EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2004/2005

SECOND SEMESTER (Mar./ Apr., 2006)

SPECIAL REPEAT EXAMINATION

MT 308 - STATISTICS

Answer all questions **Time : 02 hours**

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1. (a) A random sample of 100 shops in a town was taken and the profit margins (%) were calculated with the following results:

Profit margin (%)	Number of shops
$0- < 2$	3
$2- < 4$	8
$4- < 5$	15
$5- < 6$	16
$6- < 7$	17
$7- < 8$	18
$8- < 10$	19
$10- < 12$	3
12 and more	1

Draw a histogram for the above data. Estimate the mean and median profit margin (%), using the above data.

(b) The median of the following wage distribution is known to be 35. Find the missing frequencies in the following table:

Wages	$0-10$	$10-20$	$20-30$	$30-40$	$40-50$	$50-60$	$60-70$
Frequency	10	20	*	40	*	25	15

Total frequency $= 170$.

(c) The yield of gain (X) from 500 equal plots are grouped in classes with common class width 0.2lb in the table below. The value of X shown below are the central values of the classes and $f(X)$ represents the number of plots in the class.

X	$f(X)$	X	$f(X)$	X	$f(X)$
2.8	4	3.6	63	4.4	59
3.0	15	3.8	78	4.6	35
3.2	20	4.0	88	4.8	10
3.4	47	4.2	69	5.0	8
				5.2	4

Estimate the upper and lower quartiles of the distribution.

2. (a) In a sample of 1000 married couples, the ages of husband and wife are recorded by age nearest birthday and the following table shows the number of married couples tabulated by the husband's age.

Age nearest Birthday of husband	Number of married couples
$18-22$	341
$23-27$	392
$28-32$	135
$33-37$	46
$38-42$	30
$43-47$	22
$48-52$	20
$53-57$	14

The mean and variance of wives' age are 24.18 and 43.42 respectively. The total of the products of the wife's age and husband's age for each couple is 673500. Determine the regression line (age of wife) on (age of husband) and calculate the correlation coefficient.

(b) Calculate the quartile coefficient of skewness of the following distribution.

Variate X	$1-5$	$6-10$	$11-15$	$16-20$	$21-25$	$26-30$	$31-35$
Frequency f	3	4	68	30	10	6	2

3. (a) Show that *Spearman's rank correlation coefficient* r_s is given by

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

where n is the number of observations and d_i is the difference between ranks assigned to the i^{th} individuals.

(b) The following table shows the data on total costs in million rupees and output in million tons for a company over 10 time period.

Cost	4.39	2.38	2.86	2.77	4.04	3.64	1.93	1.65	3.10	4.66
Output	3.29	1.85	2.29	2.50	3.51	2.73	1.70	1.26	2.68	4.14

i. Compute the Pearson's correlation coefficient.

ii. Compute the Spearman's rank correlation coefficient.

iii. Comment your results on the basis of these two coefficients.

(c) Let $x_1, x_2, \cdots, x_n$ be the ranks of n individuals according to a characteristic A and $y_1, y_2, \cdots, y_n$ be the ranks of the same individuals according to other characteristic B. It is given that $x_i + y_i = 1 + n$ for $i = 1, 2, \cdots, n$. Show that the value of the rank correlation, r, between the two characteristics A and B is -1.

4. A farmer wants to find the relationship between the amount of fertilizer used and the yield of corn. He selected several acres of his land on which he used different amount of fertilizer to grow corn. The following table gives the amount of fertilizer (in pounds) used and the yield of corn (in bushels) for each of the seven acres.

Amount of fertilizer used	Yield of corn
120	138
80	112
100	129
70	96
88	119
75	104
110	134

(a) Draw a scatter diagram for these data. Does the scatter diagram show a linear relationship between fertilizer used and yield of corn.

(b) Fit a estimated regression line, giving the statistical model for the data.

(c) Give a brief interpretation of the estimated slope calculated in part (*b*).

(d) Test at 5% significance level if the true slope is different from zero.

(e) Compute the coefficient of determination and interpret it.

(f) Find a 95% confidence interval for the true slope.

(g) What is the estimated value of the yield of corn if the farmer used 125 pounds of fertilizer to grown.