



**RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES**

**B.Sc. (General) Degree in Applied Sciences  
Third Year - Semester I Examination – September/October 2019**

**MAT 3214 – APPLIED STATISTICS**

**Time: Two (02) hours**

**Statistical tables and calculators will be provided.**

**Answer All Questions.**

1.

- a)
  - i. Briefly describe two (02) random sampling methods. **(10 marks)**
  - ii. Discuss the advantages and disadvantages of any three (03) methods of data collection. **(15 marks)**
  - iii. Distinguish between the two terms “parameter” and “statistic”. **(10 marks)**
- b) Write down two graphical tests and two statistical tests which are used to test normality. **(20 marks)**
- c) Each person in a random sample of size 10 employees was asked about  $X$ , the daily time wasted at work doing non-work activities, such as surfing the internet and emailing friends. The resulting data, in minutes, are as follows:

108 112 117 130 111 131 113 113 105 128

Using **Kolmogorov-Smirnov** goodness of fit test, test whether these data come from the normal distribution with mean 120 and standard deviation 10.

**[Hint :  $(D_{10,(0.1)} = 0.3687)$ ]**

**(45 marks)**

2.

a) State the Central Limit Theorem. (10 marks)

b) The carbon monoxide (CO) emissions for a certain kind of a car follows the distribution with mean  $\mu = 2.9\text{gm/mi}$  and standard deviation  $\sigma = 0.4\text{gm/mi}$ . Suppose that a company has its fleet 80 of these cars. (45 marks)

- What is the distribution of the sample mean ( $\bar{X}$ ) of these 80 cars?
- What is the probability that the sample mean is between 3.0 and 3.1 mg/mi?
- Find the highest 5<sup>th</sup> percentile of the distribution of the sample mean.

c) Vehicles pass through a junction on a busy road at an average rate of 300 per hour as a Poisson process.

(45 marks)

- Find the probability that none passes in a given minute.
- What is the expected number passing in two minutes?
- Find the probability that this expected number actually passes through in a given two-minute period.

3.

a) Write down the procedure of hypothesis testing. (10 marks)

b) Define Type I error and Type II error. (10 marks)

c) A psychologist conducted a survey on a randomly selected sample of 63 college students. Here is a descriptive summary of the results of her survey:

Males (X)	Females (Y)
$n=34$	$m=29$
$\bar{x} = 105.5$	$\bar{y} = 90.9$
$s_x = 20.1$	$s_y = 12.2$

Is there sufficient evidence at the  $\alpha = 0.05$  level to conclude that the variance of the fastest speed driven by male college students differs from the variance of the fastest speed driven by female college students? (35 marks)

- d) A multiple-choice test question has four possible responses. The question is designed to be very difficult, with none of the four responses being obviously wrong, yet with only one correct answer. It first occurs on an exam taken by 400 students. The designers test whether more people answer the question correctly than would be expected just due to chance (i.e., if everyone randomly guessed the correct answer).

(45 marks)

- i. Set up the hypotheses for the test.
- ii. Of the 400 students, 125 correctly answer the question.  
Find the P-value, and interpret it.
- iii. Make a decision about  $H_0$ , using  $\alpha = 0.05$ .  
Based on this decision, what can you conclude about the parameter?

4.

- a) Show that the Chi-Square test statistic of goodness of fit test is

$$\sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i} = \sum_{i=1}^n \frac{O_i^2}{E_i} - N$$

where,  $O_i$  is the observed frequency of the  $i^{\text{th}}$  category,  $E_i$  is the expected frequency of the  $i^{\text{th}}$  category and  $N$  is the total number of observations. (40 marks)

- b) Researchers have conducted a survey of 1600 coffee drinkers asking how much coffee they drink in order to confirm previous studies. Previous studies have indicated that 72% of Americans drink coffee. The results of previous studies (left) and the survey (right) are below. (60 marks)

Response	% of Coffee Drinkers
2 cups per week	15%
1 cup per week	13%
1 cup per day	27%
2+ cups per day	45%

Response	Frequency
2 cups per week	206
1 cup per week	193
1 cup per day	462
2+ cups per day	739

At  $\alpha = 0.05$ , is there enough evidence to conclude that the distributions are the same?

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