Questions 1 to 3, on *Chapters 11* to *13*, form Tutor-marked Assignment M246 04. Question 1 is marked out of 30; Question 2 is marked out of 30; Question 3 is marked out of 40. Your overall mark for TMA 04 will be the sum of your marks on all three questions.

Please send all your answers to your tutor, along with an appropriately completed assignment form (PT3). Be sure to fill in the Assignment Number on this form as

M246 04 .

Question 1 (*Chapter 11 Related variables*)

(a) At the turn of the century, there was much interest amongst statisticians in the study of inheritance. One study in this area, published by Karl Pearson and Alice Lee in 1902, involved measuring the heights (in inches) of eleven pairs of brothers and sisters. The data set `heights` in the SSC data subdirectory contains the resulting data.

(i) Load the data into your SSC worksheet and plot them. Comment on the degree of association between the two variables, on the basis of the appearance of your plot. On the basis of your plot, explain whether you think it is appropriate to calculate the Pearson product-moment correlation coefficient to investigate the association between these two variables. [3]

(ii) Calculate the Pearson product-moment correlation coefficient for these two variables. Calculate a 95% confidence interval for the corresponding correlation in the population. Do these data provide evidence that the heights of brothers and sisters are associated? [3]

(b) The data set `wind` in the SSC data subdirectory gives 25 measurements on the electrical output and the wind speed for a wind generator.

(i) Plot the data and comment on the nature of the association between the two variables. [3]

(ii) Calculate the Pearson and the Spearman correlation coefficients for these data. In the light of the plot you produced in part (c)(i), comment on why one of these coefficients is larger than the other. [3]

(c) A study of factors potentially associated with low birth weight in babies was carried out at the Baystate Medical Center, Springfield, Massachusetts, in 1986. A series of 189 new-born babies were classified as being of low birth weight (under 2500g at birth) or not, and were also classified according to whether their mother had smoked during the pregnancy. The resulting data are shown in the following table.

		Smoked	
		No	*Yes*
Birth weight	*Normal*	86	29
	Low	44	30

(i) Carry out an appropriate exact test to investigate whether smoking is associated with low birth weight. Report your conclusions carefully. [4]

(ii) Do these data establish that mothers who smoke during pregnancy are more likely to give birth to low birth weight babies? Do they show that smoking during pregnancy causes low birth weight? Briefly explain your answers. [4]

(d) Data were collected on 2537 urine drug screenings performed on applicants seeking to work at the US Postal Services Management Sectional Center. The results, classified according to the gender of the applicant (male, female) and the result of the test (negative, positive for marijuana only, positive for cocaine only, positive on other non-therapeutic drugs), are recorded as a contingency table in matrix form in the data set `drug`, in the SSC data subdirectory. The