

1. According to Plotkin *et al.* (2000, *Proc. Natl. Acad. Sci* 97: 10850-10854) the number of tree species in a plot of area A in a tropical forest is:

$$S = S(1 \text{ ha}) \cdot A^z \cdot e^{-kA}$$

In the Pasoh forest reserve (Malaysia), $z = 0.125$ and $k = -5.66 \cdot 10^{-4}$.

In the Mudumalai Wildlife Sanctuary (India), $z = 0.161$ and $k = -5.41 \cdot 10^{-4}$.

If $S(1 \text{ ha}) = 200$ species, then compute the number of species expected in plots of area $A=2$ ha in the Pasoh reserve.

$$S = \text{_____} [2]$$

The parameter k is small, and hence as an approximation can be taken as zero: $e^{-kA}=1$.

Compute the approximate number of species S_{Approx} in plots of $A=2$ ha if k assumed to be zero.

$$S_{\text{Approx}} = \text{_____} [2]$$

Report the approximation relative to your first computation as a ratio.

$$\text{Ratio} = (S_{\text{Approx}} / S) = \text{_____} [1]$$

2. If we define $\ln R = \ln(S(A) / S(A=1\text{ha}))$, then

$$\ln R = z \cdot \log_e(A) + k \cdot A$$

Write the H_0/H_A pair for the testing whether the parameter k differs from zero. [2]

3a. For the following general linear model (ANCOVA) write in below each term the degrees of freedom, where the categorical variable *Location* consists of four sites and there are 48 observations. [5]

$$\ln R - \beta_0 = \beta_{\text{Loc}} \cdot \text{Location} + \beta_A \cdot \ln A + \beta_{A*\text{Loc}} \cdot \ln A \cdot \text{Location} + \text{error}$$

3b. Complete an ANOVA table for this ANCOVA, where the SS for the regression variable is 200, the SS for the categorical explanatory variable *Location* is 300, the SS for the error term is 800, the SS for the interaction term is 120, and there are 48 observations that contribute to the total degrees of freedom. [MS: 1]

[F: 1]