HW #9

10.3, 10.10, 10.13, 10.19, 10.28, 10.32

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2022-12-03

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