | $\frac{102+133+190}{3}$ | $\frac{1}{8}$ |
| 8 | $\{2,4,6\}$ | $\frac{102+133+175}{3}$ | $\frac{1}{8}$ |

Plan 2:

| Sample Number | Sample, $S$ | $\bar{y}_S$ | $P(S)$ |
|---|---|---|---|
| 1 | $\{1,4,6\}$ | $\frac{98+133+175}{3}$ | $\frac{1}{4}$ |
| 2 | $\{2,3,6\}$ | $\frac{102+154+175}{3}$ | $\frac{1}{2}$ |
| 3 | $\{1,3,5\}$ | $\frac{98+154+190}{3}$ | $\frac{1}{4}$ |

(i) $E(\bar{y}) = \sum_S \bar{y}_S P(S)$;

(ii) $V(\bar{y}) = \sum_S [\bar{y}_S - E(\bar{y})]^2 P(S)$;

(iii) $\text{bias}(\bar{y}) = E(\bar{y}) - \bar{y}_U$;

(iv) $\text{MSE}(\bar{y}) = V(\bar{y}) + [\text{bias}(\bar{y})]^2$.

| | $E(\bar{y})$ | $V(\bar{y})$ | $\text{bias}(\bar{y})$ | $\text{MSE}(\bar{y})$ |
|---|---|---|---|---|
| Plan 1 | 142 | 18.94 | 0 | 18.94 |
| Plan 2 | 142.5 | 19.36 | 0.5 | 19.61 |

(c) Plan 1 is better because it has smaller variance and unbiased mean.

2.2. (a)

| $i$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| $\pi_i$ | $\frac{2}{8}$ | $\frac{5}{8}$ | $\frac{3}{8}$ | $\frac{5}{8}$ | $\frac{2}{8}$ | $\frac{5}{8}$ | $\frac{3}{8}$ | $\frac{7}{8}$ |

(b)

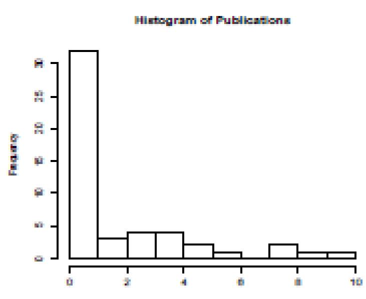
| $S$ | $\bar{y}_S$ | $\hat{t}_S = 8\bar{y}_S$ | $P(S)$ |
|---|---|---|---|
| $\{1,3,5,6\}$ | $\frac{1+4+7+7}{4}$ | 38 | $\frac{1}{8}$ |
| $\{2,3,7,8\}$ | $\frac{2+4+7+8}{4}$ | 42 | $\frac{1}{4}$ |
| $\{1,4,6,8\}$ | $\frac{1+4+7+8}{4}$ | 40 | $\frac{1}{8}$ |
| $\{2,4,6,8\}$ | $\frac{2+4+7+8}{4}$ | 42 | $\frac{3}{8}$ |
| $\{4,5,7,8\}$ | $\frac{4+7+7+8}{4}$ | 52 | $\frac{1}{8}$ |

So, we can obtain the sampling distribution of $\hat{t} = 8\bar{y}$:

| $\hat{t}$ | 38 | 40 | 42 | 52 |
|---|---|---|---|---|
| $P(\hat{t})$ | $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{5}{8}$ | $\frac{1}{8}$ |

2.6. In this case, we assume that this is a finite population.

(a) The shape of the data is highly right-skewed.



(b) $\bar{y} = 1.78$; $SE_{\bar{y}} = \sqrt{\left(1 - \frac{n}{N}\right)\frac{s^2}{n}} \approx 0.3674$.

(c) It will approximate normal distribution according to C.L.T.

(d) (i) $\hat{p} = \frac{28}{50} = 0.56$.

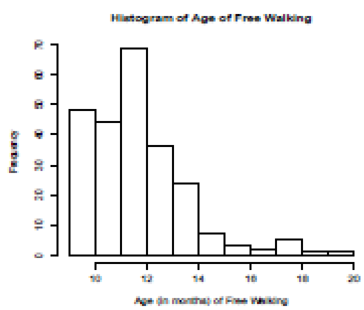
(ii) 95% confidence interval for $p$:

$$\hat{p} \pm z_{\alpha/2}\sqrt{\left(1 - \frac{n}{N}\right)\frac{\hat{p}(1-\hat{p})}{n-1}}$$

$\Rightarrow (0.4254, 0.6946)$.

2.11. In this case, we assume that there is an infinite population.

(a) The shape of the data is right-skewed.




The sampling distribution of the sample average will approximate normal distribution according to C.L.T.

(b) (i) $\bar{y} = 12.07917$; $SE_{\bar{y}} = \sqrt{\frac{s^2}{n}} \approx 0.1242$.

(ii) 95% confidence interval for $\mu$:

$$\bar{x} \pm z_{\alpha/2}\sqrt{\frac{s^2}{n}}$$

$\Rightarrow (11.8356, 12.3227)$.

(c) $0.5 = \frac{(1.96)(1.9248)}{\sqrt{n}} \Rightarrow n \approx 56.93$. So, we need to take sample size 57.