RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Health Promotion
First Year - Semester II Examination – October/November 2017

BIO 1208 – STATISTICAL METHODS IN BIOLOGY I

Time: Two (02) hours

Answer ALL questions.

1. The life expectancy (in months) for two hypothetical species of birds in captivity are as follows

Species A	36, 34, 39, 37, 41, 40, 43, 42, 79
Species B	45, 43, 44, 34, 36, 40, 39, 37, 41, 42

a) Calculate the mean and median for the two species.
b) Calculate the range, variance and standard deviation for the two species and comment on your answers.

(25 marks)

2. a) A normal distribution of sucrose concentrations has a $\mu = 65$ mg/100 ml and $\sigma = 25$ mg/100 ml. Calculate the proportion of the population,

i. greater than 85 mg/100 ml
ii. less than 45 mg/100 ml
iii. between 45 and 85 mg/100 ml.

b) A national survey sampled 1400 voters after each had cast a vote in a national election. Of these voters, 742 claimed that they had voted for candidate A and 658 for candidate B. Assume that there are only two candidates in the race. Assuming that each sampled voter actually voted as claimed and the sample is a random sample from the population of all voters, is there enough evidence to predict the winner of the election? Base your decision on the 95% confidence interval.

c) A sports agent claims that there is no difference in the salaries of Indian and Australian international cricketers. A survey of 15 Indian cricketers found an average salary of $501,580 while a survey of 15 Australian cricketers found an average of $513, 360. If the standard deviations of the two samples are $20,000 and $18,000 respectively, is the agent correct? Use $\alpha = 0.05$.

(25 marks)

3. The following has been summarized from the IUCN Red Data Book. At $\alpha = 0.05$, is there an association between the class of vertebrate and whether it is endangered or threatened?

	Class of vertebrate				
	Mammal	Bird	Reptile	Amphibian	Fish
Endangered	68	76	14	13	76
Threatened	13	15	23	10	61

(25 marks)

4. The average daily temperature (in degrees Fahrenheit) and the average monthly precipitation (in inches) of a hypothetical city is given in the table below. Use the table to answer the following questions.

Avg. daily temp. (°F)	Avg. mo. precip. (inches)
86	3.4
81	1.8
83	3.5
89	3.6
80	3.7
74	1.5
64	0.2

a) Construct a scatter plot for the data and comment on the relationship between the two variables.
b) Compute the value of *r*.
c) Is *r* significant at $\propto = 0.05$?
d) Find the linear regression equation.
e) Find the average monthly precipitation when the average daily temperature is 70°F.

(25 marks)

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Equation sheet

$$s^2 = \frac{\Sigma(X - \bar{X})^2}{n - 1}$$

$$z = \frac{X - \mu}{\sigma}$$

$$z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

$$\bar{X} - z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) < \mu < \bar{X} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$\bar{X} - t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right) < \mu < \bar{X} + t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

$$\hat{p} - z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}}$$

$$z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$(\bar{X}_1 - \bar{X}_2) - z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{X}_1 - \bar{X}_2) + z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

$$(\bar{X}_1 - \bar{X}_2) - t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{X}_1 - \bar{X}_2) + t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n(\Sigma x^2) - (\Sigma x)^2][n(\Sigma y^2) - (\Sigma y)^2]}}$$

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$a = \frac{(\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy)}{n(\Sigma x^2) - (\Sigma x)^2}$$

$$b = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$$