

PRACTICE EXAM II

MAT 209 · SPRING 2009

You must show all work to get full credit.

Problem 1 (10 points). An ecosystem containing two species is modeled by the system of differential equations given below, where N_1 and N_2 denote the number of members of each species and the rates are annual rates of change of the species populations:

$$\begin{aligned}\frac{dN_1}{dt} &= -0.1N_1(10 - N_2) \\ \frac{dN_2}{dt} &= 0.2N_2(20 - N_1)\end{aligned}$$

- (a) Determine the steady state solution of this system.
- (b) Explain (in one brief sentence) the significance of the term $-N_2$ in the first equation, and the term $-N_1$ in the second, for the competitive process.

Problem 2 (10 points).

- (a) For the data in the table below, the regression line has equation $y = 0.375 + 0.25x$ (or, $y = \frac{3}{8} + \frac{x}{4}$).
 - (i) Use least squares method to find how well the line fits the data.
 - (ii) What would be the predicted y for $x = \frac{1}{2}$?

x	0	1	1	2
y	0.5	0	1	1

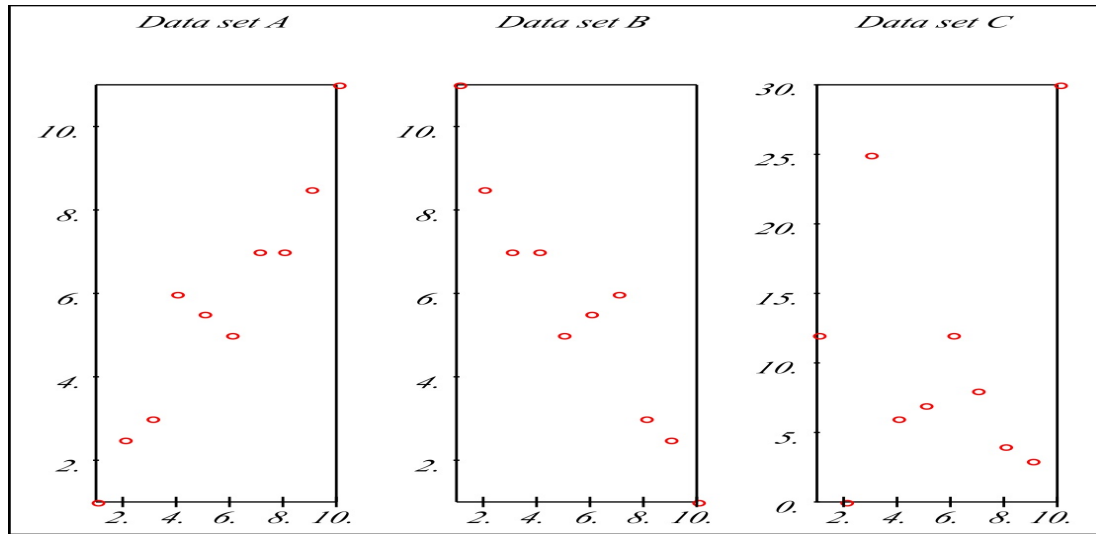
- (b) Suppose a set of bivariate data is plotted on semilog paper ($z = \log(y)$ vs. x), and a linear relation appears, with regression line $z = 2 + .5x$. What equation would we expect for y vs. x ?

Problem 3 (10 points).

- (a) Put the three graphs below in order of increasing correlation coefficient r . Smallest r to largest r

Date: April 23, 2009 *Due Date:* Monday, April 27, 2009.

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(b) Sketch your best guess as to the regression line of the data set B, and write down the equation of that line.

Problem 4 (8 points).

- (a) Consider the four points $(1, 2)$, $(5, 1)$, $(2, 2)$, and $(0, 8)$. Find the quantities s_x , s_y , and r and use these to find the regression line.
- (b) [2 points] What estimate would you give for the value of y when $x = 3$?