BIOLOGY 300 - ASSIGNMENT #11

Note: This assignment is due on Friday, December 3rd.

1. A recent experiment in grasslands tested the effects of plant biodiversity on the stability and productivity of ecosystems. A range of diversity treatments (number of species planted) was randomly assigned to a series of plots. The variables measured at the end of the experiment included nitrite in the rooting zone, an index of nutrient loss. Mean nitrite concentrations in plots of differing species diversity is given below.

Number of species planted	1	2	3	6	8	12	24
Nitrite (mg/kg soil)	0.33	0.28	0.22	0.20	0.17	0.17	0.18

   a) Estimate the linear dependence of nitrite on species diversity. Include the r^2- value.
   b) Draw a plot of the data, and include the estimated regression line.
   c) Calculate the residuals ($Y_i - \hat{Y}_i$) and plot these against number of species planted.
   d) In view of the plots in b) and c), comment on the appropriateness of the data for a linear regression analysis. What solution would you recommend to carry out a valid linear regression?

2. Answer briefly:

   a) Give an interpretation of s_b, the standard error of the regression slope.
   b) What are the uses of the log transformation in regression?

3. The species-area curve is a general phenomenon in nature. A large series of surveys was recently compiled, revealing that the relationship between the number of species on islands (Y) and island area (X) usually has a power function, $Y = a X^b$. They also observed that in nature the exponent (b) of the relationship tends to be near 0.30. You are in possession of the measurements below, which are numbers of vascular plant species present on a random sample of small islands in the Juan da Fuca Strait.

Island area (ha)	80	250	509	582	388	413	177	820	226
Number of species	15	38	56	59	42	47	43	87	56

   Test whether or not the data are consistent with an exponent of 0.30. Make all necessary assumptions.

4. A study of natural selection in a wild bird population compared overwinter survival of individuals with their body weight prior to winter. Data for a random sample of 10 individuals is given below. Use the most powerful method available to test whether survival varied with body weight.

Survival	0	0	1	0	0	0	1	1	1	1
Weight	18	20	22	23	24	25	26	31	32	33