



MTH4106

Introduction to Statistics

Test 1

24 February 2012, 1410–1450

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 name and type of machine used.

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1 (20 marks) Each country in the EU has recorded male mortality (for those aged under 65) from liver disease in 2007, expressed as number of deaths per 100,000 people. Rounded to the nearest integer, the results for 26 countries excluding the UK are as follows, shown in increasing order.

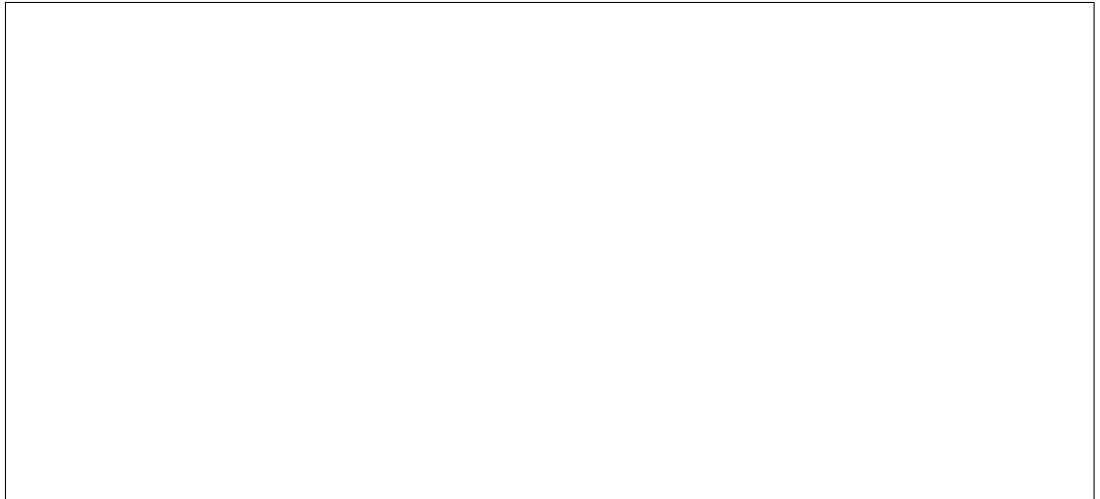
3, 4, 5, 5, 7, 7, 7, 10, 10, 12, 15, 16, 16, 17, 17, 20, 21, 22, 27, 28, 29, 31, 32, 40, 60, 62

(a) What type of variable is this?

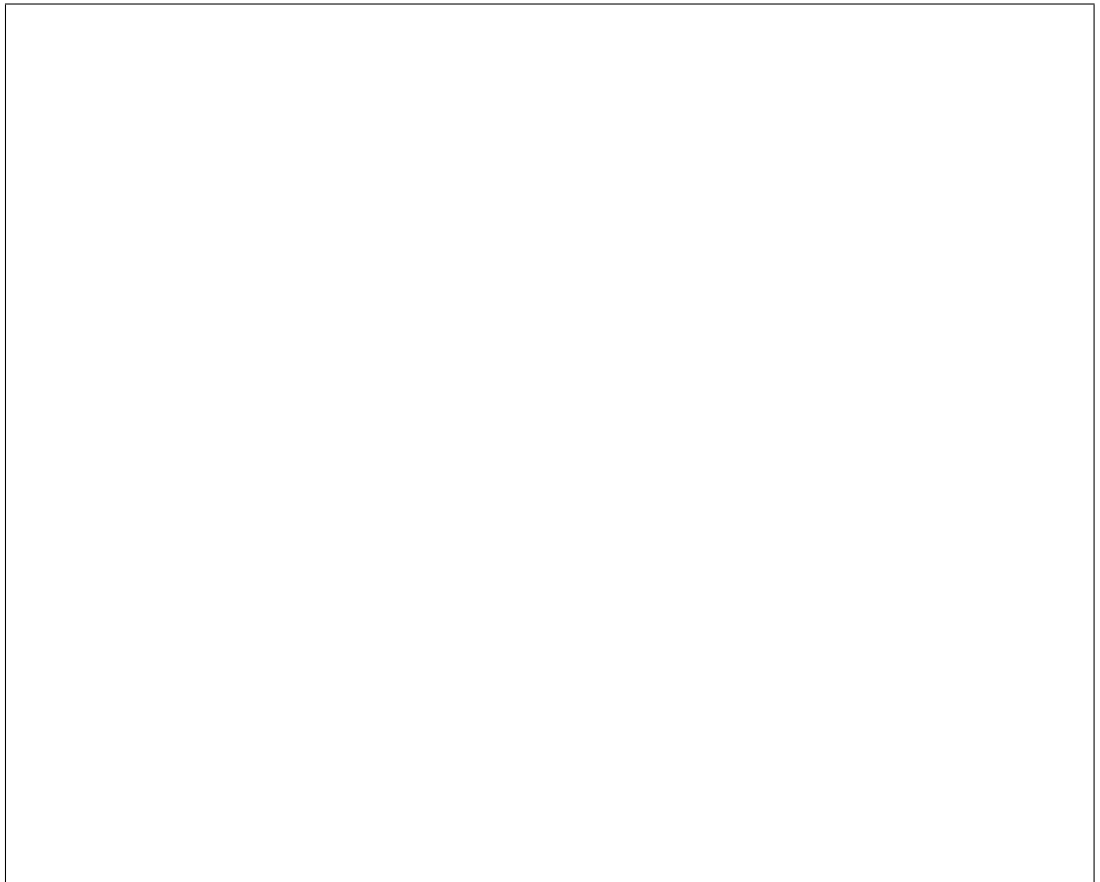
(b) Give the five-number summary for these data.

2 (20 marks) Let X be a discrete random variable all of whose values are non-negative integers.

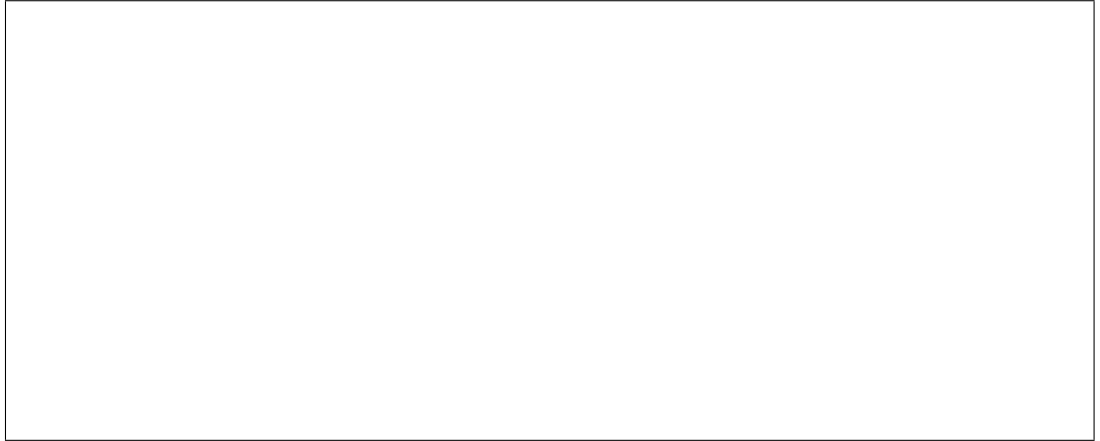
- (a) Define the *probability generating function* of X .



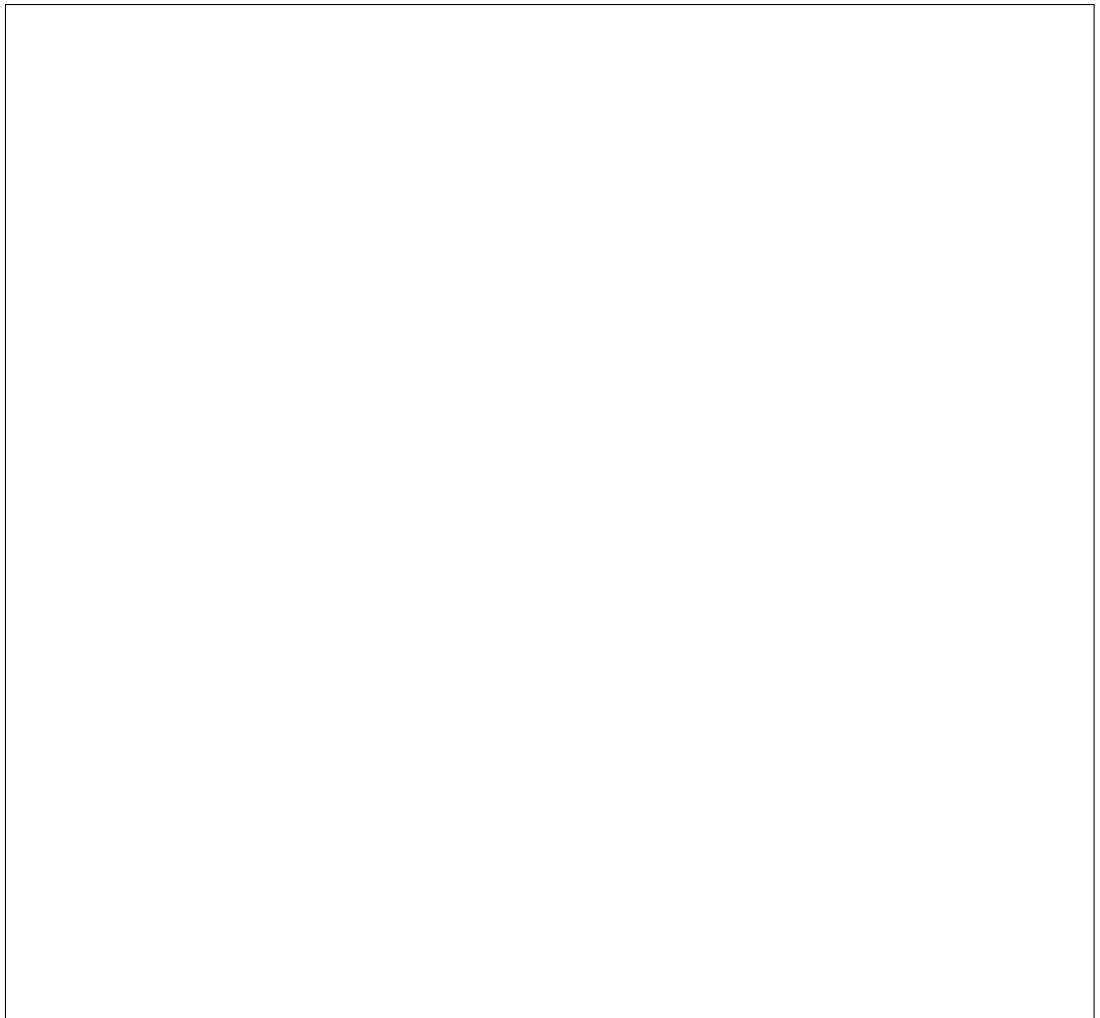
- (b) Find the probability generating function in the case that $X \sim \text{Geom}(\frac{1}{4})$.



3 (20 marks) (a) Explain the difference between an observational study and an experiment.



(b) Give one example of each, and explain their important features.



4 (20 marks) Suppose that T is an estimator for an unknown proportion p .

- (a) Define the *bias* of T and the *mean squared error* (MSE) of T .

- (b) Prove that $\text{MSE}(T) = \text{Var}(T) + (\text{Bias}(T))^2$.

5 (20 marks) Suppose that $X \sim \text{Exp}(3)$ and that $Y = 5X + 1$.

- (a) Write down the probability density function of X .

- (b) Find the probability density function of Y .

- (c) To draw the graph of the probability density function of X in Minitab, you need to specify the values of **Scale** and **Threshold**. What values should you give?