



EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

EXTERNAL DEGREE EXAMINATION IN SCIENCE -2008/2009

FIRST YEAR, <sup>First</sup> SECOND SEMESTER <sup>Dec./Jan.</sup> (May/Sept., 2012)

EXTCC 103 - BIO MATHEMATICS AND BIO STATISTICS

(REPEAT)

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Answer all questions

Time: Two hours

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Q1. (a) For a study, the number of leaves of 20 plants have been recorded as follows.

1 3 2 5 2 4 5 2 3 3 3 4 2 2 3 3 4 2 3 4

- Draw the stem and leaf plot for the above data.
- Build the frequency distribution for the number of leaves.
- Find the mean, variance and coefficient of variation for the number of leaves based on frequency distribution in part (ii).

(b) The weights  $X$  (in grams,  $g$ ) of insects of a certain species are normally distributed with mean  $100g$  and standard deviation  $5g$ . Find the probability that the weight of an insect randomly selected will be

- less than  $90g$ ;
- between  $90g$  and  $110g$ ;
- more than  $110g$ .

Q2. The following table gives the soil temperature  $X$  (in  $^{\circ}C$ ) and the number of days  $Y$  for germination of pea nuts.

Temperature $X$	9	11	14	17	20	21	25
Number of days $Y$	44	35	34	28	25	20	16

- i. Draw a suitable plot to represent the relationship between temperature and number of days for germination and discuss it.
- ii. Compute the correlation coefficient between temperature and number of days for germination and interpret it.
- iii. Estimate the parameters  $\beta_0$  and  $\beta_1$  in the simple linear regression model of the form  $Y = \beta_0 + \beta_1 X + \varepsilon$ .
- iv. Interpret the estimated parameters in part (iii).
- v. Predict the number of days for germination, when soil temperature is  $18^\circ\text{C}$ .

Q3. (a) Simplify each of the following:

i. 
$$\frac{\sqrt[3]{8y^{-6}x^3}}{\sqrt{y^{-4}x^2 - 3y^{-2}x}};$$

ii. 
$$\left(\frac{81}{4}\right)^{-\frac{1}{2}} \times 8^0 \times \left(\frac{27}{8}\right)^{\frac{2}{3}} \times (0.5)^{-1};$$

- (b) i. If  $a, b$  and  $c$  are three consecutive integers then show that  $\log(1 + ac) = 2 \log b$ .
- ii. If  $p = q^{2a}$ ,  $q = r^{2b}$  and  $r = p^{2c}$  then prove that  $abc = \frac{1}{8}$ .
- iii. If  $2a - 3b = 2$  and  $ab = 6$  then find  $8a^3 - 27b^3$ .

(c) Solve the following equations:

i.  $x^2 + \frac{11}{2}x + 6 = 0;$

ii.  $4^{5-9x} = \frac{1}{8^{x-2}};$

iii.  $\log_2(x^2 - 6x) = 3 + \log_2(1 - x).$

Q4. (a) Evaluate the following:

i. 
$$\lim_{x \rightarrow 2} \frac{4 - x^2}{3 - \sqrt{x^2 + 5}};$$

ii. 
$$\lim_{x \rightarrow \infty} \frac{x^2 + x - 2}{4x^3 - 1}.$$

- (b) i. Differentiate the function  $y = e^{-x \sin x}$  with respect to  $x$ .
- ii. Find the maximum and minimum points of the function  $y = x^3 - 2x^2 + x$ .

(c) Evaluate the following:

i.  $\int \frac{x^2 + 2}{x(x+2)(x-1)} dx;$

ii.  $\int \frac{2x^2}{\sqrt[3]{x^3 + 1}} dx;$

iii.  $\int_0^1 x \ln x dx.$

