MA-331 : Midterm - Aparajita Rana

1)

	sample size	mean	std dev
organic	20	5.58	0.59
control	20	5.08	0.62
comfort	22	4.89	0.57

{Overall ≈ 5.18}

2) $F = \frac{s_1^2}{s_2^2} = \frac{0.59^2}{0.57^2} = 1.07$ (Testing Stats)

Degrees of Freedom = 20-1, 22-1, = 19, 21

$\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2 \Big/ \frac{1}{n_1-1}\left(\frac{s_1^2}{n_1}\right)^2 + \frac{1}{n_2-1}\left(\frac{s_2^2}{n_2}\right) = \frac{0.001}{0.016} \approx 0.625$ (?)

precise

$p(F > 1.07) = 1 - pf(1.07, 19, 21) < \alpha$

$0.44 > \alpha = 0.05$, because $p = 0.44$ which is greater than $\alpha = 0.05$, we fail to reject the null hypothesis.

3) $H_0: \mu_{organic} = \mu_{comfort}$

$H_a: \mu_{organic} \neq \mu_{comfort}$

$t = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{5.58 - 4.89}{\sqrt{\frac{0.59^2}{20} + \frac{0.57^2}{22}}} = 3.847$

Degrees of Freedom: $\left[\frac{\left(\frac{s_1^2}{n_1}\right)^2 + \left(\frac{s_2^2}{n_2}\right)^2}{\left(\frac{1}{n-1}\right)\left(\frac{s_1^2}{n_1}\right) + \frac{1}{n_2-1}\left(\frac{s_2^2}{n_2}\right)}\right] = 39.313$ → ceiling = 40

$p\text{-val} = P(|T| > 13.851) = 2 \cdot pt(-3.847, 40)$

$= 0.00042 < 0.05$, Since $p = 0.00042$ is less $\alpha = 0.05$, we reject the null ~~hypo~~

4) i)

	mean	std	std^2
organic	5.58	0.59	0.35
control	5.08	0.62	0.38
comfort	4.89	0.57	0.32

Overall avg = 5.17

ii) $SSB = \sum_{i=1}^{k} n_i(\bar{x}_i - \bar{x}_j)^2 = 20(5.17-5.58)^2 + 20(5.17-5.08)^2 + 22(5.17-4.89)^2 = 5.2488$

$SSE = \sum_{i=1}^{k} (n_i - 1)s_i^2 = 19(0.57)^2 + 19(0.62)^2 + 21(0.57)^2 = 20.74$

$SST = SSB + SSE$ → $20.74 + 5.2488 = 25.9888$

iii)

source	df	SS	MS	F	p-val
group	k-1=2	5.248	2.624	7.47	0.0013
error	n-k=59	20.74	0.3515		
total	61	25.98			

iv) Since $p = 0.0013 < 0.05$ we reject the null hypothesis because mean of org and comfort are not equal.

v) $R^2 = \frac{SSB}{SST} = 0.2019 \approx 0.202$

5) i) $T_{i,j} = \frac{5.58 - 4.89}{\sqrt{0.35\left(\frac{1}{20} + \frac{1}{22}\right)}} = \frac{0.69}{\sqrt{0.035}} = 3.69$

$P(|T_{i,j}| > 3.69)$ → Degrees freedom = 59

p-value $= 2(1 - pt(3.69, 59)) \approx 0.0004$

ii) $0.0004 < 0.05$ → So we reject null hypothesis since organic and comfort are different.