

PROBLEM SET #1  
BioS 101 Fall 2008

Name \_\_\_\_\_  
T.A. \_\_\_\_\_

This Problem Set is worth 10 points, one point per problem. IN ORDER TO RECEIVE FULL CREDIT YOU MUST SHOW YOUR CALCULATIONS OR EXPLAIN THE REASON FOR YOUR ANSWER.

**Questions 1 & 2.** A biology student studied a population of house mice in a 5 acre vacant lot. In 1997, he determined that natality was 50 per year, mortality 30 per year, immigration 3 per year, and emigration was 13 per year.

1. If the initial population was 40 mice, what was the population size at the end of the year?

Show calculations.

2. In 2000, the population increased from 100 to 115 mice. How does the finite rate of increase ( $\lambda$ ) in 1997 compare with that in 2000? Show calculations.

**Questions 3 & 4.** In 2007, the student, who was now an ecology professor, decided to do a quick census of the mouse population in the 5 acre lot. He captured 20 mice and marked them. He returned the second day and captured 20 mice of which 3 were marked.

3. Assuming that sampling was random, how many mice were in the 5 acre lot? Show calculations.

4. Comparing the population of 7 years ago (2000) with the present (2007) and assuming that immigration and emigration balanced out, it is possible to conclude:

- a. mortality rates have exceeded natality rates.
- b. natality rates have exceeded mortality rates.
- c. natality rates were equal to mortality rates.

Explain the reason for your choice.

**Questions 5 and 6.** Refer to the population data given for the human species, as well as seven geographical regions of the earth. This data is for mid-2006 as reported by Population Reference Bureau.

Area	Population Estimate	% Increase	Doubling Time
WORLD	6,555,000,000	1.2	58
AFRICA	924,000,000	2.3	30
N. AMERICA	332,000,000	0.6	116
L. AMERICA	566,000,000	1.5	46
ASIA	3,968,000,000	1.2	58
EURPOE	732,000,000	-0.1	---
OCEANIA	34,000,000	1.0	69

5a. By mid-2007 the population of Africa will have increased by about \_\_\_\_\_ people. Show calculation.

5b. By the year 2096 the projected population of Africa will be:  
Show projection or calculation.

6a. Given that the birth rate in L. America is 21 births per 1,000 population and in N. America is 14 births per 1,000 population, which area has the highest per capita death rate?  
Show calculation and or give reason for your answer. [Hint:  $b - d = r$ ; see page 1196 in Freeman 2005]

6b. Which region (area) has the highest proportion of its population under 20 years of age? Give reason for answer.

**Questions 7 & 8** refer to the maternity table for a gray squirrel population.

x	D(x)	S(x)	l(x)	m(x)	l(x)m(x)
0	35	100	1.00	0	0
1	?	65	0.65	0	?
2	25	40	0.40	3	1.20
3	5	15	?	1	?
4	10	10	0.10	0	0
5	0	0	0.00	0	0

Ro =

7a. How many grey squirrels died in the year before their second birthday, i.e. what is D(1)? Show calculation.

7b.. What is the expected reproduction at age 3, i.e. what is l(3)m(3)? Show calculation

8a. What is the net reproductive rate, i.e. what is Ro? Show calculations.

8b. If all squirrels 3 years old and older were harvested before they could reproduce, the population would immediately decline and then:

Explain reason for your answer.

9. People and their crops, catch, pets, pests and pathogens illustrate many of the population interactions known to ecologists. Name each of the following interactions and give the reasoning behind your answer.

9a. Populations of laboratory white rats are maintained for medical research. From an ecological perspective this interaction between people and white rats is best considered a form of \_\_\_\_\_. Give reasoning.

9b. The harvest of tuna from the sea by commercial fishing fleets is an example of \_\_\_\_\_. Give reasoning.

9c. Goldfish have been bred and reared by people as pets from more than a century. This interaction is an example of \_\_\_\_\_. Give reasoning.

9d. Mice are known to infest grain storage areas and can destroy a major portion of stored wheat. Farmers spend a good deal of money on pesticides to get rid of mice. From an ecological viewpoint, our interaction with mice is regarded as \_\_\_\_\_. Give reasoning.

9e. The impending bird flu has caused a concern among the medical community. The potential interaction between people and this virus is an example of \_\_\_\_\_. Give reasoning.

**10.** An Honors Biology student obtained the dry weight biomass of an experiment to determine the effect of increasing rates of nitrogen deposition growth of Indian Grass in sand with no organic matter. Here are her results:

mg Nitrogen	Plant Biomass (g)
131	2.9
262	3.1
523	13.95

10a. Make a graph that shows the relationship between N deposition and growth of Indian Grass in sand with no organic matter. Be sure to title and label both axes of graph.

10b. Before the experiment started the student hypothesized that higher levels of nitrogen deposition would result in larger plants. In comparing the biomass of plants grown at 131 and 262 mg of N she found that results are not statistically significant. Her findings:

- do not support her predictions. She should accept the null hypothesis.
- support her predictions. She should accept the null hypothesis.
- do not support her predictions. She should reject the null hypothesis.
- support her predictions. She should reject the null hypothesis.

Explain the reason for your choice to receive credit.