



EASTERN UNIVERSITY, SRILANKA
DEPARTMENT OF MATHEMATICS
THIRD YEAR EXAMINATION IN SCIENCE – 2013 / 2014
SECOND SEMESTER (December-2017)
AM 308 – STATISTICS

Answer **all** questions.
Calculators will be provided.

Time: **Two** hours.

(a) Draw a box plot for the data given below and interpret it.

14, 36, 39, 41, 17, 22, 19, 16, 21, 21, 18, 33, 25, 31, 18, 60.

(b) Marks (out of fifty) of students in a class for a certain course unit, have been summarized as shown in table below.

Intervals	Frequency (f)
$0 < X \leq 10$	10
$10 < X \leq 20$	20
$20 < X \leq 30$	30
$30 < X \leq 40$	25
$40 < X \leq 50$	15

Comment on the symmetry of the distribution of marks of students by using the Pearson's first coefficient of skewness.

A researcher wants to find out the relationship between length of head (X , in cm) and length of body (excluding head) (Y , in cm) of a newly discovered species of fish. He has collected the following data:

X	1	2	3	4	5	6
Y	8	20	28	43	49	60

- Draw a scatter plot for the above data and interpret it.
- Based on the given data, comment on the relationship between X and Y by using the Pearson's correlation coefficient.
- Use a statistical test to confirm the relationship at significance level of size 0.05. State your assumptions and hypotheses clearly.

(P.T.O.)

[Question 2 continued ...]

- (iv) Show that Spearman's correlation coefficient for rank data is given by (with usual notation),

$$r_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)}.$$

- (v) Use the coefficient in part (iv) to confirm your results in part (ii).

03. The relationship between two random variables X and Y was found to be linear of the form of $Y = \beta_0 + \beta_1 X + \varepsilon$.

X	1	2	3	4	5	6	7	8	9	10
Y	4	12	14	21	25	29	38	42	46	52

- (i) Derive the least square estimators of parameters β_0 and β_1 .
- (ii) Estimate β_0 and β_1 by using the data given in table above.
- (iii) Test the significance of each parameter at 0.05 significance level by stating the assumptions clearly and update the model according to their significance.
- (iv) Find the prediction error of Y for the value of $X=6$.
- (v) Find the 95% confidence interval for β_1 and interpret it.
4. A company, manufactures electronic items, uses a machine to assemble parts of items. This company plans to replace the existing machine with a new one, if efficiency of new machine is higher than that of the existing machine. With the purpose of comparing efficiencies of these two machines, company has recorded the assembling time (in hours) for 9 item each from the existing and new machine. Data are given in the following table.

Existing Machine	New Machine
1.18	1.06
1.15	0.9
1.32	1.06
1.33	1.06
1.20	1.06
1.40	1.18
1.36	1.04
1.53	1.09
1.55	1.05

- (i) Clearly state the claim of the company.
- (ii) State the null hypothesis and alternative hypothesis.
- (iii) Based on the information available, suggest an appropriate test statistic to test the above hypothesis and compute it. State your assumptions clearly, if any.
- (iv) What is the corresponding table value for the significance level of size 0.05?
- (v) What is the decision of the above hypothesis test?
- (vi) Give your conclusion and recommendation on purchasing the new machine.

-THE END-

Note: Corresponding values of T-distribution are given in the following table.

df	0.025	0.05
4	2.776	2.132
5	2.571	2.015
6	2.447	1.943
7	2.365	1.895
8	2.306	1.86
9	2.262	1.623
10	2.228	1.812
.....
15	2.134	1.753
16	2.12	1.746
17	2.11	1.74
18	2.101	1.734
19	2.093	1.726
20	2.086	1.725