RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
First Year - Semester II Examination – November/December 2016

BIO 1208 – STATISTICAL METHODS IN BIOLOGY I

Time: Two (02) hours

Answer all questions.

1. The normal daily high temperatures (in degrees Fahrenheit) in January for 10 selected cities are as follows.

   50, 37, 29, 54, 30, 61, 47, 38, 34, 61
   The normal monthly precipitation (in inches) for these same 10 cities is listed here.
   4.8, 2.6, 1.5, 1.8, 1.8, 3.3, 5.1, 1.1, 1.8, 2.5

   a) Calculate the range and interquartile range of the two samples.

   b) Calculate the variance and standard deviation for the above samples and comment on your answers.

   (20 marks)

2. a) A survey found that women spend on average $146.21 during New Year holidays. Assume the standard deviation is $29.44. Find the percentage of women who spent less than $160.00. Assume the variable is normally distributed.

   a) A researcher wishes to estimate the number of days it takes an automobile dealer to sell a Toyota. A sample of 50 cars had a mean time on the dealer's lot of 54 days. Assume the population standard deviation to be 6.0 days. Find the best point estimate of the population mean and the 95% confidence interval of the population mean.

b) The data represent a sample of the number of home fires started by candles for the past several years. Find the 99% confidence interval for the mean number of home fires started by candles each year.

5460, 5900, 6090, 6310, 7160, 8440, 9930

(20 marks)

3. a) The table below gives the results (blood clotting times) of an experiment in which adult male rabbits were divided at random into two groups, one group of six and one group of seven. The members of the first group were given drug B and the members of the second group were given drug G. Blood was taken from each rabbit and the time taken for blood to clot was recorded. At $\alpha=0.05$ can it be concluded that there is a significant difference in the two drugs in their ability to clot blood.

Given drug B (Min)	Given drug G (Min)
8.8	9.9
8.4	9.0
7.9	11.1
8.7	9.6
9.1	8.7
9.6	10.4
	9.5

b) In a sample of 200 workers, 45% said that they missed work because of personal illness. Ten years ago in a sample of 200 workers, 35% said that they missed work because of personal illness. At $\alpha=0.01$, is there a difference in the proportion?

(20 marks)

4. A researcher wishes to determine whether there is a relationship between the gender of an individual and the amount of alcohol consumed. A sample of 68 people is selected, and the following data are obtained.

	Alcohol consumption			
Gender	Low	Moderate	High	Total
Male	10	9	8	27
Female	13	16	12	41
Total	23	25	20	68

At a $\alpha = 0.10$, can the researcher conclude that alcohol consumption is related to gender?

(20 marks)

5. In a study on speed and braking distance, researchers looked for a method to estimate how fast a person was traveling before an accident by measuring the length of the skid marks. An area that was focused on in the study was the distance required to completely stop a vehicle at various speeds. Use the following table to answer the questions.

MPH	Braking distance (m)
20	20
30	45
40	81
50	133
60	205
80	411

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 $\alpha = 0.05$?
d) Find the linear regression equation.
e) Find the braking distance when MPH =45 and 100.

(20 marks)

END

Equation sheet

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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