Answer Key for Final review (Updated 5/10/18)

= Solution Video on www.helpyourmath.com/150.5

Problem 1.

$(np = 1000(0.86) = 860 \geq 5 \; and \; nq = 1000(0.14) = 140 \geq 5)$

$H_o: p = 0.86 \; (claim) \qquad and \qquad H_a: p \neq 0.86$

Because the test is a two-tailed test and the level of significance is $\alpha = 0.10$, the critical values are $-z_0 = -1.645 \; and \; z_0 = 1.645$

Since $x = 845 \; and \; n = 1000, then \; \hat{p} = \frac{x}{n} = \frac{845}{1000} = 0.845$

$z = \frac{\hat{p}-p}{\sqrt{\frac{pq}{n}}} = \frac{0.845-0.86}{\sqrt{\frac{0.86(0.14)}{1000}}} \approx -1.37 > -1.645$

Fail to reject H_o

<u>(Solution Video also uses P-Value Method)</u>

Problem 2.

x	$P(x)$	$xP(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2P(x)$
1	0.16	0.16	-1.94	3.7636	0.602176
2	0.22	0.44	-0.94	0.8836	0.194392
3	0.28	0.84	0.06	0.0036	0.001008
4	0.20	0.80	1.06	1.1236	0.22472
5	0.14	0.70	2.06	4.2436	0.594104
		$\sum xP(x) = 2.94$			$\sum (x-\mu)^2P(x) = 1.6164$

$\mu = E(x) = \sum xP(x) = 2.94$

$\sigma^2 = \sum (x-\mu)^2P(x) = 1.6164$

$\sigma = \sqrt{\sum (x-\mu)^2P(x)} = \sqrt{1.6164} = 1.27$

Problem 3.

(a) Rearrange data:

160 173 173 175 180 185 190 195 200 230

Mode = 173

$$Median = \frac{180 + 185}{2} = 182.5$$

$$Mean = \frac{\sum x}{n} = \frac{1861}{10} = 186.1$$

x	$x - \bar{x}$	$(x - \bar{x})^2$
160	-26.1	681.21
173	-13.1	171.61
173	-13.1	171.61
175	-11.1	123.21
180	-6.1	37.21
185	-1.1	1.21
190	3.9	15.21
195	8.9	79.21
200	13.9	193.21
230	43.9	1927.21
$\sum x = 1861$		$\sum (x - \bar{x})^2 = 3400.9$

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}} = \sqrt{\frac{3400.9}{10 - 1}} = \sqrt{377.8778} \approx 19.44$$

(b) Min = 160

1st Quadrant = 173

Median = 182.5

3rd Quadrant = 195

Max = 230

(c) $IQR = Q_3 - Q_1 = 195 - 173 = 22$

$Q_1 - 1.5(IQR) = 173 - 1.5(22) = 140$

$Q_3 + 1.5(IQR) = 195 + 1.5(22) = 228$

Hence, 230 is outlier.

Problem 4.

		Gender		
		Male	Female	Total
Level of degree	Associate's	361	581	942
	Bachelor's	734	982	1716
	Master's	292	439	731
	Doctoral	80	84	164
	Total	1467	2086	3553

(a)

$$P(master\ or\ male) = P(master) + P(male) - P(master\ and\ male)$$
$$= \frac{731}{3553} + \frac{1467}{3553} - \frac{292}{3553} \approx 0.5364$$

(b) $P(doctorate|female) = \frac{84}{2086} \approx 0.0403$

(c) $P(associate) = \frac{942}{3553} \approx 0.2651$

$P(not\ associate) = 1 - 0.2651 = 0.7349$

Problem 5

(a)

$n = 4, \quad p = 0.62, \quad q = 1 - p = 1 - 0.62 = 0.38$

$$P(x = 1) = {}_nC_x p^x q^{n-x} = \frac{4!}{(4-1)!\,1!}(0.62)^1(0.38)^{4-1} = 4 * 0.62 * 0.054872 = 0.1361$$

(b)

$$P(x = 2) = {}_nC_x p^x q^{n-x} = \frac{4!}{(4-2)!\,2!}(0.62)^2(0.38)^{4-2} = 6 * 0.3844 * 0.1444 = 0.3330$$

$$P(x = 3) = {}_nC_x p^x q^{n-x} = \frac{4!}{(4-3)!\,3!}(0.62)^3(0.38)^{4-3} = 4 * 0.238328 * 0.38 = 0.3623$$

$$P(x = 4) = {}_nC_x p^x q^{n-x} = \frac{4!}{(4-4)!\,4!}(0.62)^4(0.38)^{4-4} = 1 * 0.147763 * 1 = 0.1478$$

$$P(x \geq 2) = P(x = 2) + P(x = 3) + P(x = 4) = 0.3330 + 0.3623 + 0.1478 = 0.8431$$

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Problem 6

Age	Frequency	Class width Typo, class width should be 10	Midpoints	Class boundaries	Relative frequency	Cumulative frequency
0 – 9	30	~~9~~	4.5	0 – 9.5	0.13	30
10 – 19	28	~~9~~	14.5	9.5 – 19.5	0.12	58
20 – 29	17	~~9~~	24.5	19.5 – 29.5	0.08	75
30 – 39	22	~~9~~	34.5	29.5 – 39.5	0.10	97
40 – 49	23	~~9~~	44.5	39.5 – 49.5	0.10	120
50 – 59	46	~~9~~	54.5	49.5 – 59.5	0.20	166
60 – 69	37	~~9~~	64.5	59.5 – 69.5	0.16	203
70 – 79	18	~~9~~	74.5	69.5 – 79.5	0.08	221
80 – 89	4	~~9~~	84.5	79.5 – 89.5	0.02	225

Age	Frequency	Midpoint, x	xf	$x - \bar{x}$	$(x - \bar{x})^2$	$(x - \bar{x})^2 f$
0 – 9	30	4.5	135	-36.89	1360.8721	40826.163
10 – 19	28	14.5	406	-26.89	723.0721	20246.0188
20 – 29	17	24.5	416.5	-16.89	285.2721	4849.6257
30 – 39	22	34.5	759	-6.89	47.4721	1044.3862
40 – 49	23	44.5	1023.5	3.11	9.6721	222.4583
50 – 59	46	54.5	2507	13.11	171.8721	7906.1166
60 – 69	37	64.5	2386.5	23.11	534.0721	19760.6677
70 – 79	18	74.5	1341	33.11	1096.2721	19732.8978
80 – 89	4	84.5	338	43.11	1858.4721	7433.8884
	$\sum f = 225$		$\sum xf = 9312.5$			$\sum (x - \bar{x})^2 f = 122022$

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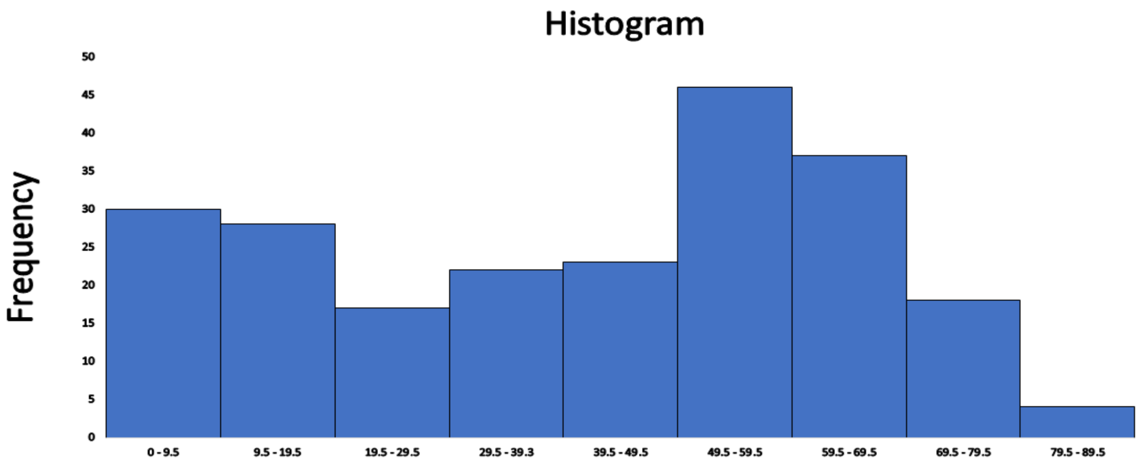
Mean: $\bar{x} = \frac{\sum xf}{n} = \frac{9312.5}{225} = 41.39$

Variance: $s^2 = \frac{\sum(x-\bar{x})^2 f}{n-1} = \frac{122022}{224} \approx 544.74$

Standard deviation: $s = \sqrt{544.74} \approx 23.34$



Problem 7

a.) Hypotheses:

$H_o: u = 13960$ (claim)

$H_a: u \neq 13960$

Level of Significance: $\alpha = 0.10$

Sample Size: $n = 500$

b.) Calculate the test statistic:

$$z = \frac{\bar{x} - u}{\frac{s}{\sqrt{n}}} = \frac{13725 - 13960}{\frac{2345}{\sqrt{500}}} \approx -2.24$$

c.) Rejection Region: ***<u>(Solution Video also uses P-Value Method)</u>***

$-z_0 = -1.645, \qquad z_0 = 1.645$

Draw a sketch that illustrates the relationship between the critical values in this situation

d.) Decision: Reject H_o

Conclusion: There is not enough evidence to support claim that the mean annual cost of raising a child (age 2 and under) by husband-wife families in the U.S. is $13,960.

Problem 8

$$z_2 = \frac{x-\mu}{\sigma} = \frac{54-45}{12} = 0.75$$
$$P(x < 54) = P(z < 0.75) = 0.7734$$

Problem 9

a) Greater than 96.25 inches. (Draw the bell curve)

$$\mu_{\bar{x}} = \mu = 96, \quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.5}{\sqrt{40}} = 0.079$$
$$z = \frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{96.25-96}{0.08} = 3.13$$
$$P(x > 96.25) = P(z > 3.13) = 0.0009$$

b) Between 95.85 inches and 96.25 inches (Draw the bell curve)

$$z_1 = \frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{95.85-96}{0.08} = -1.88$$
$$z_2 = \frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{96.25-96}{0.08} = 3.13$$

Problem 10

a) The best point estimate for the population mean μ is 22.9.

b) $E = z_c \frac{\sigma}{\sqrt{n}} = 1.645 \frac{1.5}{\sqrt{30}} \approx 0.45$

$22.9 - 0.45 < \mu < 22.9 + 0.45$

$22.45 < \mu < 23.35$

Problem 11

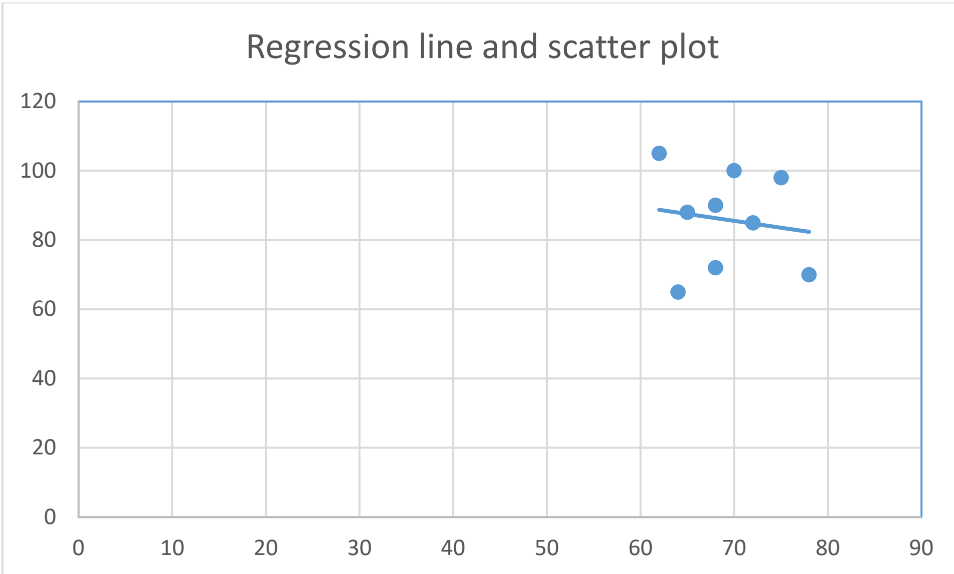
(a) $r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2}\sqrt{n\sum y^2 - (\sum y)^2}} = \frac{9(53336)-622(773)}{\sqrt{9(43206)-622^2}\sqrt{9(68007)-733^2}} =$

$\frac{480024-480806}{\sqrt{388854-386884}\sqrt{612063-597529}} = \frac{-782}{\sqrt{1970}\sqrt{14534}} = \frac{-782}{5350.88591} = -0.146$

(b) $m = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2} = \frac{9(53336)-622(773)}{9(43206)-622^2} = \frac{480024-480806}{388854-386884} = \frac{-782}{1970} \approx -0.397$

$b = \bar{y} - m\bar{x} = \frac{\sum y}{n} - m\frac{\sum x}{n} = \frac{622}{9} - (-0.397)\frac{773}{9} \approx 103.209$

(c)



Problem 12

a.) Hypotheses:

$H_o: \mu \geq 1200$

$H_a: \mu < 1200$ (claim)

Level of Significance: $\alpha = 0.10$

Sample Size: $n = 7$

b.) Calculate the test statistic:

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{1125 - 1200}{\frac{55}{\sqrt{7}}} \approx -3.608 < -1.440$$

c.) Rejection Region:

$-t_0 = -1.440$

Draw a sketch that illustrates the relationship between the critical values in this situation.

d.) Decision: Reject H_o

Yes, there is enough evidence to support the agent's claim at $\alpha = 0.10$.