Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
100 level 2nd Semester Examination – Dec./Jan. 2016/17
ESD 141-2 Quantitative Reasoning

Uva Wellassa University

4. The data given below are the numbers (in thousands) of farms in each of the 50 states of the USA in 2014, given in order of increasing numbers of farms.

1	1	2	3	3	4	4	6	7	8
8	9	9	14	14	17	21	24	24	27
28	33	36	36	37	38	39	42	46	49
50	50	52	57	57	61	70	71	73	78
79	82	87	88	93	96	99	109	115	160

[Note: $\sum_{i=1}^{50} x_i = 2217$ and $\sum_{i=1}^{50} x_i^2 = 164441$]

a. Draw a stem and leaf diagram to display these data. Briefly discuss whether the data appear to be symmetrical or skew with appropriate kurtosis measure. (5 mark)

b. Compute and compare the median and mean. (5 mark)

c. Compute and comapre standard deviation and inter-quartile range. (6 mark)

d. State, with reasons, which measure of central location you consider more appropriate for summarising these data. Interpret the results for this measure with the corresponding measure of variability (or spread). (4 mark)

5. In a recent study, 960 people aged between 25 and 30 years were asked about their academic achievements and their levels of satisfaction in their current jobs. "71 of the 960" were not able to respond because they were not currently employed. Academic achievement was measured by qualifications obtained and categorized as 'none', 'basic', 'intermediate' or 'advanced'. Job satisfaction was categorized as 'high', 'medium' or 'low'. Collected data are summerized in below table.

Academic Achievements	**Job Satisfaction**			
	High	Medium	Low	**Total**
Advanced	72	112	*	**271**
Intermediate	*	64	98	**250**
Basic	117	*	73	**281**
None	*	36	*	*
Total	**306**	*	**280**	*

a. Complete the above contingency table (marked with an Asterisk) (5 mark)

b. Calculate, for each of the four groups defined by academic achievement, the percentages having high and low job satisfaction. Comment briefly on the claim that higher academic achievement leads to greater job satisfaction. (Calculated Chi-squared value is 12.59) (10 mark)

6. An experiment is being conducted into the physical fitness of older people. A physical fitness test is given to each of 10 subjects (a higher score represents greater fitness). Each subject's fitness score for the test is recorded as value *y* and age as value *x* (ages are between 40 and 80 years).

The following totals are given.

$\sum_{i=1}^{10} x_i = 581$ $\quad \sum_{i=1}^{10} y_i = 607$ $\quad \sum_{i=1}^{10} x_i y_i = 33426$

$\sum_{i=1}^{10} x_i{}^2 = 37193$ $\quad \sum_{i=1}^{10} y_i{}^2 = 38795$

a. Calculate the sample Mean of x and mean of y; Comment on it. (4 mark)

b. Calculate the Pearson Product-moment correlation coefficient (r) and Comment on both the sign and the magnitude of the coefficient. (5 mark)

c. By fitting the appropriate straight line, estimate the average fitness score of a person who is aged 45. (8 mark)

d. Explain briefly why your value is an estimate and why it is the average fitness score that is being estimated (3 mark)

Useful Formula

1. $r = 1 - 6 \sum \frac{d_i^2}{n(n^2-1)}$

2. $r = \frac{\left(\sum_{i=1}^{n} X_i Y_i - n\bar{X}\bar{Y}\right)}{\sqrt{(\sum_{i=1}^{n} X_i^2 - n\bar{X}^2)(\sum_{i=1}^{n} Y_i^2 - n\bar{Y}^2)}}$

3. $\beta_1 = \frac{\left(\sum_{i=1}^{n} X_i Y_i - n\bar{X}\bar{Y}\right)}{(\sum_{i=1}^{n} X_i^2 - n\bar{X}^2)}$

4. $\beta_0 = \bar{Y} - \beta_1 \bar{X}$

5. $Mode = L_0 + (\frac{f_1 - f_0}{2f_1 - f_0 - f_2})C$
   - L_0 = Lower class boundary of the modal class
   - f_0 = Frequency of the class preceding the modal class
   - f_1 = Frequency of the mode class
   - f_2 = Frequency of the class succeeding the modal class
   - C = Size of the modal class

6. $Qi = L_{qi} + \left(\frac{i*N/4 - F_{qi}}{f_{qi}}\right) Cqi$
   - Q = Quartiles
   - i = 1, 2, 3
   - N = Number of items in the data set
   - L_{qi} = Lower class boundary of the Q_i^{th} class
   - F_{qi} = Cumulative frequency of the class preceding the Q_i^{th} class
   - f_{qi} = Frequency of the Q_i^{th} class
   - C_{qi} = Size of the Q_i^{th} class interval