HW #10

10.3, 10.10, 10.13, 10.19, 10.28, 10.32

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10.3

In both (a) and (b), the t-test cannot be used because there are multiple parameters.

10.10

Model	RSS	DF	Mean Sq	Extra SS	Extra DF
Full	6.00	32	0.187	2.38	2
No Interactions	8.38	34	0.247		

The F-statistic is therefore $\frac{2.38/2}{0.187} = 6.36$, and $P(F_{2,32} > 6.36) = 0.005$. This gives evidence that the slopes are different for the different species.

10.13

a

term	estimate	std.error	statistic	p.value
(Intercept)	-1.576	0.287	-5.49	0.000
log(Mass)	0.815	0.045	18.30	0.000
Typebird	0.102	0.114	0.90	0.384
Typeebat	0.079	0.203	0.39	0.703

b

The slope of log(Energy) on log(Mass) is 0.815 for all subjects. The intercept is -1.576 for nbats, -1.576 + 0.079 = -1.497 for ebats, and -1.576 + 0.102 = -1.474.

c

term	estimate	std.error	statistic	p.value
(Intercept)	-1.498	0.150	-9.99	0.000
log(Mass)	0.815	0.045	18.30	0.000
Typebird	0.024	0.158	0.15	0.883
Typenbat	-0.079	0.203	-0.39	0.703

d

This gives the same slope as in (b), and the intercepts are -1.498 for ebat, -1.474 for birds, and -1.577 for nbat.

e

The test that the intercepts for ebat and birds are the same is given from the table in (c). This intercept has a p-value of 0.883, which gives no evidence that the difference in intercepts is not 0.

10.19

a

term	df	sumsq	meansq	statistic	p.value
Time	1	887.0	887.0	21.4	1e-04
Intensity	1	2579.8	2579.8	62.2	0e+00
Residuals	21	871.2	41.5		

b

term	df	sumsq	meansq	statistic	p.value
Time	1	887.0	887.0	16.2	0.0017
Intensity	5	2683.5	536.7	9.8	0.0006
Time:Intensity	5	111.5	22.3	0.4	0.8342
Residuals	12	655.9	54.7		

c

term	df.residual	rss	df	sumsq	statistic	p.value
Flowers ~ (Time + Intensity)^2	12	655.9				
Flowers ~ Time + Intensity	21	871.2	-9	-215.3	0.438	0.889

10.28

We start by analyzing the models with all potential explanatory variables (El Nino, West African wetness and Year):

Table 1: Effect on Storms

term	estimate	std.error	statistic	p.value
(Intercept)	-105.945	65.882	-1.608	0.115
ElNinoneutral	-0.219	1.022	-0.214	0.832
ElNinowarm	-3.288	1.019	-3.227	0.002
WestAfrica	2.373	0.987	2.404	0.021
Year	0.059	0.033	1.763	0.085

Table 2: Effect on Hurricanes

term	estimate	std.error	statistic	p.value
(Intercept)	-3.044	48.670	-0.063	0.950
ElNinoneutral	-0.297	0.755	-0.393	0.696
ElNinowarm	-2.417	0.753	-3.212	0.003
WestAfrica	1.392	0.729	1.908	0.063
Year	0.005	0.025	0.189	0.851

Table 3: Effect on Storm Index

term	estimate	std.error	statistic	p.value
(Intercept)	-102.794	992.740	-0.104	0.918
ElNinoneutral	-24.347	15.405	-1.580	0.121
ElNinowarm	-57.673	15.350	-3.757	0.001
WestAfrica	47.549	14.877	3.196	0.003
Year	0.108	0.501	0.216	0.830

We remove the Year variable from the latter two models as it is not at all shown to be different from 0:

Table 4: Effect on Hurricanes

term	estimate	std.error	statistic	p.value
(Intercept)	6.172	0.628	9.835	0.000
ElNinoneutral	-0.336	0.719	-0.468	0.642
ElNinowarm	-2.420	0.744	-3.253	0.002
WestAfrica	1.325	0.630	2.103	0.041

Table 5: Effect on Storm Index

term	estimate	std.error	statistic	p.value
(Intercept)	111.321	12.803	8.695	0.000
ElNinoneutral	-25.254	14.659	-1.723	0.092
ElNinowarm	-57.756	15.178	-3.805	0.000
WestAfrica	45.987	12.853	3.578	0.001

10.32

term	estimate	std.error	statistic	p.value
(Intercept)	16.43	2.728	6.02	2.46e-09
Gendermale	5.22	0.142	36.78	0.00e+00
Father	0.39	0.029	13.72	0.00e+00
Mother	0.32	0.031	10.26	0.00e+00

a

$h_c = 16.43 + 0.39h_f + 0.32h_m + 5.22(?\text{male})$

b

5.22 inches

c

fit	lwr	upr
65.1	60.9	69.4