Subject: Assignment 5

Date:

Group Members:

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Question 1

a) $H_0 : \sigma_1^2 = \sigma_2^2$, where σ_1 from Zinc Supplement Group, σ_2 from Placebo Grp

$H_1 : \sigma_1^2 > \sigma_2^2$

$\alpha = 0.05$

Hypothesis testing of variance of 2 independent sample using F test:

degree of freedom:

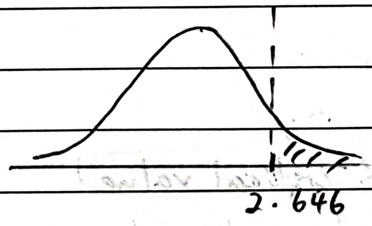
numerator: $v_1 = n_1 - 1$ $= 10 - 1$ $= 9$

denominator: $v_2 = n_2 - 1$ $= 15 - 1$ $= 14$

$F_{0.05,9,14} = 2.646$ (critical value)

$F_0 = \dfrac{s_1^2}{s_2^2}$

$= \dfrac{669^2}{728^2}$



$= 0.844$ (< 2.6458)

Since the test statistic value does not falls in the critical region, H_0 is failed to be rejected.

Conclusion:

In 0.05 significant level, there is insufficient evidence to support the claim that the variation of birth weights for the placebo population is less than the variation for the population treated with zinc supplements.

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b) Hypothesis testing for 2 dependent samples , $\alpha = 0.01$

$H_0 : \mu_D = 0$

$H_1 : \mu_D > 0$

$\bar{D} = \frac{\Sigma D}{n} = \frac{743}{5}$

$= \frac{274 + 83 + 29 + 236 + 121}{5}$

$= 148.6$

$\Sigma D^2 = 75076 + 6889 + 841 + 55696 + 14641$

$= 153143$

degree of freedom, $df = n - 1$

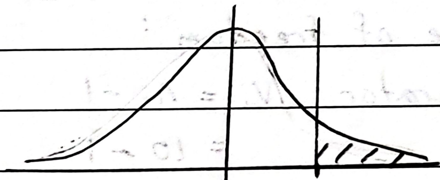
$= 4$

$S_D = \sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{n}}{n-1}}$

$= \sqrt{\frac{153143 - \frac{743^2}{5}}{5-1}}$

$= 103.360$

$t_{0.01, 4} = 3.747$ (critical value)



3.747

$t_0 = \frac{\bar{D} - \mu_0}{s_D / \sqrt{n}}$

$= \frac{148.6 - 0}{103.36 / \sqrt{5}}$

$= 3.215$ (< 3.747)

Since test statistic value does not lies in critical region, Hence H_0 is failed to be rejected.

Conclusion :

There is insuffricient evidence to support that the independent workshop has lower repair costs in a significance level of 0.01.

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Question 2

a) Hypothesis testing of proportion of 2 independent samples, $\alpha = 0.01$

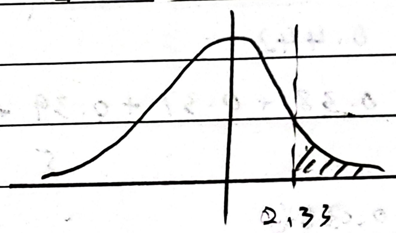
Babies Having Flu	
With medicine	Without medicine
$n_1 = 120$	$n_2 = 280$
$x_1 = 29$	$x_2 = 56$
$\hat{p}_1 = \frac{x_1}{n_1} = \frac{29}{120} = 0.2417$	$\hat{p}_2 = \frac{x_2}{n_2} = \frac{56}{280} = 0.2$
$\bar{p} = \frac{29+56}{120+280} = 0.2128$	$\bar{q} = 1 - 0.2125 = 0.7875$

$H_0 : \hat{p}_1 = \hat{p}_2$

$H_1 : \hat{p}_1 > \hat{p}_2$

$\alpha = 0.01$

$Z_{0.01} = 2.33$ (critical value)



$$Z_0 = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}}$$

$$= \frac{0.2417 - 0.2 - 0}{\sqrt{\frac{(0.2125)(0.7875)}{120} + \frac{(0.2125)(0.7875)}{280}}}$$

$$= 0.9343 \quad (< 2.33)$$

Since test statistic value does not lies in critical region, H_0 is failed to be rejected.

Conclusion :

In 0.01 significant level, there is insufficient evidence to support the company's claim of the effectiveness of the flu medicine.

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b) Hypotesis testing on mean of 2 independent samples with unknown variance assuming $\sigma_1^2 = \sigma_2^2$, $\alpha = 0.05$

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$

$$\bar{x}_1 = \frac{0.48 + 0.39 + 0.42 + 0.52 + 0.40}{5}$$

$$= 0.442$$

$$\bar{x}_2 = \frac{0.38 + 0.37 + 0.39 + 0.41 + 0.38}{5}$$

$$= 0.386$$

$$s_1 = \sqrt{\frac{(0.48 - 0.442)^2 + (0.39 - 0.442)^2 + (0.42 - 0.442)^2 + (0.52 - 0.442)^2 + (0.4 - 0.442)^2}{5 - 1}}$$

$$= 0.0559$$

$$s_2 = \sqrt{\frac{(0.38 - 0.386)^2 + (0.37 - 0.386)^2 + (0.39 - 0.386)^2 + (0.41 - 0.386)^2 + (0.38 - 0.386)^2}{5 - 1}}$$

$$= 0.0152$$

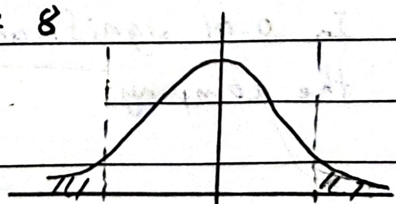
$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{(5-1)(0.0559^2 + 0.0152^2)}{5 + 5 - 2}}$$

$$= 0.0410$$

$df = n_1 + n_2 - 2$

$= 8$



$-t_{0.025,8} = -2.306$ $\quad t_{0.025,8} = 2.306$

$$t_0 = \frac{\bar{x}_1 - \bar{x}_2 - (\mu_1 - \mu_2)}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$= \frac{0.442 - 0.386}{0.041\sqrt{1/5 + 1/5}}$$

$$= 2.1596$$

$\therefore -2.306 < t_0 < 2.1596$

Since test statistic does not lies in critical region, H_0 failed to be rejected. There is sufficient evidence to conclude that production line 1 is producing as consistently as production line 2 in terms of alcohol content at significant level of 0.05.

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c) Hypothesis testing of 2 dependent samples, $\alpha = 0.05$

$H_0 : \mu_D = 0$

$H_1 : \mu_D < 0$

B4 training, x_1	Af training, x_2	D	D^2
204	223	-19	361
393	412	-19	361
391	402	-11	121
265	285	-20	400
326	353	-27	729
220	243	-23	529
423	443	-20	4.00
342	340	2	4
480	582	-102	10404
464	490	-26	676
		-265	13985

$$s_D = \sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{n}}{n-1}}$$

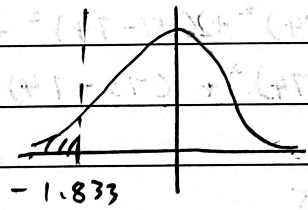
$$= \sqrt{\frac{13985 - \frac{-265^2}{10}}{9}}$$

$$= 27.81$$

$df = n - 1$

$= 9$

$-t_{0.05,9} = -1.833$ (critical value)



$$\bar{D} = \frac{-265}{10}$$

$$= -26.5$$

$$t = \frac{\bar{D} - \mu_D}{s_D/\sqrt{n}}$$

$$= \frac{-26.5 - 0}{27.81/\sqrt{10}}$$

$$= -3.01 \quad (< \text{critical value} = 1.833)$$

Since test statistic value lies in critical region, Ho is rejected.

Conclusion :

There is sufficient evidence to conclude that training can increase number of words spelled correctly by participants in significance level of 0.05

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Question 3

a) Hypothesis testing of mean of 2 independent samples with unknown population variance assuming $\sigma_1^2 = \sigma_2^2$, $\alpha = 0.05$

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 < \mu_2$

$$\bar{x}_1 = \frac{71+75+65+69+73+66+68+71+74+68}{10}$$

$= 70$

$$\bar{x}_2 = \frac{72+77+84+78+69+70+77+73+65+75}{10}$$

$= 74$

$$s_1 = \sqrt{\frac{(71-70)^2+(75-70)^2+(65-70)^2+(69-70)^2+(73-70)^2+(66-70)^2 + (68-70)^2+(71-70)^2+(74-70)^2+68-70)^2}{10-1}}$$

$= 3.3665$

$$s_2 = \sqrt{\frac{(72-74)^2+2(77-74)^2+(84-74)^2+(78-74)^2+(69-74)^2+(70-74)^2+(73-74)^2+(65-74)^2+(75-74)^2}{10-1}}$$

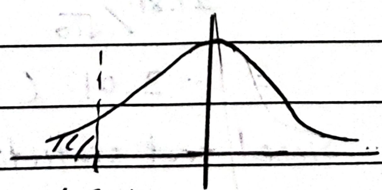
$= 5.3955$

$$S_p = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$$

$df = n_1+n_2-2 = 18$

$-t_{0.05,18} = -1.734$

$$= \sqrt{\frac{(10-1)(3.3665)^2+(10-1)(5.3955)^2}{10+10-2}}$$



-1.734

$= 4.4969$

$$t_0 = \frac{70-74-0}{4.4969\sqrt{1/10+1/10}}$$

$= -1.989$ (<-1.734)

$\therefore$ Since t_0 lies in critical region, H_0 is rejected. There is sufficient evidence to support that Method B is more effective in significance level of 0.05.

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b) Hypothesis testing of 2 dependent samples, $\alpha = 0.01$

$H_0 : \mu_D = 0$

$H_1 : \mu_D > 0$

B4, x_1 :	95	81	76	96	82	87	71	82	77	83	81	65	
Af, x_2	89	77	77	94	80	86	72	82	74	81	78	63	
D	6	4	-1	2	2	1	-1	0	3	2	3	2	23
D^2	36	16	1	4	4	1	1	0	9	4	9	4	89

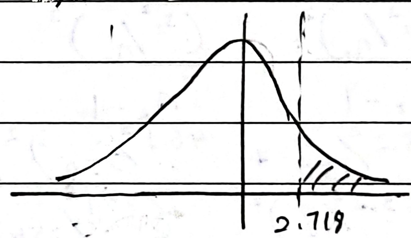
$$S_D = \sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{n}}{n-1}}$$

$$= \sqrt{\frac{89 - \frac{23^2}{12}}{12-1}}$$

$$= 2.0207$$

$df = 12 - 1$
$= 11$

$t_{0.01, 11} = 2.718$ (critical value)



$$\bar{D} = \frac{\Sigma D}{n}$$

$$= \frac{23}{12}$$

$$= 1.9167$$

$$t_0 = \frac{\bar{D} - \mu_D}{S_D / \sqrt{n}}$$

$$= \frac{1.9167 - 0}{2.0207/\sqrt{12}}$$

$$= 3.2858 \quad (> 3.2858)$$

Since t_0 lies in the critical region, H_0 is rejected.

Conclusion:

In significance level of 0.01, there is sufficient evidence to conclude that prescribed program is effective.

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Question 4

a) Hypothesis testing on mean of 2 independent samples with unknown population variance assuming $\sigma_1^2 \neq \sigma_2^2$, $\alpha = 0.05$

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$

$n_1 = 150$, $s_1 = 53.20$, $\bar{x}_1 = 75.50$

$n_2 = 250$, $s_2 = 46.10$, $\bar{x}_2 = 65.20$

degree of freedom :

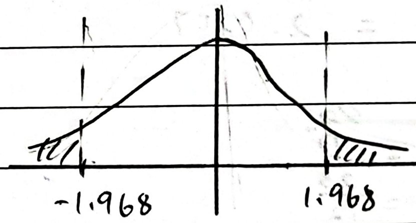
$$v = \frac{\left(s_1^2/n_1 + s_2^2/n_2\right)^2}{\frac{\left(s_1^2/n_1\right)^2}{n_1 - 1} + \frac{\left(s_2^2/n_2\right)^2}{n_2 - 1}}$$

$$= \frac{\left(53.2^2/150 + 46.1^2/250\right)^2}{\frac{\left(53.2^2/150\right)^2}{150 - 1} + \frac{\left(46.1^2/250\right)^2}{250 - 1}}$$

$= 279.55$

≈ 280

$t_{0.025, 280} = 1.968$



$$t_0 = \frac{\bar{x}_1 - \bar{x}_2 - (\mu_1 - \mu_2)}{\sqrt{s_1^2/n_1 + s_2^2/n_2}}$$

$$= \frac{75.50 - 65.20 - 0}{\sqrt{\frac{53.20^2}{150} + \frac{46.10^2}{250}}}$$

$= 1.9688$ (> 1.968)

Since t_0 lies in critical region, H_0 is rejected.

Conclusion :

There is insufficient evidence to conclude that there is no difference in the mean spending between these two populations at 0.05 significant level.

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b) Hypothesis testing of 2 dependent samples, $\alpha = 0.05$

$H_0 : \mu_D = 3$

$H_1 : \mu_D > 3$

Student	1	2	3	4	5	6	7	8	9	10	
1hr, x_1	14	12	18	7	11	9	16	15	13	17	
24hr, x_2	10	4	14	5	8	5	11	12	9	10	
D	4	8	4	2	3	4	5	3	4	7	44
D^2	16	64	16	4	9	16	25	9	16	49	224

$$s_D = \sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{n}}{n-1}}$$

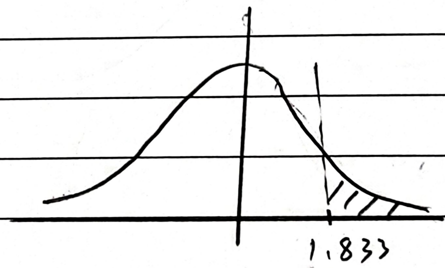
$$= \sqrt{\frac{224 - \frac{44^2}{10}}{9}}$$

$$= 1.8379$$

$df = 10 - 1$

$= 9$

$t_{0.05, 9} = 1.833$



$$\bar{D} = \frac{\Sigma D}{n}$$

$$= \frac{44}{10}$$

$$= 4.4$$

$$t_0 = \frac{\bar{D} - \mu_D}{s_D/\sqrt{n}}$$

$$= \frac{4.4 - 3}{1.8379/\sqrt{10}}$$

$$= 2.409 \quad (> 1.833)$$

Since t_0 lies in critical region, H_0 is rejected.

Conclusion:

There is sufficient evidence to conclude that mean number recalled after 1 hour exceeds the mean recall after 24 hours by more than 3.