Uva Wellassa University
B.Sc. in Export Agriculture

End Semester Examination December/ January 2009/10
Year IV Semester I

Econometrics EAG 423-2

Instructions

Answer **four (04)** questions only. **Question number one (01) is compulsory**
No. of questions : Six (06)
No. of pages : Eight (08)
Total marks allocated : 40/100
Time : Two hours (02 hrs)

1.

a. What do you mean by type –I error and type –II error in hypothesis testing?

b. Giving justifications, choose a suitable statistical test for following studies (i – xii) from the list (A – L) given in **page two.**

i. To test whether there is a difference between plant heights in two nurseries.

ii. To test whether there is a significant weight reduction of 20 participants after an aerobic exercise program.

iii. To test whether there is an association between latex yield of rubber trees and the girth of the tree.

iv. To test whether there is a significant yield difference between two rice varieties cultivated in Passara area.

v. To test the impact of farmer organizations in reduction of water related conflicts in irrigation systems. Farmers have given the responses in the scale of 'reduced', 'no change' and 'increased'.

vi. To test whether there is an association between gender of the children and color preference in buying plastic toys.

vii. To test whether there is a difference between 'Z' scores of AL examination of the first year students and the second year students of the Faculty of Agriculture.

viii. To test whether there is an association between preference to choose varieties of fruits and 'education level' of the buyers.

ix. To test whether there is a difference between weights of one month old broilers in two cages.

x. To test whether there is an association between gender and preferences for four different colours of containers of ice-cream.

xi. To test whether there is a significant difference of 'Grade Point Average (GPA) between girls and boys in the Third year Batch.

xii. To test whether there is a relationship between monthly expenditure for mobile phone charges and Overall Grade Point Average (OGPA) of the final year students.

A – Karl Pearson correlation coefficient

B - Kruskal Wallis Non-parametric One-way ANOVA

C - Simple linear regression

D – Chi-square test (χ^2)

E - 'Z' test

F - 't' test

G - Sign test

H – Wilcoxon ranked sign test

J – ANOVA

K – Multiple Regression

L - Freidman Non-parametric two-way ANOVA

2.

a. The average paddy yield in Badulla district is 4000 kg ha^{-1}. Randomly selected 20 farmers were given a new variety and their average yield was 4100 kg ha^{-1} and the standard deviation (s) was 40. Test whether the new variety has significantly improved the paddy yield using an appropriate test.

b. A researcher wanted to test whether there is a significant difference of general knowledge of students in Badulla district and Monaragala district. Two randomly selected samples of class ten students from two districts were given a general knowledge paper and marks are summarized below.

	Badulla District	Monaragala district
Sample size	200	200
Average marks	67	63
Standard deviation	23	17

Test whether there is a significant difference of general knowledge between two districts using an appropriate statistical test.

c. To reduce the late attendance of the workers, tea factories of Badulla district introduced a new motivational package for the factory workers. Average number of late attendance per day before and after the motivational package in ten tea factories is given below. Test whether there is a significant impact of the motivational package.

Factory	A	B	C	D	E	F	G	H	I	J
Late attendance (Before)	23	12	8	31	14	3	5	14	16	9
Late attendance (After)	15	9	8	27	15	3	6	10	12	5

3.

a. What are the different types of scales of measurements of variables?

b. Briefly explain the importance of non-parametric statistical methods in social science research.

c. There are gainers and losers of policy changes. The Mahaweli Authority introduced the policy of "Irrigation Management Transfer (IMT)" in order to increase the efficiency and the fairness of water distribution in 1990s. A sample of 200 farmers were asked whether fairness of water distribution was improved or not with implementation of IMT. Farmers' responses are summarized in the following table. Using an appropriate statistical procedure, test whether the "IMT" has improved the fairness of water distribution in Mahaweli area.

Response of the farmer	***Number of farmers***
Highly improved	21
Improved	89
No change	27
No idea	23
Declined	26
Drastically declined	14

4.

a. What are the basic differences of use of the Kruskal-Wallis and the Friedmann ANOVA Models?

b. To test the three different packages of 'curry powder', a researcher asked 10 buyers about their preference. The marks given by the buyers were ranked in a single series and rank scores are given in the table.

Buyer	Rank scores for marks		
A	16	1	28
B	11	3	20
C	23	5	11
D	25	3	23
E	16	6	23
F	11	7	28
G	20	5	20
H	25	11	28
I	16	6	16
J	11	5	25
K	30	11	16
Average rank	18.54545	5.727273	21.63636

Test whether there is a significant difference of consumer preference between packages and select the best package.

5. A researcher wanted to develop a model to explain the per-capita expenditure for food per year. Explanatory variables used in the model were current year income, previous year income and the family size.

$$C_t = \alpha + \beta_1 Y_t + \beta_2 Y_{t-1} + \beta_3 X + \epsilon$$

Where; C_t = Consumption expenditure in the current year (Rs)

Y_t = Income in the current year (Rs)

Y_{t-1} = Income in the preceding year (Rs)

X = Family size (number of members)

a. What are the factors which affect the magnitude of ϵ?

b. Statistical software was used to analyze the data gathered and output is given below.

Dependent Variable: C_t

Analysis of Variance (ANOVA)

Source of Variation	Degree of Freedom	Sum of Squares	Mean Squares	F value	Prob. > F
Model	3	1823.04	607.68	57.10	0.001
Error	116	1234.53	10.64		
Total	119	2057.57			

$R^2 = 0.9531$ Adjusted $R^2 = 0.9372$

Parameter Estimates

Variable	Coefficient	Standard Error	Student ' T '	"P"
Constant	13427.45	12.823	10.51	0.0001
Y_t	0.7345	0.0771	11.71	0.0001
Y_{t-1}	0.0134	0.2535	0.94	0.5431
X	-121.87	3.2431	4.56	0.0045

i. What are the statistically significant parameters?

ii. What are the general meanings of α, β_1 and β_2 and β_3 ?

iii. What do you mean by the R^2?

iv. Estimate the consumption expenditure for 03 member family, when the annual income of the current year is Rs. 220000 and the income of the last year was Rs.200000 .

6.

a. What are the demerits of 'Karl Pearson Correlation Coefficient (r)' as an indicator of relationship between two variables?

b. To estimate the relationship between timber volume which can be harvested of mahogany forest plantation, following model was used.

$$Y = \alpha + \beta_1 X + \beta_2 X^2$$

Where; Y is the timber volume per hectare (m^3) , X is the number of year after planting trees.

Output of the regression analysis is given below

VARIABLES	COEFFICIENT	STD ERROR	STUDENT'S T	P
CONSTANT	-579.164	277.771	-2.09	0.0501
X	703.233	53.3231	13.19	0.0000
X^2	-18.6335	2.15722	-8.64	0.0000

R-SQUARED 0.9598 RESID. MEAN SQUARE (MSE) 164831

ADJUSTED R-SQUARED 0.9557

SOURCE	DF	SS	MS	F	P
REGRESSION	2	7.863E+07	3.932E+07	238.53	0.0000
RESIDUAL	20	3296616	164831		
TOTAL	22	8.193E+07			

i. Justify the suitability of the model.

ii. Estimate the timber volume of one hectare of lands after 15 years of planting trees.

iii. To obtain the maximum timber volume, what is the best time to harvest?

Statistical Equations

Spearman's rank correlation coefficient

$$r' = 1 - 6\sum d^2 / [N(N^2 - 1)]$$

The sign test;

$$Z = \frac{2x \pm 1 - N}{\sqrt{N}}$$

The Wilcoxon ranked sign test

$$Z = \frac{T^+ - N(N+1)/4}{\sqrt{[N(N+1)(2N+1)/24]}}$$

The Wilcoxon - Mann – Whitney test

$$Z = \frac{W_x \pm 0.5 - m(N+1)/2}{[mn(N+1)/12]^{.5}}$$

Kruskal-Wallis One-way ANOVA

$$KW = \left[\frac{12}{N(N+1)}\sum n_j \bar{R}_j^2\right] - 3(N+1)$$

$$t = 1 - \left[\frac{\sum (t_i^3 - t_i)}{N^3 - N}\right]$$

$$CD = \frac{Z_\alpha}{k(k-1)} \cdot \sqrt{\frac{N(N+1)}{12} \cdot \left(\frac{1}{n_2} + \frac{1}{n_2}\right)}$$

Friedmann Two-way ANOVA

$$Fr = \left[\frac{12}{Nk(k+1)}\sum R_j^2\right] - 3N(k+1)$$