

3.9: Try It!

? Exercise 3.9.1: Diet Study

The weight gain due to 4 different diets given to 24 calves is shown below.

diet1	diet2	diet3	diet4
12	18	10	19
10	19	12	20
13	18	13	18
11	18	16	19
12	19	14	18
09	19	13	19

a) Write the appropriate null and alternative hypotheses to test if the weight gain differs significantly among the 4 diets.

Solution

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$ vs. $H_a: \mu_i \neq \mu_j \text{ for some } (i, j = 1, 2, 3, 4 \text{ OR "Not all means are equal"})$

Note: Here, μ_i , $i = 1, 2, 3, 4$ are the actual mean weight gains due to diet1, diet2, diet3, and diet4, respectively.

b) Analyze the data and write your conclusion.

Solution

Using SAS...

```
data Lesson3_ex1;
input diet $ wt_gain;
datalines;
diet1 12
diet1 10
diet1 13
diet1 11
diet1 12
diet1 09
diet2 18
diet2 19
diet2 18
diet2 18
diet2 19
diet2 19
diet3 10
diet3 12
diet3 13
diet3 16
diet3 14
diet3 13
diet4 19
diet4 20
diet4 18
diet4 19
diet4 18
diet4 19
;
ods graphics on;
proc mixed data= Lesson3_ex1 plots=all; class diet;
model wt_gain = diet;
contrast 'Compare diet1 with diets 2,3,4 combined ' diet 3 -1 -1 -1;
store result1;
title 'ANOVA of Weight Gain Data';
run;
ods html style=statistical sge=on;
proc plm restore=result1;
lsmeans diet/ adjust=tukey plot=meanplot cl lines;
run;
```

The ANOVA results shown below indicate that the diet effect is significant with an F -value of 51.27 (p -value <.0001). This means that not all diets provide the same mean weight gain. The diffogram below indicates the significant different pairs of diets identified by solid blue lines. The estimated mean weight gains from diets 1, 3, 2, and 4 are 11, 13, 18.1, and 19 units respectively. The diet pairs that have significantly different mean weight gains are (1,2), (1,4), (3,2), and (3,4).

Partial Output:

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
diet		3	20	51.27
				<.0001

diet Least Squares Means									
diet	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper	
diet1	11.1667	0.5413	20	20.63	<.0001	0.05	10.0374	12.2959	
diet2	18.5000	0.5413	20	34.17	<.0001	0.05	17.3708	19.6292	
diet3	13.0000	0.5413	20	24.01	<.0001	0.05	11.8708	14.1292	
diet4	18.8333	0.5413	20	34.79	<.0001	0.05	17.7041	19.9626	

Differences of diet Least Squares Means Adjustment for Multiple Comparisons: Tukey												
diet	_diet	Estimate	Standard Error	DF	t Value	Pr > t	Adj P	Alpha	Lower	Upper	Adj Lower	Adj Upper
diet1	diet2	-7.3333	0.7656	20	-9.58	<.0001	<.0001	0.05	-8.9303	-5.7364	-9.4761	-5.1906
diet1	diet3	-1.8333	0.7656	20	-2.39	0.0265	0.1105	0.05	-3.4303	-0.2364	-3.9761	0.3094
diet1	diet4	-7.6667	0.7656	20	-10.01	<.0001	<.0001	0.05	-9.2636	-6.0697	-9.8094	-5.5239
diet2	diet3	5.5000	0.7656	20	7.18	<.0001	<.0001	0.05	3.9030	7.0970	3.3572	7.6428
diet2	diet4	-0.3333	0.7656	20	-0.44	0.6679	0.9716	0.05	-1.9303	1.2636	-2.4761	1.8094
diet3	diet4	-5.8333	0.7656	20	-7.62	<.0001	<.0001	0.05	-7.4303	-4.2364	-7.9761	-3.6906

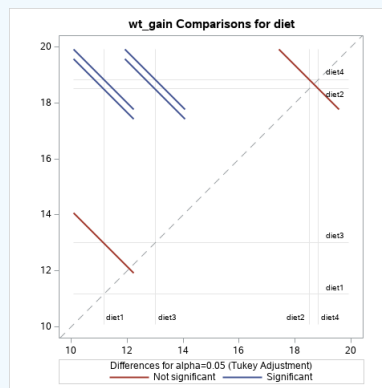


Figure 3.9.a1: SAS-generated diffogram for weight gain comparisons by diet.

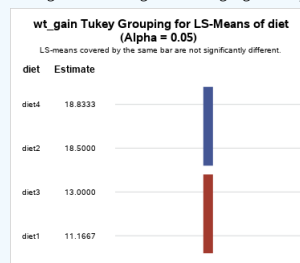


Figure 3.9.a2: SAS-generated Tukey grouping of weight gains for diet LS-means.

? Exercise 3.9.2: Commuter Times

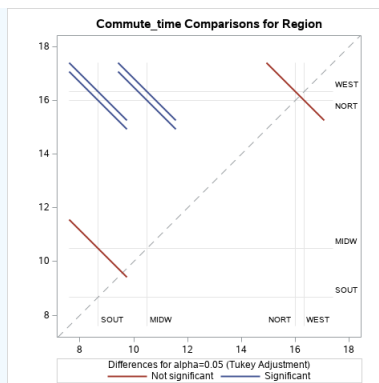


Figure 3.9.b1: Commute time comparisons in hours by region.

Above is a diffogram depicting the differences in daily commuter time (in hours) among regions of a metropolitan city. Answer the following.

a) Name the regions included in the study.

Solution

SOUT, MIDW, NORT, and WEST

b) How many red or blue lines are to be expected?

Solution

4 choose 2 = 6 red or blue lines

c) Which pairs of regions have significantly different average commuter times?

Solution

(SOUT and NORT), (SOUT and WEST), (MIDW and NORT), and (MIDW and WEST) have significantly different mean commuter times.

d) Write down the estimated mean daily commuter time for each region.

Solution

Region	SOUT	MIDW	NORT
Estimated mean commuter time in hours	8.7	10.5	16

This page titled 3.9: Try It! is shared under a CC BY-NC 4.0 license and was authored, remixed, and/or curated by Penn State's Department of Statistics.