Biology 4605/7220   Name _____
Exam #1a   4 October 2005

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

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

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

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

2a. Complete the following computations.   [2]

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

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

2b. Convert an energy expenditure of 36 kiloJoules in 4 minutes to Watts (Joules/sec)
                                                                                     [1]

3. In the blank spaces below list the 5 parts of a well defined biological quantity
then give a five-part definition of human breathing rate.   [5]
The numerical values you list must be biologically reasonable. If you don't have a watch,
you can count seconds by repeating to yourself 1 monkey, 2 monkey, 3 monkey ......

  Name   _____   _____   _____
                _____
breathing
  rate

4. 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 probability of invasion is the percent of trees invaded in tree species A then the odds 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 = _____[1]

What are the odds of invasion for species A ?

Odds = _____[1]

What is the probability of invasion for species B ?

p = _____[1]

What are the odds of invasion for species B ?

Odds = _____[1]

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

OR = _____[1]

5. R.D. Budd (1989, *American Journal of Drug and Alcohol Abuse* 15: 375-382) reported cocaine levels (microgram/ml) in 70 victims of violent death, in three categories.

Homicide	Accident	Suicide	
50	12	8	n
1.387	1.511	1.094	mean
1.319	2.175	1.002	stdev
0.05	0.05	0.05	alpha
1.013	0.129	0.256	lower limit
1.762	2.892	1.932	upper limit

Compute the confidence interval, defined as CI = Upper limit - Lower limit
for homicides   _____[1]

If the sample size for homicides decreases does the CI increase or decrease ?_____[1]

6. 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 $\$$ (cm^{1} sec^{-1}) and concentration difference C.

$$F = \$ \cdot C$$

If mass flux is held constant, and the transfer velocity is reduced to one quarter of its original value , by what factor do we expect concentration difference C to change ?   _____[1]

What units does the concentration difference have ?   _____[1]

M	L	T	
1	-3	0	Dimensions of mass concentration (kg cm^{-3})
___	___	___	Dimensions of mass flux F [1]
___	___	___	Dimensions of transfer velocity $\$$ [1]
___	___	___	Dimensions of concentration difference C [1]

7. 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 <u>potential</u> problem with each of the following decisions.   [4]

A government agency analyzes highly variable catch data, concludes there is no evidence of decline in a lobster stock, and recommends no reduction in catch rate.   I II
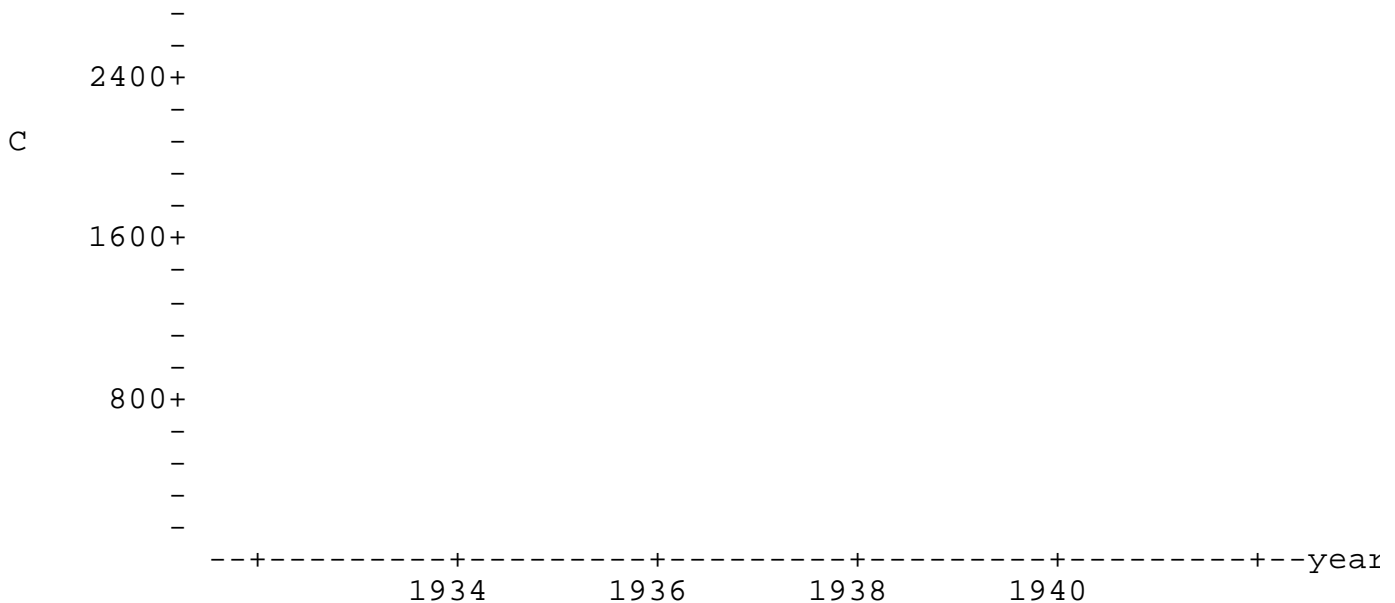
If this type of error is made, who bears the cost of the erroneous decision? (Circle one)
                                    Fisherman's income   Fish population size

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

If this type of error is made, who bears the cost of the erroneous decision? (Circle one)
                                    Fisherman's income   Fish population size

8a.   The sign of a residual is defined as the sign (plus or minus) of (Data ! Model)
```
 MTB > plot c2 c1


          -
          -
     2400+
          -
 C        -
          -
          -
     1600+
          -
          -
          -
          -
      800+
          -
          -
          -
          -
       --+---------+---------+---------+---------+---------+--year
          1934      1936      1938      1940
```

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

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

Add 6 data points (1935 through 1940) consistent with the following
pattern of residuals   ! + + + ! !   [1]

8b. For the straight line you have drawn, estimate the slope of the line $\$_{yr}$ = _____ [1]

                                        What units does $\$_{yr}$ have ?   _____ [1]

For the data you have drawn, make a rough estimate of
the mean of the 6 values of catch   mean(N) = $\$_{0}$ = _____[1]

8c. In words state an H_A/H_o pair for testing whether catch increases with time.   [2]

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 $\$_{yr}$, the slope of the line.