

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. /B.Ed. Degree Programme, Continuing Education Programme

APPLIED MATHEMATICS-LEVEL 03

APU1141/ PCU1141/PCE3141/APE3141- Basic Statistics

FINAL EXAMINATION 2016/2017

Duration: Two Hours.



Date: 06.08.2017

Time: 09.30am - 11.30am

Instructions

- Non-programmable calculators are permitted.
- Answer four questions only.
- Each question is allocated 25 marks.

(1) The following table summarises the numbers of seeds germinated from 100 packets of seeds with 50 seeds in each.

Number germinated	Number of packets
20 – 24	5
25 – 29	14
30 – 34	20
35 – 39	42
40 – 44	19

- i) Calculate the sample median and explain what it measures in relation to this study.
- ii) Calculate the sample mean.
- iii) Estimate the expected number of seeds that will germinate from 300 packets of seeds.
- iv) Estimate the number of packets that had over 75% of germinating seeds.
- v) Suppose a planter earns a profit of Rs. 200/= from each packet that has over 50% of germinating seeds and incurs a loss of Rs. 50/= from each packet that does not meet this requirement. Estimate the expected net profit from 1000 packets of seeds.

- (2) The following table summarises the number of items inspected and the number of defective items found by a quality controller on items sampled from the output of two machines (labeled as 1, 2) on four day shifts (coded as 1) and on four night shifts (coded as 2).

Machine number	Shift number	Number of items inspected	Number of defective items
1	1	207	13
1	1	301	22
2	1	187	9
2	1	204	11
1	2	102	6
1	2	98	7
2	2	121	8
2	2	87	7

The quality controller is interested in finding out whether there is a shift-wise difference and a machine-wise difference with respect to the number of defectives.

- i) Construct a suitable graph to address the quality controller's objectives.
- ii) Clearly state the findings from the graph constructed in part (i).
- iii) Suppose from Machine labeled 1, the quality controller had daily sampled 250 items from the day shift and 100 items from the night shift over a period of two years and counted the number of defectives in each. Clearly describe a suitable graphical summary that can be used to compare how the two shifts vary with respect to the number of defectives and the variation in the number of defectives.
- iv) State whether each of the following statements is true or false for the data described in part (iii).
 - a) A frequency polygon illustrates the percentiles of the data.
 - b) A bar chart can be used to examine whether the data are symmetrically distributed or not.

- (3) The number of customers served in a 5 minute period at a supermarket, X , is found to have the following probability mass function.

X	0	1	2	3	4
$P(X=x)$	0.05	0.25	0.50	0.15	0.05

- i) Find the probability that at least two customers will be served, in a 5 minute period.
 - ii) Two five minute periods are selected at random. Assuming that the numbers of customers served in the two periods are independent, find the probability that the total number of customers served in the two periods is two.
 - iii) Find the expected number of customers that will be served in a 5 minute period.
 - iv) Find the standard deviation of X .
 - v) Suppose the expected cost to serve a customer is around Rs. 20/=. Let Y denote the cost to serve all the customers in an eight hour shift. Find the mean and the standard deviation of Y .
- (4) The following table summarises the heights (in cm) of 100 medicinal plants at the age of 4 weeks.

Height (cm)	Number of plants
10 – 14	8
15 – 19	19
20 – 24	53
25 – 29	16
30 – 34	4

- i) Calculate the standard deviation of the data and explain what it measures in relation to this study.
- ii) Calculate the first quartile of the data and explain what it measures in relation to this study.
- iii) Calculate the inter-quartile range of the data.
- iv) Construct a suitable graphical summary that can be used to find the shape of the distribution of the data.
- v) Clearly describe all the findings from the graphical summary constructed in part (iv).

- (5) A bookshelf has seven Chemistry books, eight Geography books, five History books and ten Statistics books. Two books are selected at random without replacement. Find the probability of each of the following outcomes:
- Both books are History books,
 - None of the books are Chemistry books;
 - At least one of the books is a Chemistry book;
 - The books are of different disciplines;
 - Only one of the books is a Chemistry book.

- (6) In a study to examine the electricity consumption of households in a certain town, a researcher recorded data on the following variables:

V_1 : floor area of the house (in square feet) coded as

1: less than 2000; 2: 2000 – 3000; 3: more than 3000

V_2 : ownership of the house coded as

1: self-owned; 2: rented, 3: leased

V_3 : number of tenants

V_4 : average monthly electricity consumption (in units)

V_5 : type of usage of electric equipment coded as

1: heavy use; 2: moderate use; 3: minimal use

- Classify the variables as qualitative or quantitative.
- Classify the quantitative variables as discrete or continuous.
- Classify the variables as nominal, ordinal, interval or ratio.
- Suggest a suitable graphical summary that can be used to examine the association between the floor area (V_1) and average monthly electricity consumption (V_4) and how this association varies depending on the type of usage of electric equipment (V_5).
- Clearly describe all possible findings one can get from a box plot of the data collected on 100 customers on the average monthly electricity consumption (V_4).

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