Biology 4605/7220 Name ____Key________
Exam #1b 2 October 2007

1. Sokal and Rohlf (1995, *Biometry)* reported number of trees invaded by ants for each of two tree species:

	Not Invaded	Invaded
Tree species A	2	13
Tree species B	10	3

If the percent of trees invaded in species A is some percentage p, then the odds in favour of invasion are defined as Odds = p/q where q = 1 − p.
Read the expression (Odds = p/q : 1) as "odds are ____ to 1."

The odds ratio, for one population relative to another, is defined as the odds for the one population, divided by the odds for the other population.

What is the probability of invasion for species A ?

p = 13/15 = 0.8667 [1]

What are the odds of invasion for species A ?

Odds = (13/15)/(2/15) = 13/2 = 6.5:1 [1]

What is the probability of invasion for species B ?

p = 3/13 = 0.2308 [1]

What are the odds of invasion for species B ?

Odds = (3/13)/(10/13) = 3/10 = 0.3:1 [1]

What is the odds ratio, for species A relative to B ?

OR = (13/2)/(3/10) = 21.67 [1]

2. Hypothesis testing is carried out with frequency distributions, either observed or theoretical.

What is the principal advantage of using a theoretical distribution ? [1]

Quick calculation of p-value in a spreadsheet or any statistical package

What is the principal advantage of using an observed distribution ? [1]

No assumptions

What is the principal disadvantage (or cost) or using an observed distribution ? [1]

Time consuming to set up analysis and compute (see Lab 4), although there are a few packages that will do this.

3a. Complete the following computations. [2]

$(100 \text{ kg})^{1.5}$ = $\underline{1000 \text{ kg}^{1.5}}$

R = (100 km)/km $\log_{10}(R)$ = ______2______

3b. Convert an energy expenditure of 36 kiloJoules in 4 minutes to Watts (Joules/sec) [1]

$$\frac{36\ \cancel{kJ}}{4\ \cancel{min}} \cdot \frac{1\ \cancel{min}}{60\ sec} \cdot \frac{1000\ J}{\cancel{kJ}} = 150\ W$$

4. List the 5 parts of a well-defined biological quantity, then construct an example. [5]

5. Sanford and Crawford (2000) *Limnology and Oceanography* 45:1181 use the following expression for mass flux F (gram cm^{-2} sec^{-1}) in relation to transfer velocity β (cm^{1} sec^{-1}) and concentration difference C. [3]

$$F = \beta C$$

If the concentration difference C is cut in half,
does mass flux decrease to one half as well ? (Circle one) No

What units does the concentration difference have ? ____g cm^{-3} ________

What dimensions does the concentration difference have ? ____M L^{-3}__________

$$F = b \cdot C$$
$$C = F \; b^{-1}$$
$$C = \left(g\,cm^{-2}\,sec^{-1}\right)\left(cm^{-1}\,sec^{-1}\right)^{-1}$$
$$C = g \; cm^{-3}\,sec^{0}$$
$$C = g \; cm^{-3}$$

6. Type I error is a potential problem when rejecting the null (just chance) hypothesis, while Type II error is a potential problem when accepting the null hypothesis. Circle either I or II to indicate the potential problem with each of the following decisions. [4]

The mayor of St. John's concludes that cosmetic use of herbicides (weed free lawns) poses no risk to children or pets playing on lawns. I

If this error is made, who benefits from no regulation?
(Circle one) the children
If this error is made, who bears the risk of no regulation ?
(Circle one) the herbicide company

A government agency analyzes highly variable catch data and concludes there has been a decline in lobster stock size. II

7a. The sign of a residual is defined as the sign (plus or minus) of (Data − Model)

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MTB > plot c2 c1
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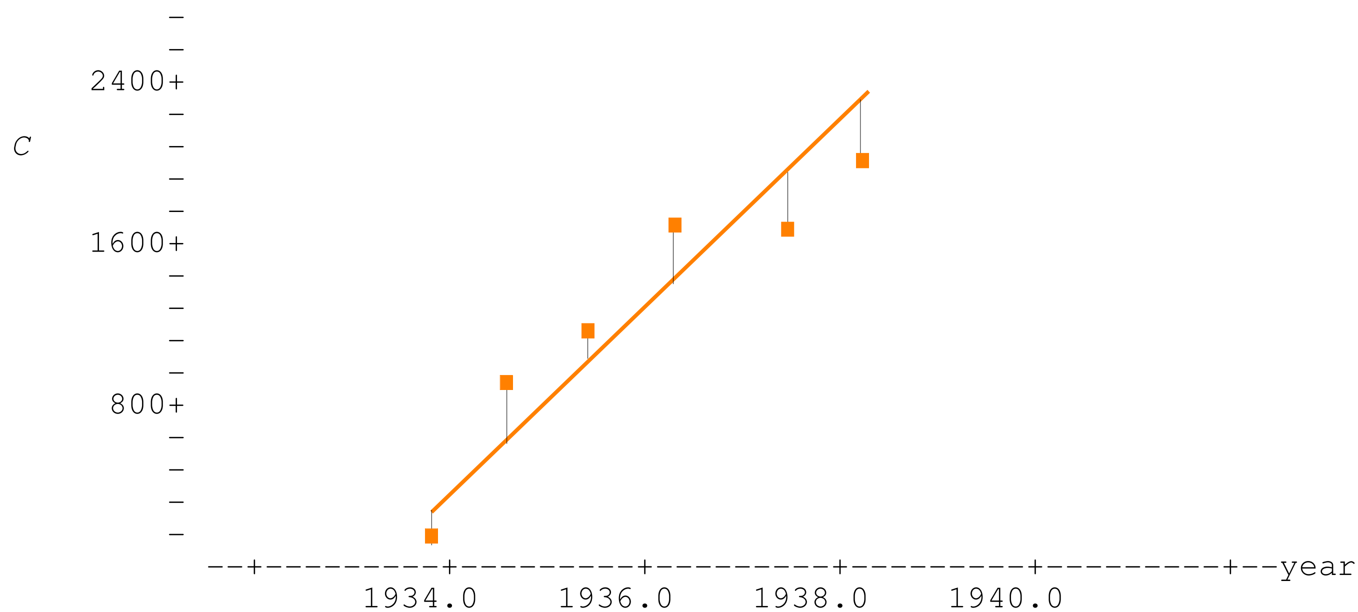

C = Catch of salmon, in tonnes (Data in Ricker, 1975).

Draw a straight line relation showing an increase in catch with year. [1]

Add 6 data points (1934 through 1939) consistent with the following pattern of residuals − + + + − − [1]

7b. For the straight line you have drawn, estimate the slope of the line β_{yr} = __480__ [1]

(2400-0)/(1939-1934) = 480

What units does β_{yr} have ? __tonnes/yr__ [1]

For the data you have drawn, make a rough estimate of the mean of the 6 values of catch mean(N) = β_0 = _1000 tonnes_ [1]

(2000-0)/2 = 1000 tonnes

7c. In words state an H_A/H_o pair for testing whether catch increases with time. [2]

H_o : catch does not increase (or change) with time
H_A : catch increases (or changes) with time

Express in symbolic notation an H_A/H_o pair for testing whether catch increases with time. [2]
A convenient statistic to measure the pattern is β_{yr}, the slope of the line.

$H_o : \beta_{yr} = 0$ $\quad$ $H_o : \beta_{yr} \leq 0$

$H_A : \beta_{yr} \neq 0$ $\quad$ $H_A : \beta_{yr} > 0$