Exam I

Name________________________________________

Total = 100 points

1 (12 points) __________  
2 (13 points) __________  
3 (12 points) __________  
4 (13 points) __________  
5 (12 points) __________  
6 (13 points) __________  
7 (13 points) __________  
8 (12 points) __________

There are 4 pages and 8 questions.

To receive full credit for numerical problems, show your calculations and give the correct units for your answer. Partial credit will be given, so try to provide an answer for all questions.

1. You are reading a scientific paper in the journal Ecology, and come across the following statement: “Species richness did not differ significantly between the low-temperature and high-temperature cultures (p = 0.31).”

   Explain the meaning of the reported probability value. Discuss the potential for error in the conclusions that are drawn from this study. (12 points)

2. You are studying a population of rotifers that doubles in size every 10 days. Calculate $r$ for this population. If you began with a culture of 1000 rotifers, what would the population size be after 5 days? (13 points)
3. List the assumptions of the exponential growth model. Which of these assumptions is most important for maintaining the pattern of exponential population growth? (12 points)

4. In the space below draw two graphs, one for exponential growth and one for logistic growth. For each graph, plot $dN/dt$ on the $y$-axis and $N$ on the $x$-axis. For the logistic graph, be sure to label the carrying capacity of the population. (13 points)
5. You are studying a population of lobsters that is growing according to the logistic equation, with \( K = 200 \) and \( r = 0.01 \) individuals / individual / year.

a) What is the maximum population growth rate \( \frac{dN}{dt} \), and what is the population size for which this growth rate occurs? (8 points)

b) What is the per capita population growth rate \( \frac{1}{N} \frac{dN}{dt} \) when the population size is 250 lobsters? (4 points)

6. Explain the difference between a natural experiment and a field experiment in ecology. What are the relative advantages and disadvantages of each kind of experiment? (13 points)
7. Here are some life-table data for an hypothetical population:

<table>
<thead>
<tr>
<th>age (years)</th>
<th>S(x)</th>
<th>b(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>800</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>400</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

For these data, calculate \( l(x) \), \( g(x) \), \( R_0 \), \( r \) (approximate), and \( G \). (13 points)

8. Define or explain the following terms (3 points each):

- \( r \)-selection
- phyllode
- type III survivorship curve
- stationary age distribution