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Homework 6

11/7/19

"I pledge my honor that I have abided by the Stevens Honor System." JNelson

Problem 12.31

104 employees — BMI 30-40 kg/m²

randomly assigned

Control
- link to info

Ind-Insentive
- link to info
- $100 every monthly target hit

Group-Insentive
- link to info
- $100 every monthly (4wk) goal/target hit
- secret groups of 5 and at end of 4wk those that met their goal (in individual insentive) split $500

24 weeks (weight in pounds)

② table: sample size, mean, std dev. for each group

Group	n	$\bar{x}$	std. dev.
Control	35	-1.01	11.50
Indiv.	35	-10.79	11.14
Group.	34	-3.71	9.08

Std dev work

$$s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

⑥

	Variance
Control	132.25
Indiv	~~124.0996~~ 124.10
Grap	82.45

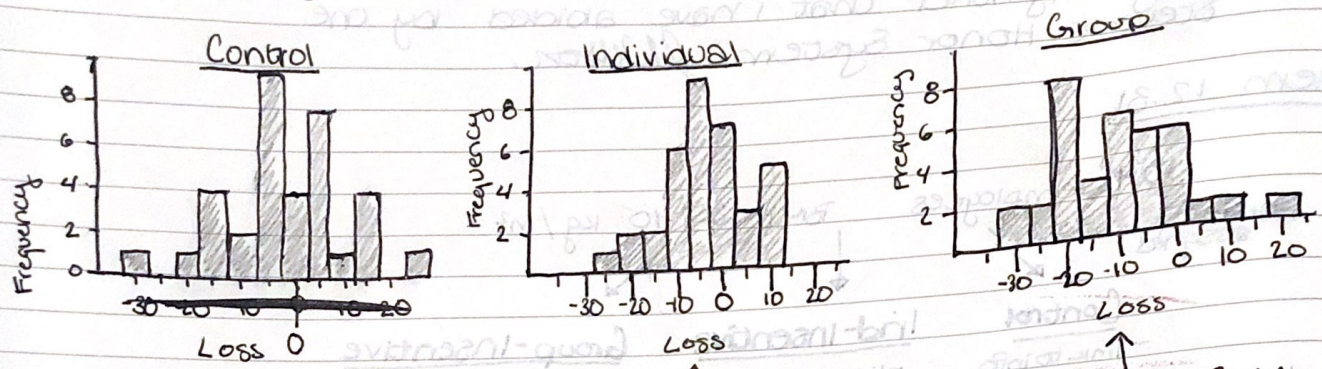
→ $\frac{132.25}{82.45} = 1.604$ → $\sqrt{1.604} < 2$

$1.27 < 2$ ✓

Yes ⇒ Reasonable to pool variance

In order to pool variances, they must be similar enough (small enough differences).
To test this, take the largest variance / smallest variance and then $\sqrt{\ }$ to get difference of standard deviations.
If this number is < 2, it is reasonable to pool variances.

© histograms.



somewhat ↗ Symmetric (

$\bar{x} = -1.01$
med = -1.20

↑ Skewed ~~Left~~ Right

$\bar{x} = -10.79$
med = -11.35

↑ Skewed Right

$\bar{x} = -3.71$
med = -4.70

Although Individual + Group's Histograms are slightly skewed, when comparing the means to medians, there is not much of a difference (<1) w/ same freq's so its appropriate to say that the sample means are approximately Normal

Problem 12.32

(a) One-Way ANOVA
Loss vs. Group Factor

H_0: All means equal
H_a: Atleast 1 mean is not equal
$\alpha = 0.05$

Source	DF	SS	MS	F-value	P-value
Group	2	1753	876.3	7.77	0.001
Error	101	11394	112.8		
Total	103	13147			

F-value = 7.77
P-value = 0.001
DF = [2], 101, [103]
P
0.001 < 0.5
Reject H_0: All means equal
So, atleast 1 mean is different

(c) Least sig difference

Indiv is significantly different

lost my screen shot of work working from memory (no wifi) to meet deadline sorry

(d) From part A we found that $p < 0.5$

So we Rejected the Null Hyp: all $\bar{X}$'s are equal

From part C we found that the Indiv group has a significant difference from Grp and Ctrl.

Problem 12.33

(a) Loss/2.2

(b) H_0: all means equal
H_A: atleast 1 different α: 0.05

Source	DF	SS	MS	F-value	P-value
Group	2	362.1	181.05	7.77	0.001
Error	101	2354.1	23.31		
Total	103	2716.2			

Compared to part A of 12.32 ...
F and P-values are the same
DF is also the same
Differences appear in SS and MS

since P is same as before → we still must REJECT the Null Hypothesis. ($P < 0.5$)

We only divide the lbs Loss by a # k never changing distributions b/w #s Loss

Problem 12.41

M_1, M_2, M_3, M_4 represent mean scores for blue, brown, gaze down, and green eyes

(a) Avg Brown vs. other colors

$$\Psi_1 = M_2 - \left(\frac{M_1 + M_4}{2}\right)$$

M_3 doesn't represent a color - gaze down $\bar{x}$
M_2 = brown $\bar{x}$
M_1 = blue $\bar{x}$
M_4 = green $\bar{x}$

Brown - $\left(\frac{\text{Blue} + \text{Green}}{2}\right)$

(b) Looking at You vs Down

$$\Psi_2 = \left(\frac{M_1 + M_2 + M_4}{3}\right) - M_3$$

$\left(\frac{\text{Blue} + \text{Green} + \text{Brown}}{3}\right)$ - Gazed Down

Problem 12.42

	N	$\bar{x}$	stand dev
Blue	67	3.19403	1.75
Brown	37	3.7243	1.72
Grizzled Down	41	3.10731	1.53
Green	77	3.8597	1.67

(a)

$\psi_1 = \mu_2 - \left(\frac{\mu_1 + \mu_4}{2}\right)$

$H_0: \psi_1 = 0$

$H_a: \psi_1 \neq 0$

$\psi_2 = \left(\frac{\mu_1 + \mu_2 + \mu_4}{3}\right) - \mu_3$

$H_0: \psi_2 = 0$

$H_a: \psi_2 \neq 0$

These look at population mean NOT sample means

(b) sample contrasts C_1, C_2

ψ_1

$C_1 = \bar{x}_2 - \left(\frac{\bar{x}_1 + \bar{x}_4}{2}\right)$

$= 3.7243 - \left(\frac{3.19403 + 3.8597}{2}\right)$

$= 0.197435$

$C_1 = 0.197$

ψ_2

$C_2 = \left(\frac{\bar{x}_1 + \bar{x}_2 + \bar{x}_4}{3}\right) - \bar{x}_3$

$= \left(\frac{3.19403 + 3.7243 + 3.8597}{3}\right) - 3.10731$

$= 0.485366$

$C_2 = 0.485$

(c) Calculate Stnd Errors SE_{c_1} SE_{c_2}

$SE_{C_1} = s_p\sqrt{\sum \frac{a_i^2}{n_i}}$

$= 1.677\sqrt{\frac{1^2}{37} + \frac{(-1/2)^2}{67} + \frac{(-1/2)^2}{77}}$

$= 0.309246$

$= 0.309$

$SE_{C_2} = s_p\sqrt{\sum \frac{a_i^2}{n_i}}$

$= 1.677\sqrt{\frac{(1/3)^2}{67} + \frac{(1/3)^2}{37} + \frac{(1/3)^2}{77} + \frac{(-1)^2}{41}}$

$= 0.2928496$

$= 0.293$

(d)

$F = 2.89$

test stat = $\frac{c_1}{SE_{c_1}} = \frac{0.197}{0.3093} = 0.636922$ ~~= 0.687~~ = 0.64

Num DF = $k-1 = 4-1 = 3$

Den DF = $N-k = 222-4 = 218$

P-value ~~(…)~~ = 0.52 ← from ANOVA + tests

$P \not< 0.05$

$0.52 > 0.05$

Fail to Reject H_0

Not enough support for Avg Brown and Avg of others are different

test stat = $\frac{c_2}{SE_{c_2}} = \frac{0.485}{0.293} = 1.655 = 1.66$

Num DF = $k-1 = 4-1 = 3$

Den DF = $N-k = 222-4 = 218$

Pval (from anova/t test) = 0.098

$P \not< 0.05$

$0.098 > 0.05$

Fail to Reject H_0

Not enough support for avg of looking + gazing down

(e) 95% Conf Int for 2 contrasts

ψ_1

df = 222-1 = 221

$\alpha = .05$

Crit val = 1.9707

$0.197 \pm (1.9707 * 0.3093)$

$\Rightarrow = -0.41253751$

$= 0.80653751$

95% CI ψ_1 lies b/w → (-0.41, 0.81)

ψ_2

df = 222-1 = 221

$\alpha = 0.05$

Crit val = 1.9707

$0.485 \pm (1.9707 * 0.293)$

$\Rightarrow = -0.0924151$

$= 1.0624151$

95% CI for ψ_2 → (-0.09, 1.06)