

Questions 3 and 4 below, on *Chapters 3 and 4*, form Part II of Tutor-marked Assignment M246 01. Question 3 is marked out of 20 and Question 4 is marked out of 25. Your overall mark for TMA 01 will be the sum of your marks on all four questions.

You are advised to look again at the section entitled *General advice on TMAs* at the start of TMA 01 Part I.

Please send your answers to Questions 3 and 4 to your tutor, who should have kept the PT3 form for this assignment so that there is no need to send another. (If your tutor has returned your original PT3 by mistake with your answers to Questions 1 and 2, send it back with your answers to Questions 3 and 4. You will eventually receive your copy of this PT3, completed by your tutor, along with your answers to these questions.)

Question 3 (*Chapter 3 Models for Data II*)

- (a) *This part of the question involves investigation of the properties of a discrete random variable: no samples of data are involved.*

The discrete random variable X has the probability distribution specified by the probability mass function

$$p(x) = \frac{x+1}{15}, \quad x = 3, 4, 5.$$

- (i) Find the probabilities $P(X=4)$ and $P(X \geq 4)$. [2]
- (ii) Find the mean of X , $\mu = E(X)$. [3]
- (iii) Find the variance of X , $\sigma^2 = V(X)$. [3]
- (iv) Find the median and the 95% quantile of X . [4]

- (b) Suppose that the random variable X has probability density function

$$f(x) = xe^{-x}, \quad x \geq 0,$$

and cumulative distribution function

$$F(x) = 1 - (1+x)e^{-x}, \quad x \geq 0.$$

Finding the median of X means solving for x the equation

$$F(x) = \frac{1}{2}$$

or, equivalently,

$$(1+x)e^{-x} - \frac{1}{2} = 0.$$

This equation is not solvable by usual methods, and some kind of numerical approach is required. Using the function `zero()`, or otherwise, find the median required. Similarly, find the lower and upper quartiles of X . [8]

func myfunc() return \$1/\$13-2; zero(myfunc,1,2)
1.678