THE UNIVERSITY of ADELAIDE

Examination in School of Mathematical Sciences

Semester 2, 2018

104843	**STATS 2107**	**Statistical Modelling & Inference II**
111111	**STATS 4107**	**Statistical Modelling and Inference (Hons)**

Official Reading Time:	10 mins
Writing Time:	120 mins
Total Duration:	130 mins

NUMBER OF QUESTIONS: 2 TOTAL MARKS: 16

Instructions

- Attempt all questions.
- Begin each answer on a new page.
- Examination materials must not be removed from the examination room.

Materials

- 1 Blue book is provided.
- Calculators without remote communications capability are allowed.
- English and foreign-language dictionaries may be used.

DO NOT COMMENCE WRITING UNTIL INSTRUCTED TO DO SO.

1. Consider the data $Y_1, Y_2, \ldots, Y_n$ such that

$$Y_i \sim N(\mu, \sigma^2).$$

Let

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

   a. Show that

$$\mathsf{E}[\bar{Y}] = \mu.$$

[3 marks]

Solution:

$$\begin{aligned}
\mathsf{E}[\bar{Y}] &= \mathsf{E}\left[\frac{1}{n}\sum_{i=1}^{n} Y_i\right] \\
&= \frac{1}{n}\sum_{i=1}^{n} \mathsf{E}[Y_i] \\
&= \frac{1}{n}\sum_{i=1}^{n} \mu \\
&= \mu.
\end{aligned}$$

   b. Consider the R code in Appendix A. Describe what is does. [4 marks]
Solution:
Description of code.

   c. Describe the scatterplot in Appendix B. [5 marks]
Solution:
Negative, strong, non-linear relationship.

[Total: 12]

2. Consider a random variable X such that

$$\mathsf{E}[X] = 4, \quad \mathsf{Var}(X) = 3$$

Let

$$Y = 3X + 1$$

   a. Calculate $E[Y]$. [2 marks]
Solution:

$$\mathsf{E}[Y] = \mathsf{E}[3X + 1] = 3\mathsf{E}[X] + 1 = 3(4) + 1 = 13.$$

   b. Calculate $\mathsf{Var}(Y)$. [2 marks]
Solution:

$$\mathsf{Var}(Y) = \mathsf{Var}(3X + 1) = 3^2 \times \mathsf{Var}(X) = 9 \times 3 = 27.$$

[Total: 4]

Please turn over for page 3

Appendix A

```
y <- rnorm(10)
mean(y)
```

```
## [1] -0.3394315
```

Appendix B