**Winter, 2011 Biometry Quiz #2**

1. Use the background information and the analytical results from R displayed on the handout to answer the following questions. Make sure to answer each question as thoroughly as possible and by citing supporting evidence where appropriate.
2. **[8 pts]** Assess the assumptions on the original scale.
3. **[6 pts]** Assess the type(s) of effects that are and are not evident in these results (*explicitly state whether you are analyzing the data on the original or transformed scale*).
4. **[6 pts]** Explicitly identify which levels or which groups (*depending on types of effects are evident*) are and are not statistically different.
5. **[5 pts]** Construct a graphic that illustrates your results from question (c) (*make sure to explicitly identify which graph(s) you marked*).
6. **[5 pts]** Summarize your findings in terms of the biology of pied flycatchers.
7. **[10 pts]** In the same study described on the handout the researchers also recorded the number of hatchlings from each nest (factors remained the same). The two-way ANOVA table for these data is shown below. Fill in the missing results.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **df** | **SS** | **MS** | **F** | **p** |
|  | 2 |  | 125.178 | 99.2513 | <2e-16 |
|  | 1 | 0.002 |  |  | 0.9702 |
| csm:fh |  |  | 0.371 |  | 0.7456 |
| Residuals |  |  |  |  |  |
| Total | 114 | 388.574 |  |  |  |

1. **[5 pts]** The relationship between the number of decaying objects in a discrete set (e.g., number of tulip bulbs in a box that rot) and time can be modeled with



where N0 (the constant initial number of objects) and  (the mean lifetime) are parameters (i.e., constants) to be estimated, Nt (number of objects at time t) and t (time) are variables, and e is the “natural number” constant. Algebraically linearize this function (*show each step of your work*) and explain how the original parameters (N0 and ) can be determined from the results of the linearized function (*i.e., how do these parameters relate to the intercept and slope of the linearized function*).

1. **[5 pts]** Kleiber's law is the observation that, for the vast majority of animals, an animal's metabolic rate scales to the ¾ power of the animal's mass. Thus, if *q* is the animal's metabolic rate and *M* is the animal's mass then Kleiber's law states that *q* = a*M*3/4, where a is a proportionality constant. Thus, for example a cat that has a mass 100 times that of a mouse will have a metabolism roughly 31 times greater than that of a mouse. Suppose that you have metabolism and mass data for a large number and wide variety of animals. What would you do with these data to test Kleiber’s Law (i.e., is the power constant in the relationship equal to ¾). Show each step of your work and be specific with your answer.
2. **[10 pts]** Throughly explain why one experiment where two factors are simultaneously manipulated is “better” than two separate experiments where one factor at a time is manipulated. If you decided to demonstrate your points with an illustrative example, assume that there are 30 individuals available for experimentation and that one factor has two levels and the other factor has three levels.