

**MTH220**  
**Statistical Methods and Inference**

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**Tutor-Marked Assignment**

**January 2022 Presentation**

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***TUTOR-MARKED ASSIGNMENT (TMA)***

This assignment is worth **16%** of the final mark for **MTH220 Statistical Methods and Inference**.

The cut-off date for this assignment is **20 April 2022 (Wednesday) , 23 55 hours**.

**Note to Students:**

You are to include the following particulars in your submission: Course Code, Title of the TMA, SUSS PI No., Your Name, and Submission Date.

For example, ABC123\_TMA01\_Sally001\_TanMeiMeiSally (omit D/O, S/O). Use underscore and not space.

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**Question 1**

When collecting the premiums, Insurance rounds 60,000 motor insurance premiums to the nearest ten dollars.

- (a) Stating any assumptions made, compute the probability that the total premiums collected will be altered by more than \$500 from the original value (before rounding). Show all details of your working.  
(15 marks)
- (b) Comment on whether Apex Insurance should be worried that the amount altered with this rounding exceeds \$2000? Explain your answer briefly.  
(5 marks)

**Question 2**

Three trainee salespersons were being monitored for their level of sales. Salesperson A made a total of 440 sales in 5 days, salesperson B made a total of 630 sales in 7 days, and salesperson C made a total of 690 sales in 10 days.

The sum of squares of all 22 daily sales is calculated as:  $\sum x_i^2 = 146,840$ .

- (a) Calculate the various entries in the one-way ANOVA table (p-values may be excluded). Show all details in your workings.  
(14 marks)
- (b) By performing the ANOVA test, comment on whether there is a significant difference among the average daily sales of the 3 salespersons? Justify your answer at a 5% level of significance.  
(6 marks)

**Question 3**

The following sample is collected: 1.6, 1.7, 1.7, 1.8, 1.5, 1.9.

- (a) Apply an appropriate hypothesis test to check if the sample is likely to be from a population with mean 1.5. Show full details of the test conducted. (16 marks)
- (b) State the assumptions made in performing the test in Question 3(a). (4 marks)

**Question 4**

The I.Q.'s (intelligence quotients) of 16 students from the rural regions of a small country showed a mean of 107, with standard deviation of 10, while the I.Q.'s of 14 students from the urban regions showed a mean of 112 with a standard deviation of 8.

- (a) Apply an appropriate hypothesis test (using critical region) to check if there is evidence at 5% level of a significant difference between the I.Q.'s of students from the two types of regions. Show full details of the test carried out. (14 marks)
- (b) Describe and comment on the changes to the test carried out in Question 4(a) if
  - (i) the test is now conducted at a 1% level of significance,
  - (ii) the interest is now to check if the I.Q.'s of students from the urban regions are higher in general compared to those from the rural regions. (6 marks)

### Question 5

Use R to answer this question. You will need to provide the R-codes used and the various related outputs from R.

Table Q5 gives experimental values of the quantity  $P$  corresponding to various values of another quantity  $V$ .

$V$	54.3	61.8	72.4	88.7	118.6	194.0
$P$	61.2	49.5	37.6	28.4	19.2	10.1

**Table Q5**

- (a) Use **R** to obtain a scatter plot and calculate the Pearson linear correlation coefficient for the data, and comment on any apparent relationship between the two variables.  
(6 marks)
- (b) According to known principles, a relationship having the form  $PV^\gamma = C$ , where  $\gamma$  and  $C$  are constants, should exist between the variables.
  - (i) Transform the relationship  $PV^\gamma = C$  into a linear form involving  $\log_{10}P$  and  $\log_{10}V$ .
  - (ii) Use **R** to obtain a scatter plot and calculate the Pearson linear correlation coefficient for the paired values of the transformed variables ( $\log P = \log_{10}P$  and  $\log V = \log_{10}V$ ), and comment on any apparent relationship between the two transformed variables.  
(6 marks)
- (c) Use **R** to determine a linear regression equation relating  $\log_{10}P$  and  $\log_{10}V$ .  
(5 marks)
- (d) Use the linear regression model obtained in Question 5(c) to estimate value of  $P$  when  $V = 100$ .  
(3 marks)

---- END OF ASSIGNMENT ----