

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.



Notices: Range = 1,000 = 4,000 - 3,000
Population $\mu = 3,417$ gms

(b) The dotplot does not show the RANGE (sample statistic) of every possible sample of size 5 from the population. Instead it 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 dotplot none of the samples had a range over 3,000gms. The mean from the dotplot shows a range with a typical value of about 1,000gms. The sample range underestimates the value of the population range.

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

R7.3b

If we want to reduce the variability of the sampling distribution of the sample range, you need to take larger samples.

R7.4

$$p = .15$$

Random sample $n = 1,540$ adults

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

or $\mu_{\hat{p}} = p = .15$

- (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

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

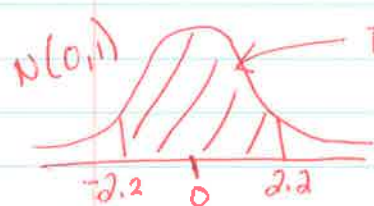
- (c) Check normal condition

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

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

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

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



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

$$\text{normalcdf}(-2.20, 2.20, 0, 1)$$

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

R7.5 (a) $p = .30$

random sample: $n = 100$ $\hat{p} = .20$

10% condition met - took an SRS $n = 100 \times 10 = 1,000$

It was reported 1,000 travel

through the airport so we may
calculate $\sigma_{\hat{p}}$.

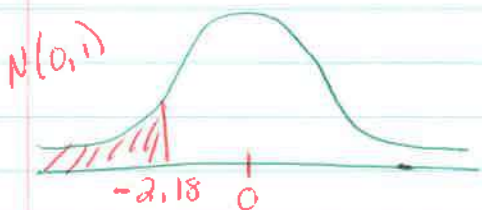
$$\mu_{\hat{p}} = .30$$

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

Check normal conditions
and they are met.

$$np = 100(.3) = 30 \geq 10 \checkmark$$

$$nq = 100(.7) = 70 \geq 10 \checkmark$$



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

$$.0146$$

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

$$Z = -2.18$$

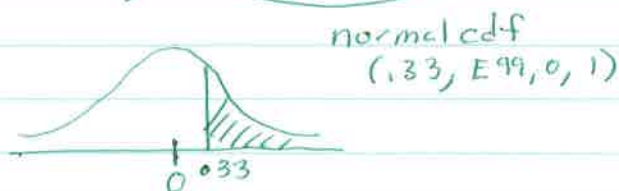
normalcdf
(-1E99, -2.18,
0, 1)

- (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 $N(100, 15)$

$$P(X > 105) = P(Z > .33) = .3707$$

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



Probability of a ^{randomly selected individual with a} WAIS score above 105 is about 37%.

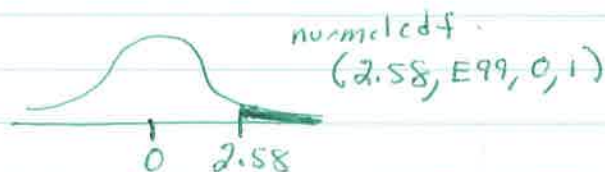
(b) SRS $n = 60$ 10% condition met since population of 16 brother

$$\mu_{\bar{x}} = \mu = 100$$

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

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

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



(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).

R7.7

Population = Skewed mean = $\mu = .5$ $\sigma = .7$

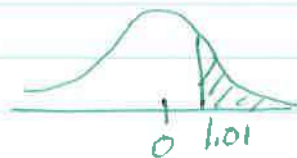
- (a) $n = 50$ 10% condition met - reasonable to assume population of moths is Scott
 $n > 30$ so a large sample and can use Normal model

$$\mu_{\bar{x}} = \underline{\underline{.5}}$$

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

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

$$Z = \frac{.6 - .5}{.099} = 1.01$$



normalcdf
(1.01, E99, 0, 1)