

STATISTICS Ph.D. QUALIFYING EXAM: TAKE HOME

Evolutionary biologists are interested in the characteristics that enable a species to withstand the selective mechanisms of evolution. An interesting variable in this regard is the brain size. One might anticipate that bigger brains are better, but certain penalties are apparently associated with large brains, for example, the need for longer pregnancies and fewer offspring. Although individual members of the large-brained species may have more chance of surviving, the benefits for the species must be good enough to compensate for these penalties. To help understand this issue, it is helpful to determine which characteristics are associated with large brains, after accounting for the effect of body size which is related to brain size.

The average value of brain weight (in grams), body weight (in kilograms), gestation period (days) and litter size for 96 species of mammals (using common names, with names followed by a Roman numeral to identify subspecies) can be downloaded from the the WWW at

<http://www.stat.unm.edu/~bedrick/mammals.XLS>.

The first 6 observations from the dataset are given below:

SPECIES	BRAIN	BODY	GESTATION	LITTER
Quokka	17.5	3.5	26	1
Hedgehog	3.5	0.93	34	4.6
Tree shrew	3.15	0.15	46	3
Elephant shrew I	1.14	0.049	51	1.5
Elephant shrew II	1.37	0.064	46	1.5
Lemur	22	2.1	135	1

Build a model that best describes the relationship between brain weight, gestation length and litter size, after accounting for body size. Make sure that you carefully assess all assumptions and write a succinct, coherent, and complete summary of your analysis.