

UNIVERSITY OF COLOMBO
FACULTY OF ARTS
SECOND YEAR EXAMINATION IN ARTS (ECONOMICS) -2018
END OF THE SECOND SEMESTER

ECN 2238: STATISTICAL ANALYSIS

Time Allowed: **Two (02) Hours Only**

Calculators are allowed to use.

Statistical tables are provided

Answer 13 questions. (03 questions from section A and 10 from section B)

SECTION A

(Section A consists of 05 questions in total. Answer any 03 questions from this section.)

Total: 30 marks

Q1.

- a. Given the standard normal distribution, calculate the probabilities related to below z values and sketch a normal curve and shade the probabilities.
- i. $P(Z < -0.22)$
 - ii. $P(-1.96 < Z < -0.22)$
 - iii. $P(-1.96 > Z)$ (02 marks for each; total 06 marks)
- b. List the criteria that you can use to evaluate the normality of a distribution. (04 marks)

Q2.

- a. Briefly explain the properties of binomial distribution using appropriate example. (4 marks)
- b. If $n=5$ and $p=0.40$, what is the probability that;
- i. $X=4$
 - ii. $X<3$
 - iii. $X>2$ (02 marks for each total 06 marks)

Q3.

- a. For which situation Poisson distribution is appropriate to calculate probability of a random event. (04 marks)
- b. Assume a Poisson distribution with $\lambda = 5.0$. What is the probability that;
- i. $X=1$
 - ii. $X>1$
 - iii. $X\leq 1$ (02 marks for each total 06 marks)

Q4. Below table shows number of medical leaves per year in a population of 03 employees in a small company.

Name of employee	Number of leaves
A	2
B	3
C	4

- a. Calculate the population mean? (02 marks)
- b. List all possible samples of size 2 ($n=2$) with replacement and calculate the mean of samples. (02 marks)
- c. Construct the sampling distribution of means. (02 marks)
- d. Are both population mean and mean of the means equal? If so what is the principal behind that? (04 marks)

Q5.

- a. Solve the following.

- i. ${}^n P_n$
- ii. ${}^n P_1$
- iii. ${}^n C_{n-r}$
- iv. ${}^{50} C_3$

(01 mark for each total 04 marks)

If $S = \{1,2,3,4,5,6,7,8,9\}$, $A = \{1,2,3,4\}$, $B = \{5,6,7,4\}$ and $C = \{8,9\}$.

- b. Find the following;

- i. $(A \cup B \cup C)$
- ii. A'
- iii. $A - B$
- iv. $(A - B) \cup C$

(01 mark for each total 04 marks)

- c. Indicate the following operations using Venn diagrams

- i. $C \cap (A \cup B)$
- ii. $(A \cup B \cup C)'$

(01 mark for each total 02 marks)

SECTION B

(Section B consists of 15 questions in total. Answer any 10 questions from this section).

3 marks for each question. Total 30 marks.

A group of university undergraduates have conducted a household survey in a selected GN division in Galle district. They have selected the sample based on the information collected from GN officer. GN officer has provided information about the study population based on the population and housing census 2012 conducted by the department of census and statistics. The table below shows parameters and statistics related to population and sample.

Parameters	
Total number of households (N)	538
Average household income in thousands Rs. (μ)	20.50
Standard deviation (σ)	14.0
Proportion of household with fixed telephone (π)	0.40
Statistics	
Number of households in the sample (n)	100
Average household income in thousands Rs (\bar{X})	22.00
Standard deviation (S)	16.00
Proportion of household with fixed telephone (P)	0.45

Answer questions Q6 to Q20 using on the above information.

Q6. Propose the most appropriate sampling method for a survey of this nature. List the advantages and disadvantages of the sampling technique that you propose.

Q7. Find the probability that a household earns less than Rs.5 thousand per month. What is the assumption required to calculate the probability?

Q8. Assume that the government has decided to give Samurdhi for households with less than Rs.5 thousand income per month. How many households are eligible for Samurdhi program in the selected GN division?

Q9. What is the probability that the household average earning in the sample is less than Rs.18 thousand? What is the assumption required to calculate the probability?

Q10. What is the probability that more than half of the households in the sample have a fixed telephone line?

Q11. Do you think that sampling distribution of proportion of households with fixed telephone line is approximately normally distributed? Give reasons for your answer.

Q12. Construct the confidence interval for the population mean income at 95 % confidence level and interpret it.

Q13. Construct the confidence interval for the population proportion of household that have a fixed telephone line at 95 % confidence level and interpret it.

Q14. Assume that population standard deviation of the household income is not given. How do you construct confidence interval?

Q15. You want to test whether the average household income has changed in this month from its previous population average household income of thousand Rs 20.50. Write down the null hypothesis and the alternative hypothesis for this test.

Q16. Test the hypothesis you developed in question 15 at 5 percent level of significance using critical value approach. Interpret the conclusion.

Q17. Calculate the P value related to the above test in Q16. How do you reach the conclusion according to the p value approach?

Q18. You want to test whether the average household income has increased in this month from its previous population average household income of thousand Rs 20.50. Write down the null hypothesis and the alternative hypothesis for this test.

Q19. Test the hypothesis you developed in question 18 at 5 percent level of significant using the critical value approach. Interpret the conclusion.

Q20. Can you conclude that the proportion of households with a fixed telephone line has increased during last 6 years at 5 percent level of significant? Use critical value approach.

EQUATIONS

$$P(n,r) = \frac{n!}{(n-r)!}$$

$$C(n,r) = \frac{n!}{(n-r)!r!}$$

$$Z = \frac{X - \mu}{\sigma}$$

$$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$Z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$$

$$\bar{X} \pm \mu + Z \frac{\sigma}{\sqrt{n}}$$

$$P \pm Z \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$$