Stats Homework 5 Date ____ 20__

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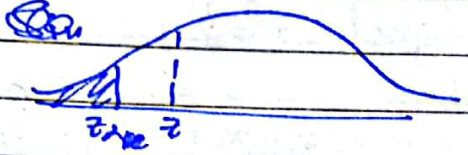
P10.1) (a) $H_0: \mu_1 - \mu_2 = 0$ $H_a: \mu_1 - \mu_2 < 0$ → single tail

$n_1 = 31$ $\bar{x}_1 = 51.3$ $\sigma_1^2 = 52$ $n_2 = 32$ $\bar{x}_2 = 53.2$, $\sigma_2^2 = 60$

$\alpha = 0.10$ $z_\alpha = -1.2816$

$z = (51.3 - 53.2) / \sqrt{52/31 + 60/32} = -1.0081$



Since $z > z_\alpha$, we fail to reject H_0!

(b) Critical values: $(\bar{x}_1 - \bar{x}_2)_c = (0) - z_\alpha \sqrt{52/31 + 60/32}$

$(\bar{x}_1 - \bar{x}_2)_c = -2.416$

(c) p-value = $P(z < -1.008) = 0.156$

P10.3) (a) $\sigma_1^2 = 22.74$ $\sigma_2^2 = 26.65$ $\alpha = 0.02$

$H_0: \mu_1 - \mu_2 \geq 0$ $H_a: \mu_1 - \mu_2 \neq 0$ → 2 tailed $\alpha/2 = 0.01$

$z_{\alpha/2} = \pm 2.3263$ $\bar{x}_1 = 88.23$ $\bar{x}_2 = 81.200$

$z_{test} = (88.23 - 81.20) / \sqrt{22.74/30 + 26.05/30} = 5.4818$

$z_{test} > z_{\alpha/2}$ → reject H_0!

(b) $(x_1 - x_2) - z\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} \leq \mu_1 - \mu_2 \leq (x_1 - x_2) + z\sqrt{\frac{\sigma_1^2}{n} + \frac{\sigma_2^2}{n}}$

$4.049 \leq \mu_1 - \mu_2 \leq 10.02$

We are at 98% confidence that the actual difference in mean is between 4.049 & 10.02. Therefore, it can't be 0, thus we rejected our hypothesis.

P10.5) $\bar{x}_A = 5.3$ $\sigma_A^2 = 1.99$ $n = 40$ $\bar{x}_B = 6.5$ $\sigma_B^2 = 2.36$ $n = 37$

CI = 95% $\alpha = 0.05$ $z_{\alpha/2} = \pm 1.96$

$(5.3 - 6.5) - 1.96\sqrt{\frac{1.99}{40} + \frac{2.36}{37}} \leq \mu_1 - \mu_2 \leq (5.3 - 6.5) + 1.96\sqrt{\frac{1.99}{40} + \frac{2.36}{37}}$

$-1.8601 \leq \mu_1 - \mu_2 \leq -0.5396$

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P 10.11) $H_0: \mu_1 - \mu_2 \geq 0$ $H_a: \mu_1 - \mu_2 < 0$

$n_1 = 8$ $\bar{x}_1 = 24.56$ $s_1^2 = 12.4$ $n_2 = 11$ $\bar{x}_2 = 26.42$ $s_2^2 = 15.8$

$\alpha = 0.01$ $\sigma = \sqrt{\frac{s_1^2(n_1-1) + s_2^2(n_2-1)}{n_1+n_2-2}} = 3.7947$

$t_{\alpha, n_1+n_2-2} = 2.5669$

$t_{test} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sigma\sqrt{\frac{1}{n_1} - \frac{1}{n_2}}} = -1.06$

Since test $<$ $t_{\alpha, df}$, we fail to reject H_0!

P10.15) $n = 21$ $\bar{x}_1 = \$122000$ $s_1^2 = 14500$ $n_2 = 26$ $\bar{x}_2 = 141500$ $s_2 = 14400$

(a) $\alpha = 0.1$ $\alpha/2 = 0.05$ $df = 21 + 26 - 2 = 45$

$t_{\alpha/2, df} = \pm 1.6794$

$\sigma = \sqrt{\frac{s_1^2(21-1) + s_2^2(26-1)}{45}} = 14444.5$

$(122000 - 141500) - 1.6794\left(\sigma\sqrt{\frac{s_1^2}{n_1} - \frac{s_2^2}{n_2}}\right) \leq \mu_1 - \mu_2 \leq (122000 - 141500) + 1.6794\left(\sigma\sqrt{\frac{s_1^2}{n_1} - \frac{s_2^2}{n_2}}\right)$

$-26617 \leq \mu_1 - \mu_2 \leq 12383$

(b) $t_{test} = (122000 - 141500) / \left(\sigma\sqrt{\frac{s_1^2}{n_1} - \frac{s_2^2}{n_2}}\right)$

$t_{test} = -4.5978$

$t_{test} < t_{\alpha/2, df}$ so we reject H_0!

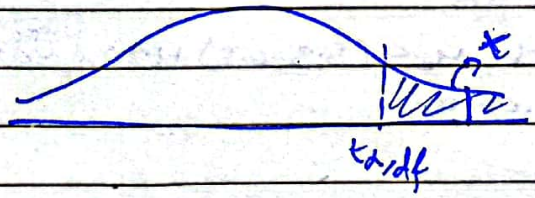
P10.21) $H_0: D \geq 0$ $H_a: D < 0$ $\alpha = 0.01$

Sample 1:	38	27	30	41	36	38	33	35	44
Sample 2:	22	28	21	38	33	26	19	31	35
d:	16	-1	9	3	-2	12	14	4	9

$n = 9$ $df = n - 1 = 8$

$t_{\alpha, df} = 2.8965$ $\bar{d} = 7.111$ $s_d = 6.4507$

$t = \bar{d} - D / \frac{s_d}{\sqrt{n}}$ $\Rightarrow t = 7.111 / (6.4507/\sqrt{9}) = 3.31$



Since $t > t_{\alpha, df}$, we reject H_0!

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P10.25) $n=11$ $\alpha=0.01$ $\alpha/2=0.005$ $df=10$

$t_{\alpha/2, df} = 3.1693$ $\bar{d}=1302.8$ $s_d=4938.2$

$$\bar{d} - t\left(s_d/\sqrt{n}\right) \le D \le \bar{d} + t\left(s_d/\sqrt{n}\right)$$

$$1302.8 - 3.1693\left(\frac{4938.2}{\sqrt{11}}\right) \le D \le 1302.8 + 3.1693\left(\frac{4938.2}{\sqrt{11}}\right)$$

$$-3416.0 \le D \le 6021.6$$

P10.31) $n_1=368$ $x_1=175$ $n_2=405$ $x_2=182$ $\alpha=0.05$

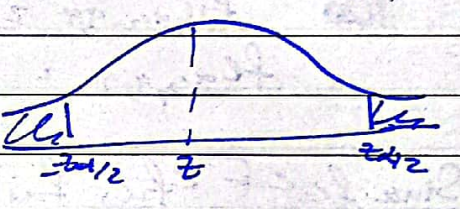
(a) $H_0: p_1 - p_2 = 0$ $H_a: p_1 - p_2 \neq 0$

$\alpha/2 = 0.025$ $z_{\alpha/2} = \pm 1.96$ $\bar{p} = \frac{x_1+x_2}{n_1+n_2} = 0.4618$

$p_1 = \frac{x_1}{n_1} = 0.4755$ $p_2 = \frac{x_2}{n_2} = 0.4494$ $\bar{q} = 1-\bar{p} = 0.5382$

$$z = \frac{(p_1-p_2)-0}{\sqrt{\bar{p}\times\bar{q}\times\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = 0.73$$

$z < z_{\alpha/2}$ → fail to reject H_0!



(b) $H_0: p_1 - p_2 = 0$ $H_a: p_1 - p_2 > 0$ $z_\alpha = 1.6449$

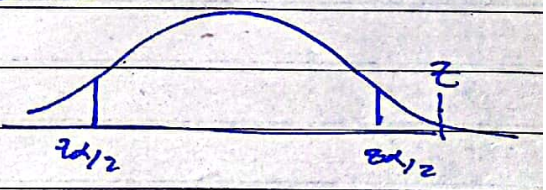
fail to reject H_0!

P10.37) $\alpha=0.1$ $n_1=780$ $p_1=0.09$ $n_2=915$ $p_2=0.06$

$H_0: p_1 - p_2 = 0$ $H_a: p_1 - p_2 \neq 0$ $z_{\alpha/2} = \pm 1.6449$

$\bar{p} = n_1p_1 + n_2p_2 / n_1+n_2 = 0.0738$ $\bar{q} = 1-\bar{p} = 0.9262$

$$z = \frac{0.09-0.06}{\sqrt{\bar{p}\times\bar{q}\times\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = 2.3545$$



Since $z > z_{\alpha/2}$, reject H_0!

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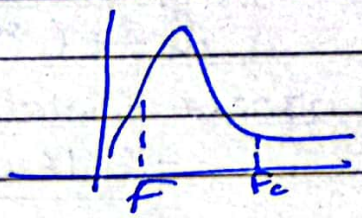
P 10-39) $H_0: \sigma_1^2 = \sigma_2^2$ $H_a: \sigma_1^2 > \sigma_2^2$ $\alpha = 0.01$

$n_1 = 10$ $n_2 = 11$ $s_1^2 = 562$ $s_2^2 = 1013$

$F = s_1^2/s_2^2 = 562/1013 = 0.5548$

$v_1 = 9$ $v_2 = 10$ $F_{critical} = 4.94$.



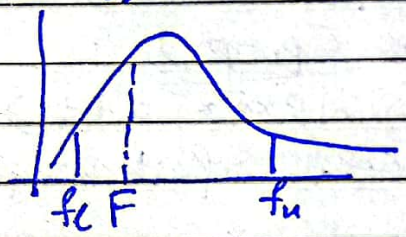
Since $F < F_c$, fail to reject H_0!

P 10-41) $\alpha = 0.01$ $n_1 = 10$ $n_2 = 10$ $v_1 = 9$ $v_2 = 9$

$s_1^2 = 0.0019$ $s_2^2 = 0.0023$ $F = s_1^2/s_2^2 = 0.8123$

$f_{u\alpha/2,9,9} = 6.5411$

$f_{l\alpha/2,9,9} = 0.1529$



Since $f_l < F < f_u$, fail to reject H_0!