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MA 331
Professor Li
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I pledge my honor that I have abided by the Stevens Honor System.

Homework 6

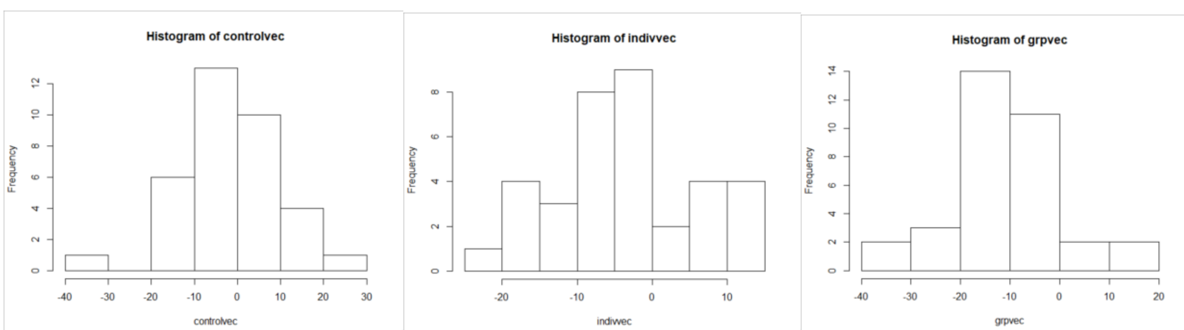
12.31a.

	Sample Size	Mean	Standard Deviation
Control	35	-1.009	11.5
Individual	35	-3.708	9.078
Group	34	-10.785	11.139

12.31b.

Yes it is, 2(9.078) = 18.156 > 11.139.

12.31c.



The distributions look quite normal, and thus we can feel confident that the sampling distribution is normal. With sample sizes > 34, small abnormality is expected and can be overlooked.

12.32.

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1752.604	2	876.3018	7.767885	0.000728	3.086371
Within Groups	11393.9	101	112.8109			
Total	13146.5	103				

My conclusion is that there is a 0.0728 % chance that the means are all equal. This is very low, and it is very likely that the survey can draw some correlation between weight loss and financial incentive for weight loss.

$$T_{1,2} = \frac{-1.009 - (-3.708)}{\sqrt{112.81 * \left(\frac{1}{35} + \frac{1}{35}\right)}}$$
$$T_{1,2} = \frac{2.699}{2.539} = 1.06$$
$$P(|t_{101}| > |1.06|) = 1 - 0.708 = 0.292$$
$$T_{1,3} = \frac{-1.009 - (-10.785)}{\sqrt{112.81 * \left(\frac{1}{35} + \frac{1}{34}\right)}}$$
$$T_{1,3} = \frac{9.776}{2.557} = 3.823$$
$$P(|t_{101}| > |3.823|) = 0.00022$$
$$T_{2,3} = \frac{-3.708 - (-10.785)}{\sqrt{112.81 * \left(\frac{1}{35} + \frac{1}{35}\right)}}$$
$$T_{2,3} = \frac{7.077}{2.539} = 2.787$$
$$P(|t_{101}| > |2.787|) = 0.00636$$

My conclusion in general is that there is very strong evidence that there is a difference among the population means, as concluded by the very small value in the ANOVA test. The least significant test also yields that the control and group groups and the individual and group groups are very different, with P values less than 0.01 for both tests.

12.33.

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	362.1082	2	181.0541	7.767885	0.000728	3.086371
Within Groups	2354.111	101	23.30803			
Total	2716.219	103				

We find the same P value for the test, which makes sense, given that we just converted the units to a different system.

12.41.

$C_1 = \mu_2 - 0.5(\mu_1 + \mu_4)$

$C_2 = 1/3\ (\mu_1 + \mu_2 + \mu_4) - \mu_3$

12.42a.

$H_0 : C_1 = 0$ (i.e. $\mu_2 = 0.5(\mu_1 + \mu_4)$)
$H_a : C_1 \neq 0$ (i.e. $\mu_2 \neq 0.5(\mu_1 + \mu_4)$)

H_0 : $C_2 = 0$ (i.e. $1/3\ (\mu_1 + \mu_2 + \mu_4) = \mu_3$)
H_a : $C_2 \neq 0$ (i.e. $1/3\ (\mu_1 + \mu_2 + \mu_4) \neq \mu_3$)

12.42b.

$C_1 = 3.72 – 0.5(3.19) – 0.5(3.86) = 0.195$

$C_2 = 1/3(3.19) + 1/3(3.72) + 1.3(3.86) – 3.11 = 0.48$

12.42c.

Pooled variance = MSE = $\frac{\sum_{i=1}^{k}(n_i-1)S_i^2}{n-k}$

$$\frac{66(1.75)^2 + 36 * (1.72)^2 + 40(1.53)^2 + 76(1.67)^2}{67 + 37 + 41 + 77 - 4}$$
$$\frac{202.125 + 106.5024 + 93.636 + 211.9564}{218} = 2.818$$

$$SE_1 = \sqrt{S_p^2 \sum_{i=1}^{k} \frac{a_i^2}{n_i}} = \sqrt{2.818 * \left(\frac{1}{37} + \frac{0.25}{67} + \frac{0.25}{77}\right)} = 0.310$$
$$SE_2 = \sqrt{S_p^2 \sum_{i=1}^{k} \frac{a_i^2}{n_i}} = \sqrt{2.818 * \left(\frac{1}{9 * 67} + \frac{1}{9 * 37} + \frac{1}{9 * 77} + \frac{1}{41}\right)} = 0.293$$

12.42d.

$$T_1 = \frac{C_1}{SE_1} = \frac{0.195}{0.310} = 0.629$$
$$P(|t_{218}| > |0.629|) = 0.53$$
$$T_2 = \frac{C_2}{SE_2} = \frac{0.48}{0.293} = 1.638$$
$$P(|t_{218}| > |1.638|) = 0.103$$

12.42e.

$$CI_1 = C_1 \pm t_{1-\frac{0.95}{2}}(218) * SE_1$$
$$CI_1 = 0.195 \pm t_{0.475}(218) * 0.310$$
$$CI_1 = 0.195 \pm 1.971 * 0.310 = (-0.416, 0.806)$$
$$CI_2 = C_2 \pm t_{1-\frac{0.95}{2}}(218) * SE_2$$
$$CI_2 = 0.480 \pm t_{0.475}(218) * 0.293$$
$$CI_2 = 0.480 \pm 1.971 * 0.293 = (-0.098, 1.058)$$