

Student: _____
Date: _____

Instructor: Andreas Lazari
Course: Math2620 F - Fall 2018

Assignment: Chapter 8.2 and 9.1 -
Homework

1. According to a survey in a country, 31% of adults do not own a credit card. Suppose a simple random sample of 800 adults is obtained. Complete parts (a) through (d) below.

(a) Describe the sampling distribution of \hat{p} , the sample proportion of adults who do not own a credit card. Choose the phrase that best describes the shape of the sampling distribution of \hat{p} below.

- A. Not normal because $n \leq 0.05N$ and $np(1-p) \geq 10$
 B. Approximately normal because $n \leq 0.05N$ and $np(1-p) \geq 10$
 C. Approximately normal because $n \leq 0.05N$ and $np(1-p) < 10$
 D. Not normal because $n \leq 0.05N$ and $np(1-p) < 10$

Determine the mean of the sampling distribution of \hat{p} .

$\mu_{\hat{p}} = \underline{0.31}$ (Round to two decimal places as needed.)

$E(\hat{p}) = \mu_{\hat{p}} = p = 0.31$

Determine the standard deviation of the sampling distribution of \hat{p} .

$\sigma_{\hat{p}} = \underline{0.016}$ (Round to three decimal places as needed.)

$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.31(1-0.31)}{800}} = 0.0163516$
 $\sigma_{\hat{p}} \approx 0.016$

(b) What is the probability that in a random sample of 800 adults, more than 33% do not own a credit card?

The probability is 0.106
(Round to four decimal places as needed.)

$P(\hat{p} > 0.33) = \text{Ncdf}(0.33, E99, 0.31, 0.016)$
 $= 0.1056498 \approx 0.106$

Interpret this probability.

If 100 different random samples of 800 adults were obtained, one would expect 11 to result in more than 33% not owning a credit card.
(Round to the nearest integer as needed.)

$100 \times 0.106 = 10.6 \approx 11$

(c) What is the probability that in a random sample of 800 adults, between 28% and 33% do not own a credit card?

The probability is 0.8561
(Round to four decimal places as needed.)

$P(0.28 < \hat{p} < 0.33) = \text{Ncdf}(0.28, 0.33, 0.31, 0.0163516) = 0.8560818$
 ≈ 0.8561

Interpret this probability.

If 100 different random samples of 800 adults were obtained, one would expect 86 to result in between 28% and 33% not owning a credit card.
(Round to the nearest integer as needed.)

$0.8561 \times 100 = 85.61 \approx 86$

(d) Would it be unusual for a random sample of 800 adults to result in 224 or fewer who do not own a credit card? Why?

Select the correct choice below and fill in the answer box to complete your choice. First, $\frac{224}{800} = 0.28$

(Round to four decimal places as needed.)

A. The result is not unusual because the probability that \hat{p} is less than or equal to the sample proportion is _____, which is less than 5%.

B. The result is not unusual because the probability that \hat{p} is less than or equal to the sample proportion is _____, which is greater than 5%.

C. The result is unusual because the probability that \hat{p} is less than or equal to the sample proportion is 0.033, which is less than 5%.

D. The result is unusual because the probability that \hat{p} is less than or equal to the sample

$P(\hat{p} \leq 0.28) = \text{Ncdf}(-E99, 0.28, 0.31, 0.0163516)$
 $= 0.033276 < 0.05$

For the standard deviation, take about 7 decimals

proportion is

which is greater than 5%.

2. Is the statement below true or false?

The mean of the sampling distribution of \hat{p} is p .

Choose the correct answer below.

True

False

3. True or False: The population proportion and sample proportion always have the same value.

Choose the correct answer below.

True

False

4. Suppose a simple random sample of size $n = 1000$ is obtained from a population proportion with a specified characteristic is $p = 0.26$. Complete parts (a) through (c) below.

$$\mu_{\hat{p}} = E(\hat{p}) = 0.26 ; \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.26(1-0.26)}{1000}} \\ = 0.0138708 \\ \approx 0.0139$$

(a) Describe the sampling distribution of \hat{p} .

A. Approximately normal, $\mu_{\hat{p}} = 0.26$ and $\sigma_{\hat{p}} \approx 0.0002$

B. Approximately normal, $\mu_{\hat{p}} = 0.26$ and $\sigma_{\hat{p}} \approx 0.0004$

C. Approximately normal, $\mu_{\hat{p}} = 0.26$ and $\sigma_{\hat{p}} \approx 0.0139$

(b) What is the probability of obtaining $x = 290$ or more individuals with the characteristic?

$P(x \geq 290) = 0.0153$ (Round to four decimal places as needed.)

(c) What is the probability of obtaining $x = 220$ or fewer individuals with the characteristic?

$P(x \leq 220) = 0.0020$ (Round to four decimal places as needed.)

$$b) P(X \geq 290) = P(\hat{p} \geq \frac{290}{1000}) = P(\hat{p} \geq 0.29) = \text{Ncdf}(0.29, E99, 0.26, 0.0138708) \\ = 0.01527757 \approx 0.0153$$

$$c) P(X \leq 220) = P(\hat{p} < \frac{220}{1000}) = P(\hat{p} < 0.22) = \text{Ncdf}(E99, 0.22, 0.26, 0.0138708) \\ = 0.00196488 \approx 0.0020$$

5. According to a study conducted by a statistical organization, the proportion of people who are satisfied with the way things are going in their lives is 0.74. Suppose that a random sample of 100 people is obtained. Complete parts (a) through (e) below.

(a) Describe the sampling distribution of \hat{p} , the proportion of people who are satisfied with the way things are going in their life. Be sure to verify the model requirements.

Since $np(1-p) \geq 10$, the distribution of \hat{p} is (1) ~~Normal~~ ^{Approximately} with $\mu_{\hat{p}} = 0.740$ and $\sigma_{\hat{p}} = 0.044$.
$$\sigma_{\hat{p}} = \sqrt{\frac{0.74(1-0.74)}{100}} = 0.0438634$$

(Round to three decimal places as needed.)

(b) In the a random sample of 100 people, what is the probability that the proportion who are satisfied with the way things are going in their life exceeds 0.76?

The probability that the proportion who are satisfied with the way things are going in their life exceeds 0.76 is 0.3242.
(Round to four decimal places as needed.)
$$P(\hat{p} > 0.76) = \text{Ncdf}(0.76, E99, 0.74, 0.0438634) = 0.3242090269 \approx 0.3242$$

- (1) skewed right
 skewed left
 uniform
 approximately normal

6. A national survey of 1500 adult citizens of a nation found that 19% dreaded Valentine's Day. The margin of error for the survey was 7.6 percentage points with 90% confidence. Explain what this means.

Which statement below is the best explanation?

$$0.19 \pm 0.076 \Rightarrow$$

- A. There is 90% confidence that 19% of the adult citizens of the nation dreaded Valentine's Day. (0.114, 0.266)
 B. In 90% of samples of adult citizens of the nation, the proportion that dreaded Valentine's Day is between 0.114 and 0.266.
 C. There is 82.4% to 97.6% confidence that 19% of the adult citizens of the nation dreaded Valentine's Day.
 D. There is 90% confidence that the proportion of the adult citizens of the nation that dreaded Valentine's Day is between 0.114 and 0.266.

7. A random sample of 1013 adults in a certain large country was asked "Do you pretty much think televisions are a necessity or a luxury you could do without?" Of the 1013 adults surveyed, 528 indicated that televisions are a luxury they could do without. Complete parts (a) and (b) below.

[Click here to view the standard normal distribution table \(page 1\).](#)¹

[Click here to view the standard normal distribution table \(page 2\).](#)²

(a) Obtain a point estimate (\hat{p}) for the population proportion of adults in the country who believe that televisions are a luxury they could do without.

$\hat{p} = 0.521$

$$\hat{p} = \frac{x}{n} = \frac{528}{1013} = 0.521224 \approx 0.521$$

(Round to three decimal places as needed.)

(b) Construct and interpret a 95% confidence interval for the population proportion of adults in the country who believe that televisions are a luxury they could do without. Select the correct choice below and fill in any answer boxes within your choice.

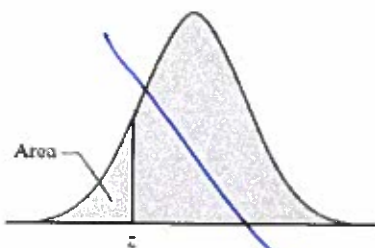
(Type integers or decimals rounded to three decimal places as needed. Use ascending order.)

- A. We are 95 % confident the proportion of adults in the country who believe that televisions are a luxury they could do without is between 0.490 and 0.552.
- B. There is a _____ % chance the proportion of adults in the country who believe that televisions are a luxury they could do without is between _____ and _____.

1: Standard Normal Distribution Table (page 1)

b) use TI83/84

$$(0.49046, 0.55199) \Rightarrow (0.490, 0.552)$$



use TI83/84

Standard Normal Distribution										
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183

8. A survey of 2281 adults in a certain large country aged 18 and older conducted by a reputable polling organization found that 421 have donated blood in the past two years. Complete parts (a) through (b) below.

[Click here to view the standard normal distribution table \(page 1\).](#)³

[Click here to view the standard normal distribution table \(page 2\).](#)⁴

(a) Obtain a point estimate (\hat{p}) for the population proportion of adults in the country aged 18 and older who have donated blood in the past two years.

$$\hat{p} = \frac{x}{n} = \frac{421}{2281} = 0.1845681719 \approx 0.185$$

$\hat{p} = 0.185$

(Round to three decimal places as needed.)

(b) Construct and interpret a 90% confidence interval for the population proportion of adults in the country who have donated blood in the past two years. Select the correct choice below and fill in any answer boxes within your choice. (Type integers or decimals rounded to three decimal places as needed. Use ascending order.)

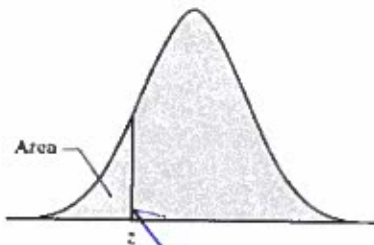
A. There is a _____ % chance the proportion of adults in the country aged 18 and older who have donated blood in the past two years is between _____ and _____

B. We are 90 % confident the proportion of adults in the country aged 18 and older who have donated blood in the past two years is between 0.171 and 0.198.

3: Standard Normal Distribution Table (page 1)

b) use TI83/84

$$(0.17121, 0.19793) \Rightarrow (0.171, 0.198)$$



use TI83/84

Standard Normal Distribution										
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0350	0.0341	0.0334	0.0326	0.0319	0.0312	0.0304	0.0297	0.0291	0.0284

0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

9. A television sports commentator wants to estimate the proportion of citizens who "follow professional football." Complete parts (a) through (c).

(a) What sample size should be obtained if he wants to be within 2 percentage points with 96% confidence if he uses an estimate of 52% obtained from a poll?

The sample size is 2632. (Round up to the nearest integer.)

(b) What sample size should be obtained if he wants to be within 2 percentage points with 96% confidence if he does not use any prior estimates?

The sample size is 2637. (Round up to the nearest integer.)

(c) Why are the results from parts (a) and (b) so close?

- A. The results are close because the margin of error 2% is less than 5%.
- B. The results are close because the confidence 96% is close to 100%.
- C. The results are close because $0.52(1 - 0.52) = 0.2496$ is very close to 0.25.

$$n = \left(\frac{z_{\alpha/2}}{E} \right)^2 p(1-p)$$

Note: find $z_{\alpha/2}$ for 96%

$$a) n = \left(\frac{2.0537}{.02} \right)^2 (.52)(1-.52)$$

$$1-\alpha = .96 \Rightarrow \alpha = .04 \Rightarrow \alpha/2 = .02$$

$$z_{\alpha/2} = \text{INVN}(.02, 0, 1) = 2.0537$$

$$n = 2631.8346 \approx 2632$$

b) Since p is not given take $p = 0.5$

$$n = \left(\frac{2.0537}{.02} \right)^2 (.5)(1-.5) = 2636.052306$$

$$\approx 2637$$

10. A researcher wishes to estimate the percentage of adults who support abolishing the penny. What size sample should be obtained if he wishes the estimate to be within 2 percentage points with 99% confidence if

(a) he uses a previous estimate of 32%?

(b) he does not use any prior estimates?

(a) $n =$ 3610 (Round up to the nearest integer.)

(b) $n =$ 4147 (Round up to the nearest integer.)

Find $z_{\alpha/2}$ for 99% $\Rightarrow 1-\alpha = .99 \Rightarrow \alpha = .01$
 $\alpha/2 = .005$

$$z_{\alpha/2} = \text{INVN}(.005, 0, 1) = 2.5758$$

$$a) = \left(\frac{z_{\alpha/2}}{E} \right)^2 p(1-p) = \left(\frac{2.5758}{.02} \right)^2 (.32)(1-.32) = 3609.301628 \approx 3610$$

$$b) = \left(\frac{2.5758}{.02} \right)^2 (.5)(1-.5) = 4146.716025 \approx 4147$$

11. A researcher wishes to estimate the proportion of adults who have high-speed Internet access. What size sample should be obtained if she wishes the estimate to be within 0.04 with 90% confidence if

(a) she uses a previous estimate of 0.58?

(b) she does not use any prior estimates?

$$Z_{\frac{\alpha}{2}} \Rightarrow 1-\alpha = .9 \Rightarrow \alpha = .10 \Rightarrow \frac{\alpha}{2} = .05$$

$$Z_{\frac{\alpha}{2}} = \text{INVN}(.05, 0, 1) = 1.6448$$

(a) $n = 412$ (Round up to the nearest integer.)

(b) $n = 423$ (Round up to the nearest integer.)

12. In a poll, 69% of the people polled answered yes to the question "Are you in favor of the death penalty for a person convicted of murder?" The margin of error in the poll was 2%, and the estimate was made with 94% confidence. At least how many people were surveyed?

$$1-\alpha = .94 \Rightarrow \alpha = .06 \Rightarrow \frac{\alpha}{2} = .03$$

The minimum number of surveyed people was 1892. (Round up to the nearest integer.)

$$\text{For } 94\% \quad Z_{\frac{\alpha}{2}} = \text{INVN}(.03, 0, 1) = 1.88079361$$

$$n = \left(\frac{1.8807}{.02} \right)^2 (.69)(1-.69) = 1891.428124 \approx 1892$$

$$\rightarrow \text{11. a) } n = \left(\frac{Z_{\frac{\alpha}{2}}}{E} \right)^2 p(1-p) = \left(\frac{1.6448}{.04} \right)^2 (.58)(.42) = 411.89213 \approx 412$$

$$\text{b) } = \left(\frac{1.6448}{.04} \right)^2 (.5)(1-.5) = 422.736 \approx 423.$$

1. B. Approximately normal because $n \leq 0.05N$ and $np(1 - p) \geq 10$

0.31

0.016

0.1106

11

0.8561

86

C.

The result is unusual because the probability that \hat{p} is less than or equal to the sample proportion is 0.0333, which is less than 5%.

2. True

3. False

4. C. Approximately normal, $\mu_{\hat{p}} = 0.26$ and $\sigma_{\hat{p}} \approx 0.0139$

0.0153

0.0020

5. (1) approximately normal

0.740

0.044

0.3242

6. D.

There is 90% confidence that the proportion of the adult citizens of the nation that dreaded Valentine's Day is between 0.114 and 0.266.

7. 0.521

A.

We are 95 % confident the proportion of adults in the country who believe that televisions are a luxury they could do without is between 0.490 and 0.552.

8. 0.185

B.

We are 90 % confident the proportion of adults in the country aged 18 and older who have donated blood in the past two years is between 0.171 and 0.198.

9. 2632

2637

C. The results are close because $0.52(1 - 0.52) = 0.2496$ is very close to 0.25.

10. 3610

4147

11. 412

423

12. 1892
