Chapter 7 Review Problems

R7.1 Population: set of all eggs shipped on the day in question

Sample: the 200 eggs examined in the SRS

parameter: the proportion $p = .001$ (.1%) of all eggs shipped that day had salmonella

statistic: the sample proportion $\hat{p} = .045$ (9 of the 200 eggs had salmonella)

R7.2 (a) Answers will vary. Example of sample data for a single SRS of 5.

Notice: Range = 1,000 = 4,000 − 3,000
Population μ = 3,417 gms

(b) The dotplot does not show the RANGE (sample statistic) of every possible sample of size 5 from the population. Instead is shows the ranges from 500 SRSs from the population. This is a very small subset of the values that make up the sampling distribution.

R7.3 (a) The population range = 3,417 grams
Sample range – looking at the dot plot none of the samples had a range over 3,000 gms. The mean from the dot plot shows a range with a typical value of about 1,000 gms. The sample range underestimates the value of the population range

The sample range is NOT an unbiased estimator of the population range.

$\boxed{R7.3b}$ If we want to reduce the variability of the sampling distribution of the sample range, you need to take larger samples

$\boxed{R7.4}$ $p = .15$ Random sample $n = 1{,}540$ adults

(a) $\mu_{\hat{p}} = .15$ or $\boxed{\mu_{\hat{p}} = p = .15}$

(b) Since the population (all adults) is considerably larger than 10 times the sample size ($n = 1540$); The "10% condition is met" and we can calculate the standard deviation of the sample

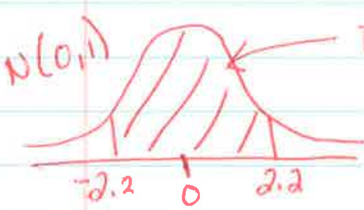
$$\sigma_{\hat{p}} = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(.15)(.85)}{1540}} \qquad \boxed{\sigma_{\hat{p}} = .0091}$$

(c) Check normal condition

$$np = 1540(.15) = 231 \geq 10 \checkmark$$
$$nq = 1540(.85) = 1309 \geq 10 \checkmark$$

$\therefore$ Since both conditions are at least 10, the sampling distribution is approximately normal.

(d) $P(.13 \leq \hat{p} \leq .17) = P\left(\frac{.13-.15}{.0091} \leq Z \leq \frac{.17-.15}{.0091}\right) =$



$P(-2.20 \leq Z \leq 2.20) = \underline{.9722}$

normalcdf $(-2.20, 2.20, 0, 1)$

The probability of a random sample of 1,540 adults is between 13% and 17% is about 97%.

$\boxed{R7.5}$ (a) $p = .30$ random sample: $n = 100$ $\hat{p} = .20$

10% condition met - took an SRS $n = 100 * 10 = 1{,}000$
It was reported 1,000 travel through the airport so we may calculate $\sigma_{\hat{p}}$.

$\mu_{\hat{p}} = .30$

$\sigma_{\hat{p}} = \sqrt{\dfrac{(.3)(.7)}{100}} = .0458$

Check normal conditions and they are met.

$np = 100(.3) = 30 \geq 10$ ✓
$nq = 100(.7) = 70 \geq 10$ ✓

$P(\hat{p} \leq .20) = P(Z \leq -2.18) = \underline{\underline{.0146}}$

$Z = \dfrac{.2 - .3}{.0458}$

$Z = -2.18$

normalcdf(-1E99, -2.18, 0, 1)

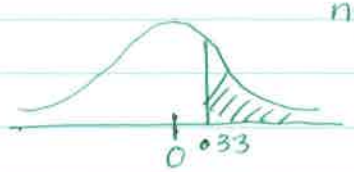
(b) The claim by the customs agents is unlikely to be true. There is only about a 1.5% chance that we would find a sample of only 20% get a red light as we saw in our sample if their claim was true.

R7.6 (a) let X = WAIS Score for a randomly selected individual

population $N(\underset{\mu}{100}, \underset{\sigma}{15})$

$P(X \geq 105) = P(Z \geq .33) = .3707$

$Z = \frac{105-100}{15} = .33$



normalcdf (.33, E99, 0, 1)

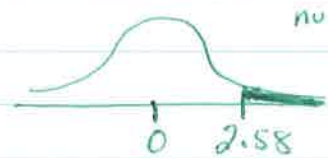
Probability of a randomly selected individual with a WAIS Score above 105 is about 37%.

(b) SRS $n = 60$ 10% condition met since population of 16 or older

$\mu_{\bar{x}} = \mu = 100$ $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{60}} = 1.9365$

(c) $P(\bar{x} \geq 105) = P(Z \geq 2.58) = .0049$ (N = 60)

$Z = \frac{105-100}{1.94} = 2.58$



normalcdf (2.58, E99, 0, 1)

(d) What would happen if we did not know the population was normal?

PART A This answer could be QUITE Different

PART B The mean and standard deviation would be the same because the shape of the population does not matter since the sample size was large ($n > 30$)

PART C The probability would be fairly reliable because of the Central Limit theorem (CLT).

$\boxed{R7.7}$ Population: skewed mean $= \mu = .5$ $\sigma = .7$

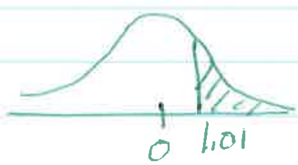
(a) $n = 50$ 10% condition met - reasonable to assume population of moths is 5000+

$n \geq 30$ so a large sample and can use Normal model

$\mu_{\bar{x}} = \underline{.5}$ $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}} = \dfrac{.7}{\sqrt{50}} = \underline{.099}$

(b) $P(\bar{x} \geq .6) = P(z \geq 1.01) = .1562$

$z = \dfrac{.6 - .5}{.099} = 1.01$



normalcdf $(1.01, E99, 0, 1)$