Biology 4605/7220 Name ________Key______
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]

It takes little time to compute a p-value

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]

It takes far longer to obtain a p-value from an observed distribution than to obtain a p-value from a theoretical distribution

2a. Complete the following computations. [2]

$(100\ \text{kg})^{1.5}$ = ___ $10^{1.5}\ \text{km}^{1.5} = 31.62\ \text{km}^{1.5}$ ________ ___

R = (100 km)/km $\log_{10}(R)$ = _________ $\log_{10} 10^2 = 2$ _______

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

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

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	Symbol	Procedural Statement	Values	Units
breathing rate			12/min to 120/min	

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 = __13/15= 0.87__[1]

What are the odds of invasion for species A ?

Odds = ___13/2= 6.5:1_[1]

What is the probability of invasion for species B ?

p = __3/13 = 0.231__[1]

What are the odds of invasion for species B ?

Odds = __3/10= 0.30:1__[1]

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

OR = _______21.67 : 1__[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 _1.762 ! 1.013 = 0.75__[1]

If the sample size for homicides decreases
does the CI increase or decrease ? _increase_[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.

$$F = \$ \,@\, C$$

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 ? _____4__[1]

What units does the concentration difference have ? __________g cm$^{!3}$____[1]

M	L	T	
1	!3	0	Dimensions of mass concentration (kg cm$^{!3}$)
1	!2	!1	Dimensions of mass flux F [1]
0	1	!1	Dimensions of transfer velocity $\$$ [1]
1	!3	0	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]

upward trending line, from left to right

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

first data point below line, next 3 above line, last 2 below

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

$\$_{yr}$ = circa (2400 ! 0)/(1940 ! 1934) . 400, or closer to zero

What units does $\$_{yr}$ have ? tonnes/year [1]

For the data you have drawn, make a rough estimate of the mean of the 6 values of catch mean(N) = $\$_0$ = circa 1200-1600 [1]

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

H_0: Catch does not vary with year
H_A: Catch varies with year

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.

H_0: $\$_{yr}$ = 0 or H_0: $\$_{yr} \leq 0$

H_A: $\$_{yr}$ ... 0 H_A: $\$_{yr} > 0$