HW #6

6.4, 6.11, 6.12, 6.16, 6.21, 6.23

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6.4

(d) is true: the range cannot be smaller than 2.2 Btu/lb.

6.11

The t-ratio will be the same since both the estimate and standard error will be scaled by a factor of 3.

6.12

We start with a look at the means by group:

Handicap	lsmean	SE	df	lower.CL	upper.CL
Amputee	4.43	0.436	65	3.56	5.30
Crutches	5.92	0.436	65	5.05	6.79
Hearing	4.05	0.436	65	3.18	4.92
None	4.90	0.436	65	4.03	5.77
Wheelchair	5.34	0.436	65	4.47	6.21

We want to contrast the *mobility* handicaps (amputee, crutches, wheelchair) with the *communication* handicaps (hearing), so we use the linear combination

$$\begin{aligned}\gamma &= \frac{A + C + W}{3} - H \\ &= \frac{1}{3}A + \frac{1}{3}C + \frac{1}{3}W - H.\end{aligned}$$

This gives us:

contrast	estimate	SE	df	t.ratio	p.value
Mobility vs. Communication	1.18	0.504	65	2.343	0.022

This indicates that there is good evidence of a difference, though not overwhelming.

6.16

We have data with 36 subjects divided into 6 groups. For the *LSD* method, we use $n - I = 30$ degrees of freedom, so the 97.5% critical value of t_{30} (and the multiplier) is 2.042. Since the *F*-test *p*-value is large (0.085), using the *F*-protected *LSD* comparison we would declare no difference between any groups. Tukey-Kramer gives us a multiplier of $\frac{q_{6,30}(0.95)}{\sqrt{2}} = \frac{4.301}{\sqrt{2}} = 3.042$. Using Bonferroni we get $k = \frac{6(6-1)}{2} = 15$, and so we use a multiplier of $t_{30}(1 - \frac{0.05}{2k}) = t_{30}(0.9983) = 3.189$. Scheffe's multiplier is $\sqrt{(6-1)F_{5,30}(0.95)} = 3.559$.

6.21

We start with an ANOVA analysis:

term	df	sumsq	meansq	statistic	p.value
Educ	4	6.882351e+11	172058784379	89.61	0
Residuals	2579	4.951743e+12	1920024320		

This shows that there are significant differences between groups.

a

Using Tukey-Kramer:

contrast	estimate	conf.low	conf.high	adj.p.value
>16-<12	48554	36577	60531	0.0000
12-<12	8563	-2355	19482	0.2031
13:15-<12	16575	5293	27856	0.0006
16-<12	41696	29845	53546	0.0000
12->16	-39991	-47221	-32760	0.0000
13:15->16	-31980	-39747	-24212	0.0000
16->16	-6858	-15431	1714	0.1861
13:15-12	8011	2002	14020	0.0026
16-12	33132	26113	40151	0.0000
16-13:15	25121	17550	32692	0.0000

All of these differences are significant except for “12 - <12” and “16 - >16”, though “13:15 - 12” is less significant than the rest.

b

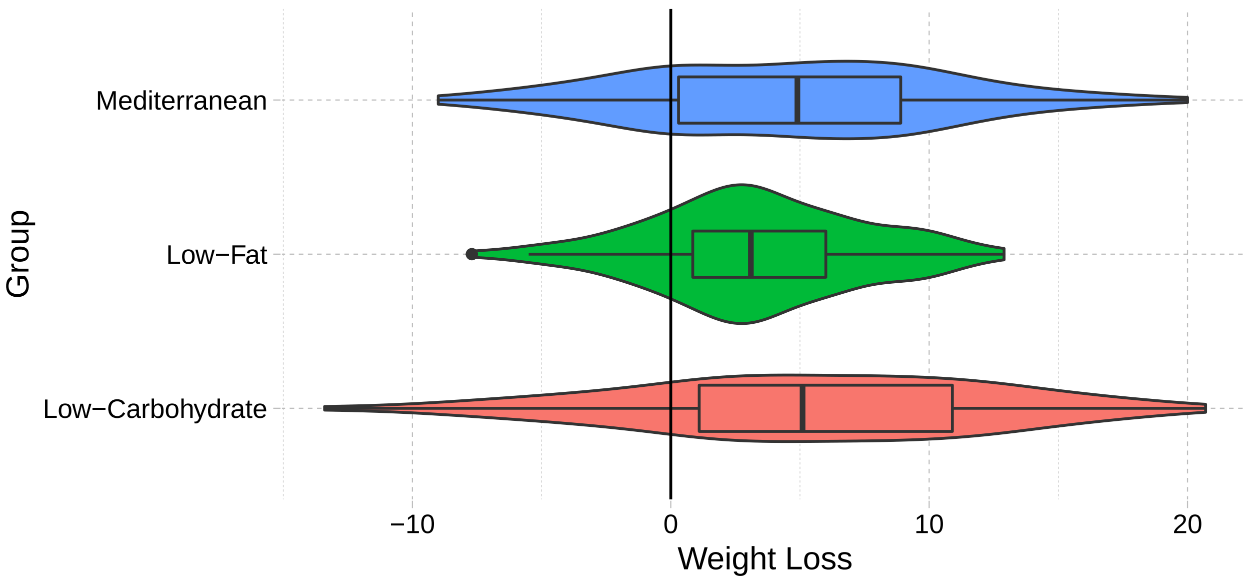
Using Dunnett:

	diff	lwr.ci	upr.ci	pval
<12-12	-8563	-18486	1359	0.1180
>16-12	39991	33420	46561	0.0000
13:15-12	8011	2551	13471	0.0011
16-12	33132	26754	39510	0.0000

All of these differences are significant except for “<12 - 12”.

6.23

Looking at a plot of the data:



Running a one-way ANOVA test gives:

term	df	sumsq	meansq	statistic	p.value
Group	2	216.86	108.43	3.236	0.0409
Residuals	269	9013.89	33.51		

This gives weak evidence that there is a difference between at least two of the means. A Tukey analysis at 95% confidence gives:

contrast	estimate	conf.low	conf.high	adj.p.value
Low-Fat-Low-Carbohydrate	-2.183	-4.225	-0.141	0.0329
Mediterranean-Low-Carbohydrate	-0.885	-2.932	1.162	0.5657
Mediterranean-Low-Fat	1.298	-0.697	3.293	0.2771

This gives evidence that there is a difference between the Low-Fat and Low-Carb diets, though again, the evidence is not overwhelming.