Biology 4605/7220 Name _____
Exam #1a 1 October 2003

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

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

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

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

2. Walters and Green (1997, *Journal of Wildlife Management* 61: 987-1006) devised a value function for comparing management options.

$v = (r - c)u - \theta \cdot u^2$

v = value, in units of dollars (fish · year)$^{-1}$
r = maximum value per fish stocked (dollars fish^{-1}) with dimensions of [$] [#]$^{-1}$
c = unit cost of stocking fish
u = frequency of stocking (year^{-1}) with dimensions of [T]$^{-1}$

What units does c have ? _____ [1]

What units does θ have ? _____ [1]

Add the correct exponents to the dimensional matrix

	[$]	[#]	[T]	
u	0	0	−1	
c	___	___	___	[3]
θ	___	___	___	[3]

3. Complete the following computations. [3]

$(100\ \text{km})^{1.1}$ = _____

$(49\ \text{km}^2)^{0.5}$ = _____

$R = (20\ \text{km})/\text{km}$ $\log_{10}(R)$ = _____

4a. Convert 50 fractal inches $(50\ \text{in})^{1.5}$ to fractal metres _____ [1]
There are 2.54 cm per inch.

4b. Convert 86.4 kiloseconds to days _____ [1]

5. List the 5 parts of a well defined biological quantity then give a five-part example [5]

6. Zang and Wynder 1992 (reported in Sokal and Rohlf 1995, Ex 17.20) obtained the following results in a retrospective study of risk of developing lung cancer, for smokers and non-smokers.

	Lung Cancer (males) present	absent	total	% present	odds of cancer	Odds Ratio
smoke	522	866	1388	_____	_____ : 1	_____
non-smokers	15	822	837	_____	_____ : 1	

Compute the percentage of males in which lung cancer is present.
If the percentage of a group having cancer is some percentage p, then the odds in favour of having cancer 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 (non-smokers), divided by the odds for the other population (non-smokers).

Compute and fill in the survival percentages, the odds, and the odds ratio, in the table above. [5]

7. A convenient statistic for the odds ratio is OR.
Write the value of OR
when the odds are the same for smokers and non smokers.

OR = _____ [1]

In words, then in symbolic notation, state an H_A/H_o pair for testing whether odds of having cancer depend on smoking or not. [3]

8. Assuming you did not know the distribution of the OR statistic, state how you would carry out a randomization test of your H_A/H_o pair. [2]

9. According to Hattori (1973 *Microbial Life in the Soil* p.384) oxygen uptake in the soil [M = ml/(ml-second)] depends on
oxygen concentration at the soil surface (C_o = ml O_2 per ml liquid)
the diffusion coefficient of oxygen (D = cm^2/second)
the thickness of the oxidative surface layer (z = cm)

$$M = C_o z^2 / 2D$$

Compute oxygen uptake when C_o = 0.02 ml/ml, diffusivity is D = 0.4 cm^2/sec, and depth is 5 cm.

M = _____ [1]

For this predicted value, compute the observed value when the residual value is 0.1 ml/(ml-second).

Data	=	Model	+	Residual
_____	=	_____	+	_____

[3]