



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

**B.Sc. in Applied Sciences
First Year - Semester II Examination – September 2020**

BIO 1202 – STATISTICAL METHODS IN BIOLOGY I

Time: Two (02) hours

Answer **ALL** questions.

1. The body weights (g) of two species of insects are given below.

Species A 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4

Species B 1.2, 1.6, 1.7, 1.8, 1.9, 2.0, 2.4

- a) Calculate the mean and median body weight for the two species. **(30 marks)**
 b) Calculate the range, variance and standard deviation for the two species and comment on your answers. **(70 marks)**

2. a) The average production of compost on a farm in Anuradhapura is 28 kg per month. The standard deviation is 2 kg. If a farm is selected at random, what is the probability it generating
 i. Between 27 and 31 kgs per month
 ii. More than 30.2 kg per month **(20 marks)**
- b) A population of one-year old children's chest circumference has a $\mu = 47$ cm and a $\sigma = 12$ cm. What is the probability of drawing from it a random sample of 9 measurements that has a mean larger than 50.0 cm? **(20 marks)**
- c) A survey of 30 individuals in a firm found that the mean time to secure their first promotion is 5.6 years. Assuming the standard deviation of the population is 0.8 years, find the 95% and 99% confidence intervals of the population mean and comment on your answers. **(20 marks)**
- d) A researcher hypothesizes that the average number of male students in a BSc Special Degree program in physics is higher than the number of female students. Fifty (50) special degree programs were samples and the average number of male students was 8.6, while the average number of female students was found to be 7.9. At $\alpha = 0.10$, is there enough evidence to support the claim? Assume σ_1 and $\sigma_2 = 3.3$. **(40 marks)**

3. The table below summarizes the number of vertebrate species found in three types of habitats. At $\alpha = 0.05$, is there an association between the class of vertebrate and habitat type?

	Class of vertebrate		
	Mammal	Bird	Reptile
Habitat A	15	12	08
Habitat B	08	15	09
Habitat C	06	08	07

(100 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)
63	7.0
29	3.9
20.8	2.1
19.1	2.8
13.4	1.4
8.5	1.5

- Construct a scatter plot for the data and comment on the relationship between the two variables.
- Compute the value of r .
- Find the linear regression equation.
- Find the average monthly precipitation when the average daily temperature is 30°F.

(100 marks)

-----END-----

Equation sheet

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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