



MTH4106

Introduction to Statistics

Test 2

1 April 2011, 1010–1050

Write your name and student number in the spaces below.

Answer all questions. Write all your answers in the boxes provided.

Name: _____

Student Number: _____

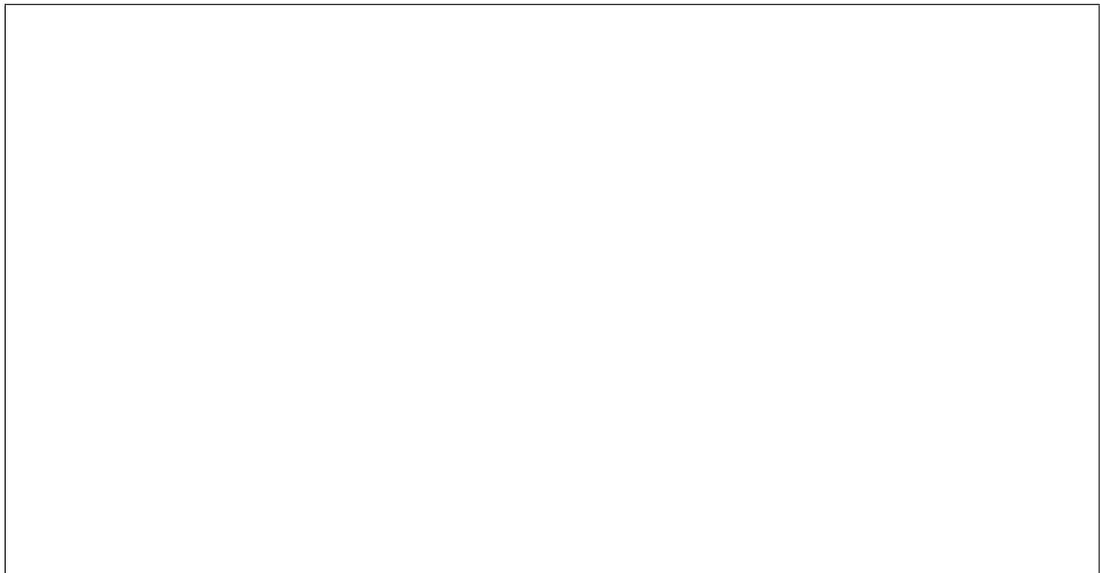
Electronic calculators may be used. Please state here the make and type of machine used.

Note that there is an extract from the *New Cambridge Statistical Tables* on the last two pages of this test.

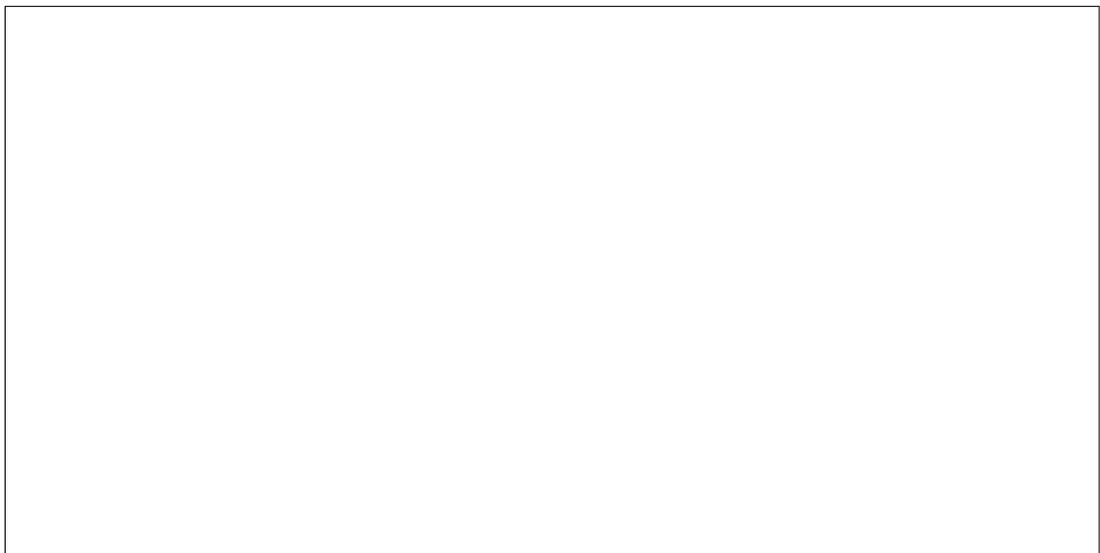
1 (25 marks) I have a Minitab worksheet with data about the students taking *MTH4106 Introduction to Statistics*. Column **C1** contains their marks on the mid-term test (integers in the range 0–100); column **C2** contains the number of Minitab sessions that they attended before that test (integers in the range 0–6); and column **C3** contains their study programmes (coded as follows).

- 1 = programmes entirely within Mathematics
- 2 = programmes including Economics
- 3 = programmes including Business
- 4 = all other study programmes

(a) Explain briefly, using a sketch, how to display these data graphically.



(b) Explain briefly how to use Minitab to produce this display.



2 (25 marks) Suppose that 36% of registered UK voters think that it is better to increase income tax than to increase university students' fees. A statistician takes a random sample of 400 voters, and asks them "is it better to increase income tax than to increase university students' fees?" Let X be the number who answer "yes".

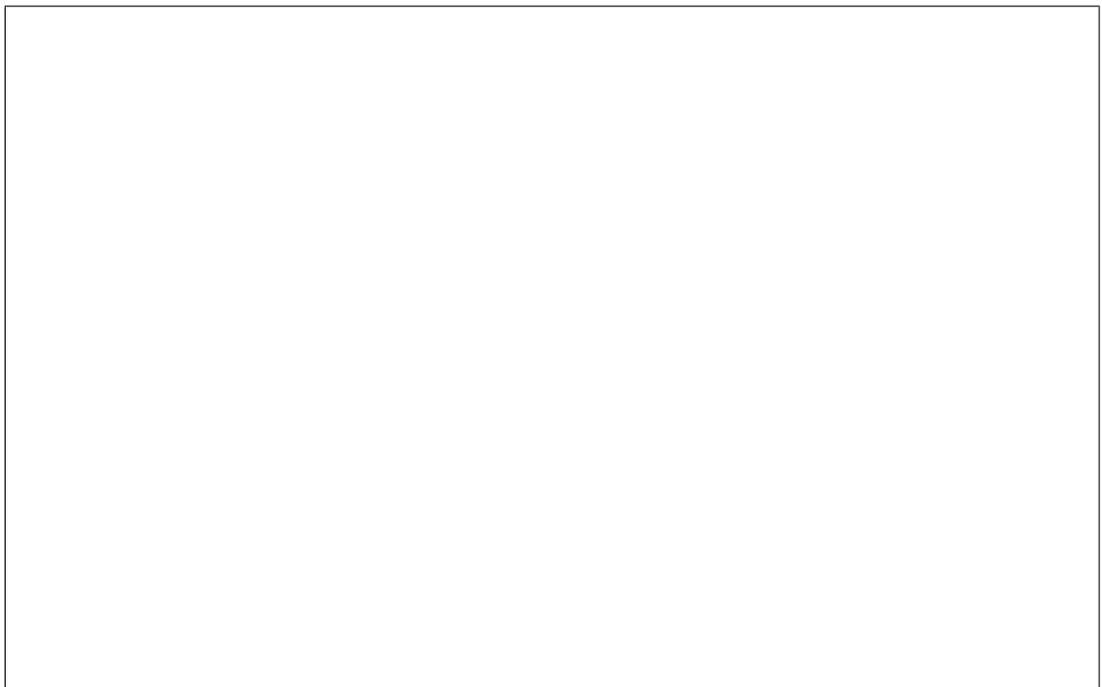
Find $\mathbb{P}(X \leq 160)$.

3 (25 marks) Let X and Y be continuous random variables whose joint probability density function is $f_{X,Y}(x, y)$.

(a) Define the *marginal* probability density functions $f_X(x)$ and $f_Y(y)$.

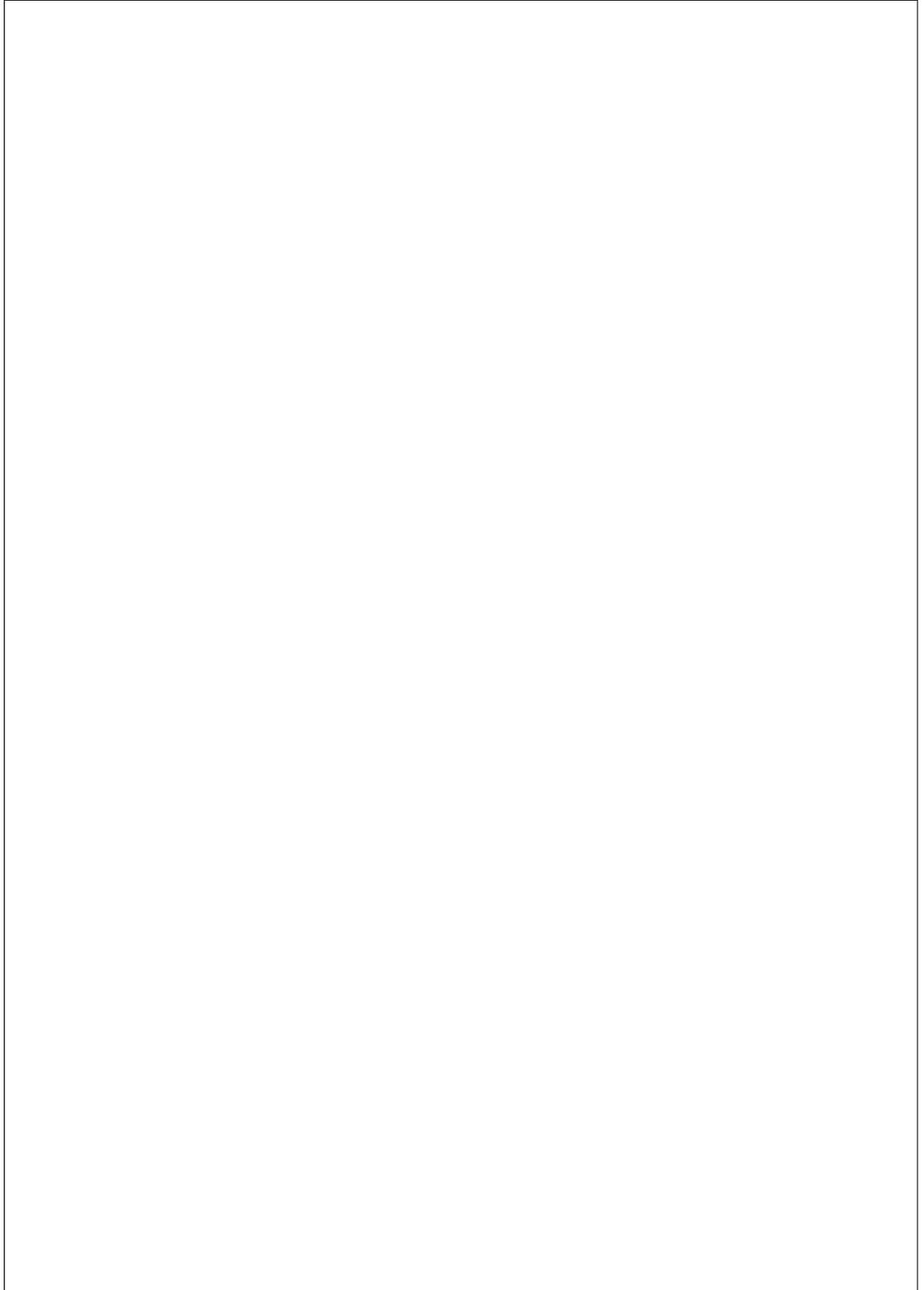


(b) Define what it means for X and Y to be *independent*.



(c) Prove that if X and Y are independent then

$$\mathbb{P}(0 \leq X \leq 1 \text{ and } 0 \leq Y \leq 1) = \mathbb{P}(0 \leq X \leq 1) \mathbb{P}(0 \leq Y \leq 1).$$



4 (25 marks) A large university in the USA takes a random sample of 900 male students and measures their height in inches. The sample mean is 70.2, with a sample standard deviation of 3.1. Construct a 90% confidence interval for the mean height of all male students at this university.