Examination in the School of Mathematical Sciences
Semester 1, 2021

STATS 3001 Statistical Modelling III
STATS 4101 Statistical Modelling - Honours

Instructions:

- Refer to the Instructions page in the Exam module for instructions.

1. **Submission instructions**

   In the exam module you should find a section with a link to the quiz called

   `Part A: Quiz`

   A single attempt is allowed for each question. The quiz will be available for the entirety of the exam.

   [60 marks]

2. **Submission instructions**

   Your answers may be hand-written and scanned as a pdf. Your pdf can then be uploaded in the section of the exam module that states

   `Part 2: Exam Question 2`

   Consider n independent random variables $Y_1, Y_2, \ldots, Y_n$ such that

$$\mathrm{E}[Y_i] = \mu$$

   and

$$\mathrm{var}(Y_i) = \sigma_i^2$$

   Let

$$\bar{Y} = \frac{1}{n}\sum_{i=1}^{n} Y_i$$

   (a) Calculate $\mathrm{E}[\bar{Y}]$
   (b) Calculate $\mathrm{var}[\bar{Y}]$
   (c) We will find a new estimator of μ using the generalised least squares framework. First write the model as

$$\boldsymbol{Y} = X\boldsymbol{\beta} + \boldsymbol{\epsilon}$$

   give the form of X, $\boldsymbol{\beta}$, $\mathrm{E}[\boldsymbol{\epsilon}]$, and $\mathrm{Var}[\boldsymbol{\epsilon}]$.
   (d) Calculate $\hat{\boldsymbol{\beta}}$, and hence $\hat{\mu}$.
   (e) Find $\mathrm{E}[\hat{\mu}]$
   (f) Find $\mathrm{Var}[\hat{\mu}]$

[30 marks]

3. In a certain experiment, the lung weights of two strains of mice were compared. One strain of mice was normal, `C57`, and the other was a mutant strain, `mdx`, that develops a condition similar to muscular dystrophy in humans.

   An analysis of the dataset is given in `Q3_mice-analysis.html`. Please read the analysis and then answer the questions in the quiz.

   Submission instructions

   The analysis is given in

   `Part C: Mice Analysis`

   in the exam module.

   As well, there is a link to a quiz with questions about the interpretation of this analysis called

   `Part C: Mice Analysis Quiz`

   A single attempt is allowed for each question. The quiz will be available for the entirety of the exam.

   [30 marks]

FINAL PAGE

End of question.