

Question 4 (*Chapter 4 Models for Data III*)

- (a) In Question 2 part (d) you calculated some probabilities for the binomial distribution $B(20, 0.01)$. State an approximating probability distribution and draw up a table of probabilities as follows.

$P(X = x)$	0	1	2	3	4	$P(X > 4)$
$B(20, 0.01)$						
Approximation						

Table 2 The binomial probability distribution $B(20, 0.01)$ and an appropriate approximation

- (b) Editors working on technical manuscript distinguish between three types of error: they are typographical mistakes (T) such as spelling errors or transpositions of characters or words; wrong references (R) such as page references to other parts of the document; and presentation errors (E) where the wrong typeface is selected. For texts of a standard kind, long experience suggests that a Poisson model for the incidence of errors is quite adequate, with type T errors occurring at an average rate of 1.5 per page, type R errors at an average rate of 0.4 per page, and type E errors occurring at an average rate of 3.2 errors per page. It may be assumed that any errors occur independently of one another and from page to page.
- (i) What is the probability that a typical page of manuscript has no wrong references? [3]
- (ii) In a five-page document, what is the expected number of typographical errors? Find the probability that there are fewer than four typographical errors altogether? [3]
- (iii) What is the expected number of errors (of any kind) in a page of manuscript? What proportion of pages have six errors or more? [3]
- (iv) In a five-page document, what is the distribution of the number of error-free pages? Find the probability that all the pages have at least one error on them. [4]
- (c) Suppose that an adequate model for the incidence of signal interference in a short-wave radio receiver is a Poisson process at average rate of 2.4 per hour. What is the median time between bursts of interference? Find the probability that after switching on the receiver one day there follows at least an hour of uninterrupted listening. [6]