

## MTH 372: Assignment I

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### Instructions

- Use statistical software R or Python for your codes and only basic in-built functions are allowed.
- Due date is March 12, 2025 (11.59 p.m.). No late assignments will be accepted.
- Submit all of your work which include the report, codes, results and graphs.
- Provide detailed explanations in the reports to obtain full marks.
- Follow the labelling method for your files.

### 1. Construct algorithms to answer the following

- (a) (2 points) Simulate a large number of draws from  $\text{Poisson}(\lambda=1)$  find the corresponding maximum likelihood estimate.
- (b) (2 points) Simulate a large number of draws from  $\text{Poisson}(\lambda=3)$  find the corresponding maximum likelihood estimate.
- (c) (3 points) Consider the addition of the values generated from part (a) and (b) (assume independence). What is the mean and variance of the data. What would be the corresponding distribution. Find the corresponding maximum likelihood estimate.
- (d) (3 points) Compare the inference and graphs obtained from part (a), (b) and (c).

### 2. Let $X_1, \dots, X_n$ be a random sample from a population with pdf $f_\theta(x) = \frac{1}{\theta}x^{(1-\theta)/\theta}$ , $0 < x < 1, 0 < \theta < \infty$ . Consider $x_1 = 0.10, x_2 = 0.22, x_3 = 0.54, x_4 = 0.36$ . Answer the following

- (a) (2 points) Obtain the maximum likelihood estimate of the parameter.
- (b) (2 points) Obtain the estimate using method of moments.
- (c) (1 point) Compare the results