EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2002/03 & 2002/03(A)

SECOND SEMESTER

SPECIAL EXAMINATION

(April/May, 2004)

MT308 - STATISTICS

Answer all questions

Time : Two hours

1. (a) Prove that Spearman's rank correlation coefficient is given by

$$1-\frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}$$, where d_i denotes the difference between the ranks of the i^{th} individual and n is the number of observations.

(b) Find the maximum and minimum value of the Spearman's rank correlation coefficient.

(c) Ten competitors in a beauty contest are ranked by 3 judges as follows:

Compititor	1	2	3	4	5	6	7	8	9	10
judge A	1	5	4	8	9	6	10	7	3	2
Judge B	4	8	7	6	5	9	10	3	2	1
Judge C	6	7	8	1	5	10	9	2	3	4

Discuss which pair of judges has the nearest approach to common tastes of beauty.

2. (a) The following table gives the distribution of marks secured by some students in an examination.

Marks	Number of students
Below 20	20
20 – 30	40
30 – 50	78
50 – 60	77
60 – 70	67
Above 70	10

i. Derive the equation that is used to calculate the median of a continuous frequency distribution.

ii. Draw an Ogive graph and read the median from the graph. Check your result by actual calculations.

iii. Find the mode of the distribution.

iv. Find the inter quartile range.

v. If 60 percentage of the students pass this test, find the minimum marks obtained by a pass student.

(b) An examination was held to decide about the award of scholarship in a University. The weights of various subjects were different. The marks obtained by two candidates A and B out of 100 on each subject are given below:

Subject	Weight	A's Marks	B's Marks
Statistics	4	85	80
Accountancy	3	75	75
Economics	2	45	60
Mercantile law	1	65	90

If the candidate getting highest marks is to be awarded the scholarship, who should get it?

3. The following are the scores which 12 students obtained in the mid-term and the final examination in statistics.

Mid – term	71	49	80	73	93	85	58	82	64	32	87	80
Final exam	83	62	76	77	89	74	48	78	76	51	73	89

(a) Using the least-squares criterion, derive equations that are used to estimate slope and intercept of a simple linear regression line.

(b) Find the equation of the least-squares regression line which will enable us to predict a student's final examination score in this course on the basis of his or her score in the mid-term examination.

(c) A student says that there is no relationship between between the mid-term and final exam scores.Test this claim at 5% level.

(d) Predict the final exam score of a student who received 84 marks in the mid-term examination.

(e) set up 95 percentage confidence intervals for your regression estimates.

4. (a) Let R be the range and σ is the standard deviation of a set of observations. Prove that $R \geq \sigma$.

(b) During 10 weeks of a session the marks scored by two candidates, Jeyanth and Vasanth, taking statistics course are given below:

Week	1	2	3	4	5	6	7	8	9	10
Jeyanth	58	59	60	54	65	66	52	75	69	52
Vasanth	87	89	78	71	73	84	65	66	56	46

i. Who is the better scorer?

ii. Who is more consistent student?

(c) If n_1 , n_2 are the sizes; $\overline{x}_1$, $\overline{x}_2$ the means and σ_1 , σ_2 the standard deviations of two series. Then the standard deviation σ of the combined series of size $n_1 + n_2$ is given by

$$\sigma^2 = \frac{1}{n_1 + n_2}\left[n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)\right].$$

where $d_i = \overline{x}_i - \overline{x}$; i = 1,2, and $\overline{x}$ is the combined mean.

Suggest a suitable equation for the combined standard deviation when there are k number of series.

(d) Prove that the algebraic sum of the deviations of a set of values from their arithmetic mean is zero.